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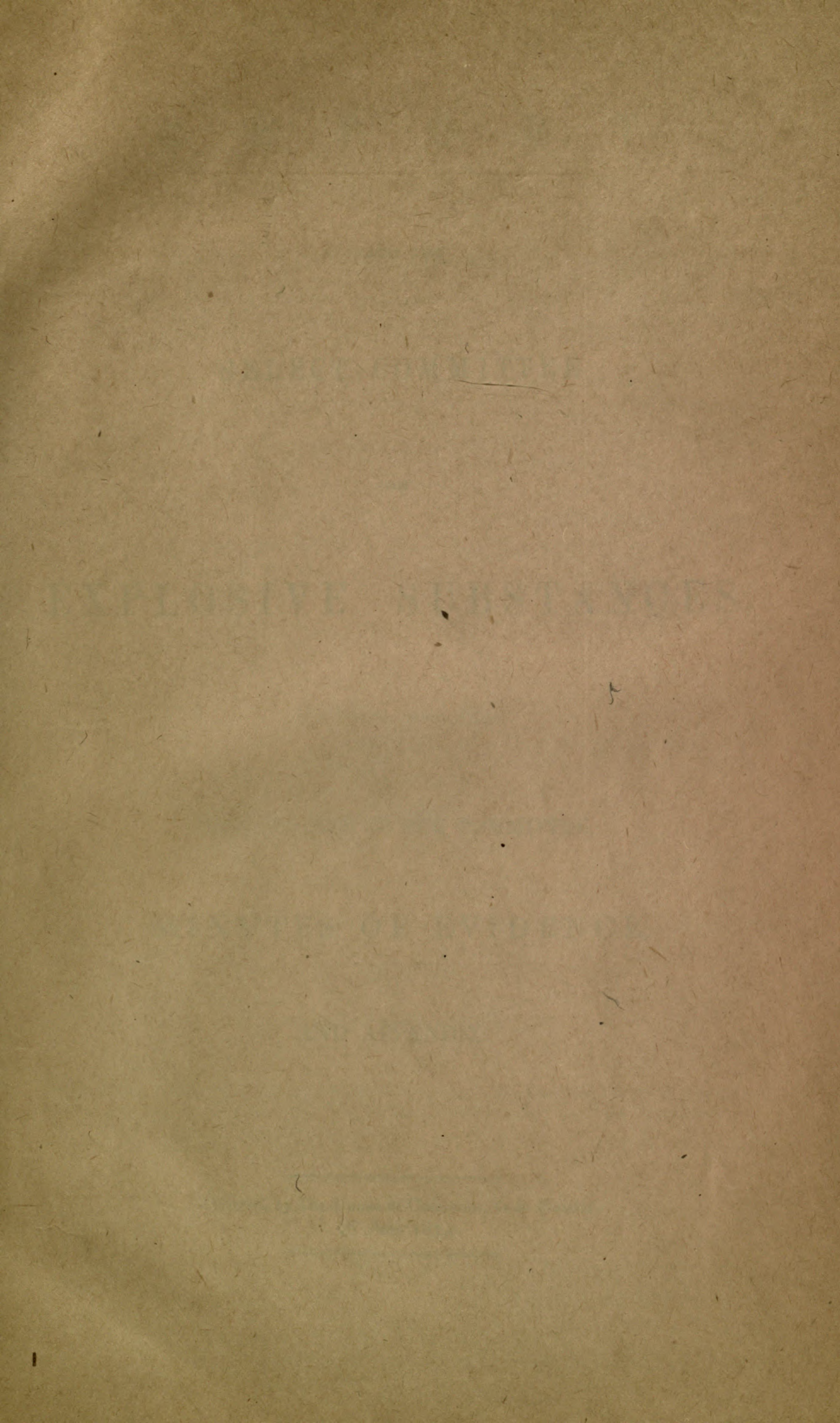
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# R E P O R T

Monday, 20th April 1874

Ordered, THAT a Select Committee be appointed to inquire into the law relating to the making, keeping, carriage, and importation of gunpowder, nitro-glycerine, dynamite, fireworks, and all substances of an explosive nature, and to consider the best means of making adequate provision for the safety of the public, and of the persons employed in such making, keeping, carriage, and importation, with a due regard to the necessities of the trade.

FROM THE

## SELECT COMMITTEE

ON

# EXPLOSIVE SUBSTANCES;

TOGETHER WITH THE



PROCEEDINGS OF THE COMMITTEE,

## MINUTES OF EVIDENCE,

### AND APPENDIX.

*Ordered, by The House of Commons, to be Printed,  
26 June 1874.*

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REPORT  
PROCEEDINGS OF THE COMMITTEE  
MINUTES OF EVIDENCE  
APPENDIX

*Thursday, 16th April 1874.*

*Ordered, THAT* a Select Committee be appointed to inquire into the law relating to the making, keeping, carriage, and importation of gunpowder, nitro-glycerine, ammunition, fireworks, and all substances of an explosive nature, and to consider the best means of making adequate provision for the safety of the public, and of the persons employed in such making, keeping, carriage, and importation, with a due regard to the necessities of the trade.

*Friday, 17th April 1874.*

Committee nominated of—

- |                            |                      |
|----------------------------|----------------------|
| Sir Henry Selwin-Ibbetson. | Mr. Edward Stanhope. |
| Mr. Stevenson.             | Mr. Whitwell.        |
| Sir John Hay.              | Mr. Knowles.         |
| Mr Laird.                  | Mr. M'Lagan          |
| Mr. Bell.                  | Mr. Hick.            |
| Colonel North.             | Mr. Dillwyn.         |
| Mr. Norwood.               | Mr. Whitelaw.        |

*Ordered, THAT* the Committee have power to send for Persons, Papers, and Records.

*Ordered, THAT* Five be the Quorum of the Committee.

*Monday, 20th April 1874.*

*Ordered, THAT* Mr. Arthur Vivian be added to the Committee.

*Friday, 26th June 1874.*

*Ordered, THAT* the Committee have power to report their Observations, together with the Minutes of Evidence taken before them, to the House.

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## R E P O R T,

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THE SELECT COMMITTEE appointed to inquire into the LAW relating to the Making, Keeping, Carriage, and Importation of GUNPOWDER, NITRO-GLYCERINE, AMMUNITION, FIREWORKS, and all SUBSTANCES of an EXPLOSIVE NATURE, and to consider the best Means of making adequate Provision for the safety of the Public, and of the Persons employed in such Making, Keeping, Carriage, and Importation, with a due regard to the Necessities of the Trade ;—HAVE considered the Matters to them referred, and have agreed to the following REPORT :

THE explosive substances to which the Committee have directed their attention, may be classified as follows :

(1.) Gunpowder ; viz., any preparation formed by the mechanical mixture of a nitrate with any form of carbon, or with any carbonaceous substance not possessed of explosive properties, whether sulphur be or be not added to such preparation, and whether such preparation be or be not mechanically mixed with any other non-explosive substance. This class comprises such explosives as,—

Gunpowder, ordinarily so called ;  
 Pyrolithe ;  
 Pudrolithe ;  
 Poudre-saxifragine ;

Any preparation of this class, if mechanically mixed with any nitro-explosive or chlorate explosive should be deemed to be included in the nitro class or chlorate class respectively, and not in this class.

(2.) Nitro-explosive class ; viz., any chemical compound possessed of explosive properties, or capable of combining with metals to form an explosive compound which is produced by the chemical action of nitric acid (whether mixed or not with sulphuric acid), or of a nitrate mixed with sulphuric acid upon any carbonaceous substance, whether such compound is mechanically mixed with other substances or not.

This class consists of two divisions. The first comprises such explosives as,—

Nitro-glycerine, ordinarily so called ;  
 Dynamite ;  
 Lithofracteur ;  
 Dualine ;  
 Gly-oxiline ;  
 Nitrate of methyl ;

And any chemical compound, or mechanically mixed preparation, which consists either wholly or partly of nitro-glycerine, or of some other liquid nitro-explosive.

The second division comprises such explosives as,—

Gun-cotton, ordinarily so called ;  
 Gun-paper ;  
 Xyloidine ;  
 Gun sawdust ;  
 Nitrated gun-cotton ;  
 Cotton gunpowder ;  
 Schultze's powder ;  
 Nitro-mannite ;  
 Picrates ;  
 Picric powder.

Where any explosive of this class consists partly of a nitro-explosive and partly of a chlorate explosive, it should be deemed to belong to the chlorate explosive class.

(3.) Chlorate-explosive Class ; viz., all preparations containing a chlorate mechanically mixed with any form of carbon or any carbonaceous substance, either with or without the addition of a nitrate, or a sulphuret, or sulphur. This class consists of two divisions: The first comprises such explosives as,—

Horsley's blasting powder ;  
 Brain's blasting powder ;

And any chlorate preparation which consists partly of nitro-glycerine or of any liquid nitro-explosive.

The second division comprises such explosives as,—

Horsley's original blasting powder ;  
 Erhardt's powder ;  
 German gunpowder ;  
 Reveley's powder ;  
 Hochstadter's blasting charges ;  
 Reichen's blasting charges ;  
 Teutonite ;  
 Chlorated gun-cotton.

(4.) Fulminate-explosives ; viz., any chemical compound or mechanical mixture, which, from its great susceptibility to detonation, is suitable for employment in percussion caps or any other appliances for developing detonation, or which, from its extreme sensibility to explosion, and from its great instability (that is to say, readiness to undergo decomposition from very slight exciting causes), is especially dangerous.

This class consists of two divisions.

The first division comprises such compounds as the fulminates of silver and of mercury, and preparations of these substances, such as are used in percussion caps ; and any preparation consisting of a mixture of a chlorate with phosphorus, or certain descriptions of phosphorus compounds, with or without the addition of carbonaceous matter, and any preparation consisting of a mixture of a chlorate with sulphur, or with a sulphuret, with or without carbonaceous matter.

The second division comprises such substances as the chloride and the iodide of nitrogen, fulminating gold and silver, diazobenzol, and the nitrate of diazobenzol.

(5.) Ammunition.—This class includes any explosive of any of the foregoing classes, when enclosed in any case or contrivance, so as to form a cartridge for small arms, or for a weapon other than cannon ; or to form any fuze for blasting or for shells ; or to form any tube for firing guns ; or to form a percussion cap, a detonator, or any contrivance other than the following : a cartridge or charge for cannon or blasting, a shell, a torpedo, or a manufactured fire-work.

This class consists of two divisions :

The first division comprises—

Safety cartridges for small arms ;  
 Safety blasting fuzes ;  
 Percussion caps ;  
 Railway fog signals ;  
 Safety fuzes for shells.

The second division comprises—

Non-safety cartridges for small arms ;  
 Detonators ;  
 Non-safety fuzes for blasting ;  
 Non-safety fuzes for shells ;  
 War rockets ;  
 Tubes for firing guns.

(6.) Fire-works.—This class consists of two divisions. The first comprises fire-work composition, which is any chemical compound or mechanically mixed preparation which is of a combustible or inflammable nature and is used for the purpose of making manufactured fire-works, and which is not included in the former classes of explosives ; and also any coloured fire composition.

The second division comprises any manufactured fire-work, which includes every explosive of the four first of the foregoing classes, and any fire-work composition, when such explosive or composition is enclosed in any case or contrivance, or is otherwise manufactured, so as to form a squib, cracker, or other article adapted to the production of pyrotechnic effects, or pyrotechnic signals.

The law relating to the foregoing explosives is at present contained in five public Acts, viz. :—

The Gunpowder Act, 1860, 23 & 24 Vict. c. 139.

Gunpowder Amendment Act, 1861, 24 & 25 Vict. c. 130.

Gunpowder Amendment Act, 1862, 25 & 26 Vict. c. 98.

The Carriage of Dangerous Goods Act, 1866, 29 & 30 Vict. c. 69.

Nitro-Glycerine Act, 1869, 32 & 33 Vict. c. 113.

There are also a number of local and special Acts containing provisions upon this subject, of which the more important are the 14 & 15 Vict. c. 67, and the 28 & 29 Vict. c. 278, both relating to the storage of explosives in Liverpool and on the River Mersey.

The Acts above named do not, in the opinion of the Committee, make adequate provision for the manufacture, storage, and transport of many of the explosives to which their attention has been directed ; nor for the safety of the public, or of the persons employed in the making, keeping, carriage, and importation of those explosives, while some of them impose in some respects unnecessary restrictions, and consequently further legislation is required.

The Committee find that the Stores of gunpowder may practically be divided into three classes :

(1.) Store magazines, belonging to gunpowder manufacturers and merchants.

(2.) Consumers' magazines, for mine and other purposes ;

(3.) Retail stores.

It appears, with regard to the situation of many of the large Store magazines that the safety of the public is not sufficiently provided for by adequate isolation of the magazines with reference to the quantities which they contain ; and that the precautions taken by the storekeepers of these magazines in the very large majority of cases, are not of the character which are shown to be necessary to ensure safety, and which are adopted in Government magazines.

It appears that the present law with regard to Consumers' magazines is, in many instances, inconvenient and impracticable, while the evidence before the Committee tends to show that very great carelessness prevails in the management of these stores.

With regard to the Retail stores, the Committee find that, except in regard to the amount which may be kept, they are wholly unregulated by the Acts; and as this trade may be carried on without a license or registration, there is really no supervision with regard to the place or mode of storage, or as to the persons by whom such retail trade may be carried on.

The evidence of many of the witnesses goes to show that no adequate provision is made for the public safety as to the proper package or modes of conveyance for explosives when transported from one place to another, or for forbidding the transport, the loading and unloading of dangerously large quantities, through cities and populous places.

The present general law does not in any way regulate the importation or exportation of gunpowder.

With regard to the manufacture of nitro-explosives, the Committee find that, excepting the Nitro-glycerine Act (32 & 33 Vict. c. 113), which forbids the manufacture of nitro-glycerine preparations, except by license from the Secretary of State, there is no adequate legal provision for regulating the manufacture, storage, transport, importation, or shipment of explosives of this class.

The law relating to the keeping of some preparations of nitro-glycerine is unnecessarily restrictive as compared with the legislation relating to other explosives.

A similar remark applies to the carriage, importation, and exportation of such preparations of nitro-glycerine.

The law relating to the chlorate and fulminate class appears to be insufficient for the public safety.

With regard to the ammunition and firework classes, the Committee find that, while the law fails to provide adequately for the safety of the public and the persons employed in those trades, it is in some respects unduly restrictive and inconvenient to the persons engaged in them.

The Committee, therefore, consider that the law relating to the making, keeping, carriage, and importation of gunpowder, nitro-glycerine, ammunition, fire-works, and all substances of an explosive nature, does not make adequate provision for the safety of the public, or of the persons employed in such making, keeping, carriage, and importation, and that further legislation is urgently required with a due regard to the necessities of the trade.

The Committee have had submitted to it a "Summary of Suggestions" by Major Majendie, which, with the modifications which the Committee have made in consequence of other evidence, includes the subject matters for further legislation.

A new Act to be framed to amend and consolidate the Acts that regulate the manufacture, keeping, selling, carrying, and importing of explosive substances according to the foregoing classification; the manufacture of gunpowder, ordinarily so called, being made the subject of separate provisions in such new Act.

Power to be given to Her Majesty in Council to extend the Act from time to time, or any part or provision thereof, to any explosive not specifically named or defined in the same.

The manufacture of explosives and the operations connected therewith to be carried on only under a "common" or "special" license, to be obtained as hereafter described, except such operations as the filling of small arm cartridges, the preparing of blasting cartridges, which should be permitted to be carried on without a license, but under certain precautions to secure safety.

No person to keep any explosive above a certain limit to be defined by the Act without a "common" or "special" license, to be obtained as hereafter described, except a carrier carrying in accordance with the Act, and not keeping the same beyond the time actually necessary for his business,

business, and except an importer who has explosives in his possession in the vessel which imported the same, and who complies with the provisions of the Act.

No person to sell or deal in explosives unless he hold a license to manufacture, keep, or import such explosives.

No explosives to be imported without a "special" license.

Licenses, whether "common" or "special," to be personal, or local, or both.

"Common" licenses to be obtained as a matter of course, on application to the licensing authority, unless the person or premises be disqualified.

In the case of manufacturers, "common" licenses to be granted for the manufacture of fireworks on a small scale, in accordance with certain conditions to be defined by statute; in all other cases "special" licenses to be taken out.

In the case of storage, "common" licenses to be of two sorts:—

(a.) "Common house" licenses to meet the case of the ordinary retailer.

(b.) "Common magazines" license to meet the case of the mine owner, or person requiring to store more considerable quantities for industrial operations.

The "common house" license to authorise the storage by a retail dealer up to, say, 300 lbs. of gunpowder, or 1,500 lbs. if in cartridges, and proportionate amounts of fireworks, according to the conditions of storage.

The "common magazine" license to authorise the storage of larger quantities, up to two tons of gunpowder or one ton of gun-cotton or dynamite, or five times the amount of gunpowder in small-arm cartridges, or 10 tons of fire-works, according to the conditions of storage and the distance from protected places.

Special licenses to be obtained for storage of either larger quantities than are allowed by common licenses, or for similar quantities under special conditions. No distances or quantities to be fixed by statute for "special" licenses, which should be in each case fixed by the license, and with reference to the local circumstances of the case.

"Special" licenses for manufacture and storage to be granted by the local authorities, upon the report of an inspector, and subject to such conditions as to area and description of licensed premises, quantities, distances, precautions, as the inspector may recommend, and subject also to any bye-laws and rules made under the Act.

Special licenses for importation to be granted by the local authorities, subject to any bye-law and rules made under the Act, the local authorities having power to ask for the report of an inspector in any case.

The licensing authorities to be,—

*For Special Licenses:*

In the City of London - - -	The Lord Mayor and Aldermen.
„ the rest of the Metropolitan Board of Works District.	The Metropolitan Board of Works.
„ Boroughs - - -	The Town Council.
„ any Harbour - - -	The Harbour Authority.
„ Counties - - -	Quarter Sessions.
„ Scotland - - -	The Sheriff.

*For Common Licenses:*

The same, except in an urban sanitary district (not included in a harbour).	The Urban Sanitary Authority.
And instead of Quarter Sessions -	Petty Sessions.

An appeal to lie to the Secretary of State for Home Affairs against the refusal of a special license, or the imposition of vexatious restrictions.

“Common” licenses to be granted for a limited term to be fixed by the licensing authority, and not exceeding 10 years, but without prejudice to the grant of a new license at the end of that time.

“Special” licenses for the establishment of manufactories to be allowed when the proposing licensee can show that he owns or can control the land adjoining the intended site to such an extent as will secure a safety area around the manufactory to the satisfaction of the licensing authority and the Home Secretary; such license to be liable to be revoked if such safety area ceases to be kept clear.

All premises licensed for manufacture by special license to be passed by an inspector before use.

The Secretary of State for Home Affairs to have power to grant permission to a person having a special license for a factory or magazine, or for importation, to vary the conditions as to extension of area of licensed premises, alteration of distance of buildings from any protected work, or increase in the amount of explosive to be manufactured, kept, or imported.

The destruction by explosion of a magazine under a common license to be at once reported to the inspector, and the existing license to be considered as temporary until the inspector has reported whether the license should be continued as before, or the licensee should take out a special license.

If two or more buildings of a licensed factory, other than the incorporating mills of a gunpowder factory, are destroyed by explosion, the licensee not to re-erect more than one of such buildings without the written consent of the Secretary of State for Home Affairs, or otherwise than in accordance with such conditions as to mounds, or other precautions, as the said Secretary of State may impose: Provided that in the case of existing factories this section shall not apply except in regard to such buildings as an inspector has previously to the explosion (in a written notice to the owner) pronounced to be in undue proximity, subject to arbitration.

The carriage of explosives to be carried on without a license (except water carriage in harbours where bye-laws to that effect exist), but under certain statutory “general rules,” and subject to any bye-laws made under the Act by competent authority (as hereinafter described).

All explosives carried to be duly labelled and declared, and no explosives (except small quantities for sportsmen) to be carried in public vehicles, or as cargo in passenger ships (except, as to the last named, by permission of the Board of Trade).

Harbour authorities to have power to make bye-laws, to regulate the navigation and place of mooring of ships, safe stowing and safe keeping of explosives on board, regulating the kind of ship or barge, licensing the same, fixing the place, time, and mode of shipping explosives, and the precautions to be taken, for which the present Liverpool Gunpowder Act seems to afford a good model.

Railway and canal companies to have power to frame bye-laws for regulating the loading and carriage of explosives over their rail or canal, the place and time and mode of such loading, amount to be carried, and necessary precautions.

All bye-laws made as above to be confirmed by the Secretary of State for Home Affairs (or Board of Trade), and the said Secretary of State (or Board of Trade) to have power to enforce the making of bye-laws, or where not made to make them, in any case where it may be deemed necessary.

Harbour and conservancy authorities to have power to provide ships and barges for the carriage of explosives, and to provide magazines (to be licensed

licensed by special license in the usual way) for safe deposit of explosives, and to charge dues for the use of the same.

Urban sanitary authorities to have the latter power.

“General rules” for the manufacture, storage, packing, and carriage of explosives to be enacted. These rules to be variable only by Order in Council, but no varied rules to be in force until they have been laid one month on the table of the House of Commons.

“Special rules” to be framed by every manufacturer (except small fire-work makers, who should be provided for by extra rules to be framed by the Secretary of State for Home Affairs), and every holder of a special or common magazine license, or of a special importation license, if required by the said Secretary of State, for the conduct and guidance of the work-people in his factory or magazine or place of importation.

All “special rules” made as above to be confirmed by the Secretary of State for Home Affairs, who may disallow or add to the same.

Inspectors to be appointed by the Secretary of State for Home Affairs.

An inspector to have power to make such examination, entry, and inquiry, as may be necessary to ascertain whether the provisions of the Act are complied with and to take samples for analysis of any explosive, or supposed explosive, on tender of payment, and to require railway companies to carry such samples.

An inspector to have power in the case of his observing anything unnecessarily dangerous and defective to give notice to licensee, and require the same to be remedied, subject to an appeal to arbitration (as in the Mines Acts); and, if the matter be, in the opinion of the inspector, urgent, and tend to the bodily danger of any person, and if it be contrary to the usage of the trade, to require the same to be remedied forthwith, provided that such power of requiring a matter to be remedied forthwith, shall not extend to matters affecting the premises or machinery.

If a licensee objects to the inspector's requisition he may (except where the matter is required to be remedied forthwith) object in writing within a certain time, and in that case the matter is to be referred to and decided by arbitration; and pending such appeal, it shall be optional for the manufacturer to comply with the requisition.

If the matter has been ordered to be remedied forthwith, the licensee, notwithstanding that he objects, must forthwith comply with such requisition; and if he feels aggrieved may apply to the county court for damages against the inspector; but no person shall be liable to any penalty for not complying with such requisition forthwith, if he can show that the practice or thing complained of was not contrary to the usage of the trade.

Licensing authorities to be empowered to make such examination and inquiry as may be necessary to ascertain if the provisions of the Act are duly observed in any premises licensed under a common license within the jurisdiction of such authority, except magazines which are subject to inspection by the inspectors of mines; and in the case of harbours, to search ships and barges, such as appears to be provided in the Thames and Mersey by existing Acts.

Where a matter in contravention of the Act is urgent and fraught apparently with serious public danger, an inspector or a “specially authorised” person may make the necessary inquiry or inspection, and take such steps in the way of the seizure of explosives or in such other way (to be defined by the Act) as may be necessary to remove the risk or source of danger.

Such person to be “specially authorised” by a warrant of a justice of the peace, or, when the case is one of emergency, and the delay in obtaining a warrant would be likely to endanger life, by a written order

from an inspector or from the chief officer of police of the district, or, in his absence, from any officer of police not lower than a superintendent; a report of any proceedings taken under this provision to be made in all cases.

Proceedings against a licensee for offences under the Act not to be instituted except by an inspector, or by a licensing authority, a justice of the peace, a chief officer or superintendent of police, or a person authorised by the Secretary of State for Home Affairs.

Arbitrations under the Act to be as in the Mines Acts, viz., one arbitrator to be appointed by the appellant, the other by the respondent, and the arbitrators to nominate an umpire.

Accidents by explosion or fire in any licensed premises, or in any vehicle or vessel carrying an explosive, to be reported to the Secretary of State for Home Affairs.

Notice of any inquest about to be held on any person killed by an explosion or fire, or any accident in connection with any explosive, to be sent by the coroner to the Secretary of State for Home Affairs, to give the inspector an opportunity of attending.

The Secretary of State for Home Affairs to have power to institute a formal inquiry (by an inspector with legal assessors, or *vice versa*, as in the Railway Act) in any case where he considers it necessary.

Penalties which may include in some cases forfeiture of license to be imposed for a substantial departure from any important condition of the license, or for making, or storing, or importing, an explosive without a license (where license is required), or otherwise than in accordance with the terms of such license, or for wilful neglect, or wilful act, tending to endanger life or limb, with power, if the case is tried on indictment, for the court to forfeit a license (except in the case of magazines and factories lawfully existing at the time of the passing of the Act).

An appeal to lie to a court of superior jurisdiction in all cases where any forfeiture or conviction is made by a court of summary jurisdiction.

Vested interests to be specially guarded and provided for, as follows:—

(a.) All occupiers of factories and magazines lawfully existing at the time of the passing of the Act (except as hereinafter named), to be entitled to obtain from the Secretary of State for Home Affairs, and without reference to the local authorities, a "continuing certificate," of unlimited duration (except to such extent as the duration may be actually limited by any existing license affecting the factory or magazine).

(b.) Any difference as to the right to this certificate to be determined by a court of law.

(c.) Occupiers of (unlicensed) mine magazine, and of magazines established in pursuance of a "general license" under the Nitro-glycerine Act, to be required to take out a "common license."

(d.) Licensed places, the license for which expires within 12 months of the passing of the Act, to be allowed to run out subject to renewal under the amended regulations.

(e.) The Secretary of State for Home Affairs to be empowered to impose conditions in the "continuing certificate," and to fix quantities (as the licensing authorities may do in the case of new licenses), except that he may not impose any conditions which would have the effect of requiring the removal of any legally existing work or building, or to diminish the quantities below what the licensee is at present entitled to have, but in the case of store magazines for unlimited quantities, he may



may assign as a limit the quantity which the magazine would contain on a given date.

(f.) Any difference as to the conditions to be settled by arbitration.

The Act not to apply to factories and magazines and explosives belonging to the Crown, or to volunteer storehouses.

The Act not to interfere with the law of nuisance.

The Committee believe that the legislation thus indicated, will add materially to the public safety, with a due regard to the necessities of the trade.

26 June 1874.

MEMBERS PRESENT:  
Mr. Edward Hays.  
Mr. Laird.  
Colonel North.  
Mr. Stevenson.  
Mr. Hick.  
Mr. Norwood.  
Mr. Arthur Vivian.

Sir John Hays.  
Mr. Whitely.  
Mr. Bell.  
Mr. Knowles.  
Sir Henry Selwin-Ibbetson.  
Mr. Dillwyn.  
Mr. M'Agan.  
Mr. Whitwell.

Sir JOHN HAYS was called to the Chair.

[Adjourned till Tuesday, 5th May, at Twelve o'clock.

Tuesday, 5th May 1874.

MEMBERS PRESENT:  
Mr. M'Agan.  
Mr. Hick.  
Mr. Norwood.  
Mr. Whitely.  
Mr. Knowles.  
Mr. Bell.  
Mr. Stevenson.

Colonel North.  
Mr. Whitely.  
Mr. Dillwyn.  
Mr. Edward Stanhope.  
Sir Henry Selwin-Ibbetson.  
Mr. Arthur Vivian.

Sir JOHN HAYS in the Chair.

Major Vivian During M'Agan, R.A., and Major Arthur Ford, R.A., were severally examined.

[Adjourned till Friday next, at Twelve o'clock.

Friday, 8th May 1874.

MEMBERS PRESENT:  
Mr. Knowles.  
Sir Henry Selwin-Ibbetson.  
Mr. Arthur Vivian.  
Mr. M'Agan.  
Mr. Laird.  
Mr. Whitely.  
Mr. Norwood.

Colonel North.  
Mr. Stevenson.  
Mr. Whitely.  
Mr. Bell.  
Mr. Dillwyn.  
Mr. Hick.  
Mr. Edward Stanhope.

Sir JOHN HAYS in the Chair.

Major Vivian During M'Agan, R.A., was further examined.

Colonel Charles Wright Youngblood, R.A., was examined.

[Adjourned till Tuesday next, at Twelve o'clock.

PROCEEDINGS OF THE COMMITTEE.

Friday, 24th April 1874.

MEMBERS PRESENT :

Sir John Hay.	Mr. Edward Stanhope.
Mr. Whitelaw.	Mr. Laird.
Mr. Bell.	Colonel North.
Mr. Knowles.	Mr. Stevenson.
Sir Henry Selwin-Ibbetson.	Mr. Hick.
Mr. Dillwyn.	Mr. Norwood.
Mr. M'Lagan.	Mr. Arthur Vivian.
Mr. Whitwell.	

Sir JOHN HAY was called to the Chair.

[Adjourned till Tuesday, 5th May, at Twelve o'clock.]

Tuesday, 5th May 1874.

MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Colonel North.	Mr. M'Lagan.
Mr. Laird.	Mr. Hick.
Mr. Whitwell.	Mr. Norwood.
Mr. Dillwyn.	Mr. Whitelaw.
Mr. Edward Stanhope.	Mr. Knowles.
Sir Henry Selwin-Ibbetson.	Mr. Bell.
Mr. Arthur Vivian.	Mr. Stevenson.

Major *Vivian Dering Majendie*, R.A., and Major *Arthur Ford*, R.A., were severally examined.

[Adjourned till Friday next, at Twelve o'clock.]

Friday, 8th May 1874.

MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Colonel North.	Mr. Knowles.
Mr. Stevenson.	Sir Henry Selwin-Ibbetson.
Mr. Whitelaw.	Mr. Arthur Vivian.
Mr. Bell.	Mr. M'Lagan.
Mr. Dillwyn.	Mr. Laird.
Mr. Hick.	Mr. Whitwell.
Mr. Edward Stanhope.	Mr. Norwood.

Major *Vivian Dering Majendie*, R.A., was further examined.

Colonel *Charles Wright Younghusband*, R.A., was examined.

[Adjourned till Tuesday next, at Twelve o'clock.]

*Tuesday, 12th May 1874.*

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MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Mr. Bell.	Mr. Whitelaw.
Mr. Hick.	Mr. Arthur Vivian.
Mr. Knowles.	Mr. Laird.
Colonel North.	Mr. Edward Stanhope.
Mr. M'Lagan.	Mr. Whitwell.

Colonel *Charles Wright Younghusband*, R.A., was further examined.

Dr. *August Dupré*, Professor *Frederick Angus Abel*, F.R.S., and Mr. *Charles William Curtis*, were severally examined.

[Adjourned till Friday next, at Twelve o'clock.]

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*Friday, 15th May 1874.*

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MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Colonel North.	Mr. Knowles.
Mr. Arthur Vivian.	Mr. Dillwyn.
Mr. Norwood.	Mr. Edward Stanhope.
Mr. Whitelaw.	Mr. Stevenson.
Sir Henry Selwin-Ibbetson.	Mr. M'Lagan.
Mr. Bell.	Mr. Whitwell.
Mr. Hick.	

Mr. *Charles William Curtis* was further examined.

Mr. *Frederick A. P. Pigou* and Mr. *Alfred Dudley Keightley* were severally examined.

[Adjourned till Tuesday next, at Twelve o'clock.]

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*Tuesday, 19th May 1874.*

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MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Colonel North.	Mr. Dillwyn.
Mr. Arthur Vivian.	Mr. Edward Stanhope.
Mr. Stevenson.	Mr. Knowles.
Mr. Whitelaw.	Mr. Hick.
Mr. M'Lagan.	Sir Henry Selwin-Ibbetson.

Mr. *James Purdey*, Major *Frederick E. B. Beaumont*, a Member of the House ; Mr. *James Lang*, Mr. *James Dalziel Dougall*, Colonel *John Thomas Smith*, R.E., Mr. *Hermann Eugene Falk*, Mr. *Samuel Joseph Mackie*, and Mr. *John Downie*, were severally examined.

[Adjourned till Friday next, at Twelve o'clock.]

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*Friday, 22nd May 1874.*

MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Colonel North.

Mr. Laird.

Mr. Arthur Vivian.

Mr. Whitwell.

Mr. Stevenson.

Mr. Knowles.

Mr. Whitelaw.

Sir Henry Selwin-Ibbetson.

The Duke of *Sutherland*, K.G., attending by permission of the House of Lords, and Mr. *William T. Eley*, were severally examined.

Mr. *John Downie* was further examined.

Mr. *Thomas Kay* was examined.

The Committee deliberated.

The following letter, addressed to the Chairman of the Committee, was read :—

“ 18, Cavendish Road, St. John’s Wood, N.W.,  
20 May 1874.

“ Sir,

“ I regret that, as Chairman of the Explosives Committee, now sitting, you have refused to receive my evidence as a mine and quarry proprietor, and also that of Sir George Denys, Bart., Mr. Hockin, and Mr. Webb, as tendered to you through my solicitor. It is true that we are but four out of the large body of mine and quarry proprietors; but we, at the same time represent many others, and have had extensive experience in the use of explosives, and particularly in the use of nitro-glycerine compounds.

“ Last Session we supplied Mr. Staveley Hill, M.P., with such information as enabled him to move for the appointment of a Committee to investigate this question, and particularly with reference to the Nitro-glycerine Act of 1869, and under which we have so grievously suffered. The then Home Secretary stated, in his place in the House, that the Session was too far advanced for the proposed inquiry to commence; but he added that there was no objection to the appointment of a Committee in the then ensuing Session. We proposed renewing our application in this Session; but almost the first act of the new Home Secretary was to move for the appointment of a Committee, and to this we could have had no objection, provided the Chairman of the Committee was in no way identified with the passing of that most oppressive measure, the repeal or modification of which we so earnestly sought.

“ Nor would I have recalled attention to the extraordinary part you took in the passing of the measure of 1869, had you dealt fairly with us during the present inquiry, and allowed us to state before the Committee, not only the injury we have thus sustained, for a period of nearly five years, but also our objections to the still further oppressive restrictions as now suggested by Major Majendie, and under which it is proposed that not only shall a common policeman be instructed by Major Majendie to walk into the magazine of any mine and quarry proprietor, but we as such are also to be compelled to take out licenses to carry on our business, and even the local magistrates are to be stigmatised as unable to grant these licences, unless advised to do so by Major Majendie in his official capacity. At the same time it is proposed that we shall not be allowed to have a single barrel of powder as a reserve, pending the arrival of the only ton of that material which it is proposed we shall be limited to, and our license is to be absolutely forfeited in the event of an accident to the magazine, even although such accident may be wilfully caused by some designing person.

“ But as you have decided to shut out our evidence, it becomes my duty, as well on my own account as on the part of those I represent, to criticise even your own position in an inquiry where, if it were conducted fairly towards those who are the most deeply interested, the result would be the disclosure of the greatest amount of pecuniary corruption on the part of Government officials which has probably ever occurred in this country, and this will be abundantly proved by the following facts:—

“ In the first place, the Nitro-Glycerine Bill of 1869 was not referred to a Select Committee, and it was, therefore, dealt with before a Committee of the whole House. It was nearly three o’clock in the morning when this Bill came before the Committee, and when Mr. Staveley Hill brought forward amendments which would have modified the Bill as regards dynamite, there was practically no answer to his proposition, inasmuch as no accident whatever could be adduced as regards dynamite, either in transport, storage, or use.

“ Seeing the emergency, you rose and read to the House the following letter, addressed to you by Professor Abel:—

‘ Dear Sir John Hay,

‘ Woolwich, 10 July 1869.

‘ In reply to your inquiries respecting nitro-glycerine, the production and properties of which have been made the subject of careful study and extensive experiment by me, I have

have to express my firm conviction that such appalling accidents as that which recently occurred in Wales, cannot be guarded against by the enforcement of any measure short of an absolute prohibition of the importation, transport, and storage of nitro-glycerine, or of any preparation of that material. The explosion near Carnarvon was but a repetition of catastrophes of similar nature which have occurred within the last few years in other countries, and are ascribable to the readiness with which nitro-glycerine explodes, when subjected to concussion or friction, especially if it be undergoing spontaneous change, to which it is very prone, however perfect the system of manufacture. No apprehension need be entertained that the enforcement of prohibitory regulations, however stringent and compact, with respect to nitro-glycerine and its preparations, would be detrimental to the interest of mine and quarry owners. The discoveries recently made with regard to the *application of gun-cotton\** as a blasting agent, have placed this material quite upon an equality with nitro-glycerine, as regards its power, and there is this important difference between the two materials; no effectual means are known of guarding against the accidental explosion of nitro-glycerine, which must inevitably be productive of fearfully destructive results, while compressed gun-cotton (the only form in which it is now manufactured) may be transported with quite as much safety as gunpowder, and, if ignited by any accident, produces considerably less destructive results than even the latter material, because gun-cotton simply burns *without* explosion, unless very strongly confined (as in guns, shells, or blast holes), or unless it is fired with a particular kind of fuse. If proprietors of mines and quarries continue to cling to a preference for nitro-glycerine, or any preparation of it, such as the substance called dynamite, for special kinds of blasting operations, the explosive agent should be manufactured *exclusively* at the particular localities where it is to be used, and only in such quantities as are required from time to time, no reserve stores being permitted.

‘ The preparation of nitro-glycerine is not a difficult operation, and the above system is pursued in some localities on the Continent where that substance is employed.

‘ By introducing the restrictions above indicated, with respect to nitro-glycerine and its preparations, such accidents will still not be guarded against as occurred not long ago at Newcastle, consequent upon the great readiness with which nitro-glycerine freezes (whereby it becomes much more sensitive to explosion by concussion or a blow), and upon the generally dangerous character of the material; but these accidents and their disastrous results will become confined to the localities where the nitro-glycerine is actually used, although, even then, others employed in or near such works may suffer through the instrumentality of those who persist in having recourse to this fearfully dangerous explosive agent.

‘ Rear Admiral Sir John Hay, Bart.,  
‘ M.P., F.R.S.’

‘ I am, &c.  
(signed) ‘ F. A. Abel.’

\* The words in italics are in the original.

“ I need hardly add that the reading of this letter alarmed the House, and Mr. Staveley Hill’s amendments were rejected.

“ Nor need I call your attention to the fact, that Professor Abel has since publicly withdrawn every statement, whatsoever, which he made in that letter. Of this you may satisfy yourself by referring to the Minutes of Proceedings of the Institution of Civil Engineers (Vol. 33, Session 1871-72.)

“ But whilst this public withdrawal was thus forced upon Professor Abel, through the action taken by the proprietors of mines and quarries, such withdrawal in no way condoned the fact that at the time Professor Abel induced you to read this letter to the House, he was himself the patentee of that very gun-cotton, the safety and value of which he thus urged upon you, and those you were addressing; at the same time also urging the exclusion of the only other explosive which really competed with his patented article.

“ Amongst other similar patents of Professor Abel I have now lying before me this patent for gun-cotton, dated 20th April 1865. I have also lying before me an official copy of Professor Abel’s license to Messrs. Prentice to manufacture this gun-cotton, on a payment to him (Professor Abel) of a royalty of ten pounds (10*l.*) per ton, and a further royalty of tenpence per thousand on all gun-cotton cartridges. I have still further a copy of Professor Abel’s Report on Scientific Invention in the International Exhibition (1871), in which the Professor states that Messrs. Prentice were then making from eight to ten tons of gun-cotton weekly. It is clear, therefore, that at the time you read to the House the letter quoted, Professor Abel was receiving an income of several thousand per annum from this very beneficial patent, and which was further turned into an absolute monopoly through your assistance at a critical moment.

“ It would be useless to encumber this letter by extracts from the various reports presented to Parliament from time to time, signed by Colonel Younghusband, Major Majendie, and Professor Abel himself, and alleging the absolute safety of the Professor’s patented explosive. Equally so as regards Major Majendie’s Report on the Stowmarket explosion, where it will be found that every particle of evidence given by witnesses, which showed the real cause of the disaster, has been carefully excluded. Nor will I dwell upon the

fact, that after the disclosures made, the late Home Secretary wrote me that Professor Abel should not act on Committees for inquiry into explosives, his letter being followed by a Treasury Minute condemning such proceedings as those I have described. It is enough for me to state that you have disregarded all these censures as passed by the late Administration, and are not only proceeding with this inquiry under the direct advice, evidence, and suggestions of the said Professor Abel, Colonel Younghusband, and Major Majendie, but have also thought fit to prevent others being heard who are the real sufferers by proceedings so corrupt and so iniquitous, that they even drew public censures from four Government departments, although even then but a small proportion of the question of official corruption had been dealt with.

“ I admit, Sir, that as Chairman you may succeed in inducing the Committee to exclude us from being heard; but you cannot prevent us, who have lost hundreds of pounds annually by the course you pursued, taking such steps as will ultimately lead to a full and a fair inquiry; and, as a first step, I beg to inform you that I shall not only send a copy of this letter to each member of the Committee, but I shall also take such further proceedings as may be deemed necessary. I think that when the facts come to be fully known it will appear exceedingly unjust that any one who took so active a part as you did in the passing of the Act of 1869, and who is now placed in the position of Chairman of a Committee (appointed, practically, to review your own proceedings in 1869), should act as if the injuries mine and quarry owners have thus sustained were of no importance.

“ In the last letter I received from Sir George Denys, he expressed his readiness to attend on being telegraphed, and Mr. Webb is, I know, equally ready to come to town to give evidence before your Committee. As you are aware, it is impossible for me to have a conference with them before your meeting on Friday, and therefore I take upon myself the full responsibility of writing this letter. Personally, I am one of the greatest sufferers, and therefore I have individually a full right to expose, in the most complete manner, a gigantic fraud, and a fraud, moreover, which could not have attained its existing proportions if you had not chosen to read, even if unwittingly, any letter which Professor Abel placed in your hands for the purpose of carrying out his designs. You are aware that it was utterly unfair to have read a letter of this character before a Committee of the whole House when the writer could not be present, and therefore could not be subjected to an examination; and under these circumstances you cannot expect me to remain quiet on the bare ground that you refuse to receive my evidence.

“ Sir John D. C. Hay, Bart, M.P.”

“ I am, &c.  
(signed) “ R. S. France.”

Motion made, and Question, That the Chairman be instructed to move the House for leave to make a Special Report—(Sir *Henry Selwin-Ibbetson*),—put, and *agreed to*.

Proposed Special Report read a first time, as follows:—“ That the attention of the Committee has been called to a letter from Mr. R. S. France addressed to the Chairman of the Committee, and that as such letter appears to reflect upon the conduct of the Chairman, the Committee had agreed to report the same to the House, in order that the House may take such steps as it shall think fit”—(Sir *Henry Selwin-Ibbetson*).

Report read a second time, and *agreed to*.

*Ordered*, To report, together with the said letter.

Committee adjourned till Tuesday, 2nd June, at Twelve o'clock.

*Tuesday, 2nd June 1874.*

MEMBERS PRESENT:

Sir JOHN HAY in the Chair.

Colonel North.  
Mr. Whitwell.  
Mr. Stevenson.  
Mr. Whitelaw.  
Mr. Knowles.

Mr. M'Lagan.  
Mr. Laird.  
Sir Henry Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Dillwyn.

Mr. *Charles Thomas Brock*, Mr. *Henry E. Taylor*, Mr. *Henry Kitchin*, Mr. *James Toy*, and Mr. *T. Tolley Jones*, were severally examined.

[Adjourned till Friday next, at Twelve o'clock.]

*Friday, 5th June 1874.*

## MEMBERS PRESENT:

Sir JOHN HAY in the Chair.

Colonel North.  
Mr. Whitwell.  
Mr. Edward Stanhope.  
Mr. Knowles.

Mr. Arthur Vivian.  
Mr. Stevenson.  
Mr. M'Lagan.  
Mr. Dillwyn.

Mr. *Orlando Webb*, Mr. *George M'Roberts*, Mr. *Samuel Holland*, a Member of the House, and Mr. *Perry Fairfax Nursey*, C.E., were severally examined.

[Adjourned till Tuesday next, at Twelve o'clock.]

*Tuesday, 9th June 1874.*

## MEMBERS PRESENT:

Sir JOHN HAY in the Chair.

Colonel North.  
Mr. Whitwell.  
Mr. Stevenson.  
Mr. Dillwyn.  
Mr. Hick.  
Mr. Knowles.

Mr. Arthur Vivian.  
Mr. Whitelaw.  
Sir Henry Selwin-Ibbetson.  
Mr. M'Lagan.  
Mr. Edward Stanhope.  
Mr. Norwood.

Mr. *Charles William Curtis* was further examined.

Mr. *George Parker Bidder*, C.E., and Mr. *Alfred Nobel*, were examined.

Mr. *Thomas Tolley Jones* and Major *Vivian Dering Majendie*, R.A., were further examined.

[Adjourned till Friday next, at Twelve o'clock.]

*Friday, 12th June 1874.*

## MEMBERS PRESENT:

Sir JOHN HAY in the Chair.

Colonel North.  
Mr. Edward Stanhope.  
Mr. Knowles.  
Mr. Hick.  
Mr. Whitwell.

Mr. Stevenson.  
Mr. Dillwyn.  
Mr. Whitelaw.  
Mr. Arthur Vivian.  
Mr. M'Lagan.

Major *Vivian Dering Majendie*, R.A., and Mr. *Alfred Dudley Keightley*, were further examined.

[Adjourned till Tuesday, 23rd June, at Twelve o'clock.]

*Tuesday, 23rd June 1874.*

## MEMBERS PRESENT:

Sir JOHN HAY in the Chair.

Sir Henry Selwin-Ibbetson.  
Mr. Whitwell.  
Mr. Stevenson.  
Mr. Whitelaw.  
Mr. Edward Stanhope.  
Mr. Knowles.

Mr. Dillwyn.  
Colonel North.  
Mr. M'Lagan.  
Mr. Hick.  
Mr. Arthur Vivian.

DRAFT REPORT proposed by the Chairman, read the first time, as follows :

“ 1. THE explosive substances to which the Committee have directed their attention, may be classified as follows :

“ (1.) Gunpowder; viz., any preparation formed by the mechanical mixture of a nitrate with any form of carbon, or with any carbonaceous substance not possessed of explosive properties, whether sulphur be or be not added to such preparation, and whether such preparation be or be not mechanically mixed with any other non-explosive substance. This class comprises such explosives as,—

Gunpowder, ordinarily so called ;		Pudrolithe ;
Pyrolithe ;		Poudre-saxifragine ;

“ Any preparation of this class, if mechanically mixed with any nitro-explosive or chlorate-explosive should be deemed to be included in the nitro class or chlorate class respectively, and not in this class.

“ (2.) Nitro-explosive class ; viz., any chemical compound possessed of explosive properties, or capable of combining with metals to form an explosive compound which is produced by the chemical action of nitric acid (whether mixed or not with sulphuric acid), or of a nitrate mixed with sulphuric acid upon any carbonaceous substance, whether such compound is mechanically mixed with other substances or not.

“ This class consists of two divisions. The first comprises such explosives as,—

Nitro-glycerine, ordinarily so called ;		Dualine ;
Dynamite ;		Gly-oxiline ;
Litho-fracteur ;		Nitrate of methyl ;

“ And any chemical compound, or mechanically mixed preparation, which consists either wholly or partly of nitro-glycerine, or of some other liquid nitro-explosive.

“ The second division comprises such explosives as—

Gun-cotton, ordinarily so called ;		Cotton gunpowder ;
Gun-paper ;		Schultze's powder ;
Xyloidine ;		Nitro-mannite ;
Gun sawdust ;		Picrates ;
Nitrated gun-cotton ;		Picric powder.

“ Where any explosive of this class consists partly of a nitro-explosive and partly of a chlorate explosive, it should be deemed to belong to the chlorate explosive class.

“ (3.) Chlorate-explosive Class ; viz., all preparations containing a chlorate mechanically mixed with any form of carbon or any carbonaceous substance, either with or without the addition of a nitrate, or a sulphuret, or sulphur. This class consists of two divisions. The first comprises such explosives as—

Horsley's blasting powder ;  
Brain's blasting powder ;

“ And any chlorate preparation which consists partly of nitro-glycerine or of any liquid nitro-explosive.

“ The second division comprises such explosives as—

Horsley's original blasting powder ;		Hochstadter's blasting charges ;
Erhardt's powder ;		Reichen's blasting charges ;
German gunpowder ;		Teutonite ;
Reveley's powder.		Chlorated gun-cotton.

“ (4.) Fulminate-explosives ; viz., any chemical compound or mechanical mixture, which, from its great susceptibility to detonation, is suitable for employment in percussion caps or any other appliances for developing detonation, or which, from its extreme sensibility to explosion, and from its great instability (that is to say, readiness to undergo decomposition from very slight exciting causes), is especially dangerous.

“ This class consists of two divisions.

“ The first division comprises such compounds as the fulminates of silver and of mercury, and preparations of these substances, such as are used in percussion caps ; and any preparation consisting of a mixture of a chlorate with phosphorus, or certain descriptions of phosphorus compounds, with or without the addition of carbonaceous matter, and any preparation consisting of a mixture of a chlorate with sulphur, or with a sulphuret, with or with or without carbonaceous matter.

“ The second division comprises such substances as the chloride and the iodide of nitrogen, fulminating gold and silver, diazobenzol, and the nitrate of diazobenzol.

“ 5. Ammunition.—This class includes any explosive of any of the foregoing classes, when enclosed in any case or contrivance, so as to form a cartridge for small arms,



arms, or for a weapon other than cannon; or to form any fuze for blasting or for shells; or to form any tube for firing guns; or to form a percussion cap, a detonator, or any contrivance other than the following:—a cartridge or charge for cannon or blasting, a shell, a torpedo, or a manufactured firework.

“ This class consists of two divisions.

“ The first division comprises—

Safety cartridges for small arms;  
Safety blasting fuzes;  
Percussion caps;

Railway fog signals;  
Safety fuzes for shells.

“ The second division comprises—

Non-safety cartridges for small arms;  
Detonators;  
Non-safety fuzes for blasting;

Non-safety fuzes for shells;  
War rockets;  
Tubes for firing guns.

“ (6.) Fire-works.—This class consists of two divisions. The first comprises fire-work composition, which is any chemical compound or mechanically mixed preparation which is of a combustible or inflammable nature, and is used for the purpose of making manufactured fire-works, and which is not included in the former classes of explosives; and also any coloured fire composition.

“ The second division comprises any manufactured fire-work, which includes every explosive of the four first of the foregoing classes, and any fire-work composition, when such explosive or composition is enclosed in any case or contrivance, or is otherwise manufactured, so as to form a squib, cracker, or other article adapted to the production of pyrotechnic effects, or pyrotechnic signals.

“ 2. The law relating to the foregoing explosives is at present contained in five public Acts, viz. :—

The Gunpowder Act, 1860, 23 & 24 Vict. c. 139.

Gunpowder Amendment Act, 1861, 24 & 25 Vict. c. 130.

Gunpowder Amendment Act, 1862, 25 & 26 Vict. c. 98.

The Carriage of Dangerous Goods Act, 1866, 29 & 30 Vict. c. 69.

Nitro-Glycerine Act, 1869, 32 & 33 Vict. c. 113.

“ There are also a number of local and special Acts containing provisions upon this subject, of which the more important are the 14 & 15 Vict. c. 67, and the 28 & 29 Vict. c. 278, both relating to the storage of explosives in Liverpool and on the River Mersey.

“ 3. The Acts above-named do not, in the opinion of the Committee, make adequate provision for the manufacture, storage, and transport of many of the explosives to which their attention has been directed; nor for the safety of the public, or of the persons employed in the making, keeping, carriage, and importation of those explosives.

“ 4. The evidence shows that with regard to the manufacture of gunpowder, although no loss of life, except to the persons engaged in the manufacture, has as yet occurred; some of the manufactories are so situated, that a violent explosion within them might seriously endanger the public outside them; and that although some gunpowder factories are generally ready to adopt the recommendations of the inspector, yet in others, not only has the present law been neglected, but numerous precautions, even of an elementary character, have been omitted, and the inspectors' recommendations as to the adoption of such precautions frequently disregarded.

“ 5. The Committee find that the Stores of gunpowder may practically be divided into three classes:

- (1.) Store magazines, belonging to gunpowder manufacturers and merchants.
- (2.) Consumers' magazines, for mines and other purposes.
- (3.) Retail stores.

“ It appears, with regard to the situation of many of the large Store magazines that the safety of the public is not sufficiently provided for by adequate isolation of the magazines with reference to the quantities which they contain; and that the precautions taken by the storekeepers of these magazines in the very large majority of cases, are not of the character which are shown to be necessary to ensure safety, and which are adopted in Government magazines.

“ It appears that the present law with regard to consumers' magazines is, in many instances, inconvenient and impracticable, while the evidence before the Committee tends to show that very great carelessness prevails in the management of these stores.

“ With regard to the retail stores, the Committee find that, except in regard to the amount which may be kept, they are wholly unregulated by the Acts; and as this trade may be carried on without a license or registration, there is really no supervision with regard to the place or mode of storage, or as to the persons by whom such retail trade may be carried on.

“ 6. The evidence of many of the witnesses goes to show that no adequate provision is made for the public safety as to the proper package or modes of conveyance for explosives when transported from one place to another, or for forbidding the transport, the loading and unloading of dangerously large quantities, through cities and populous places.

“ 7. The present law does not in any way regulate the importation or exportation of gunpowder.

“ 8. With regard to the manufacture of nitro-explosives, the Committee find that, excepting the Nitro-glycerine Act (32 & 33 Vict. c. 113), which forbids the manufacture of nitro-glycerine preparations except by license from the Secretary of State, there is no adequate legal provision for regulating the manufacture, storage, transport, importation, or shipment of explosives of this class.

“ 9. The law relating to the keeping of nitro-glycerine preparations is altogether and unnecessarily out of harmony with the legislation relating to other explosives.

“ 10. A similar remark applies both to the carriage, importation and exportation of this class of explosives.

“ 11. The law relating to the chlorate and fulminate class appears to be entirely insufficient for the public safety.

“ 12. With regard to the ammunition and fire-work classes, the Committee find that, while the law fails to provide adequately for the safety of the public and the persons employed in those trades, it is in some respects unduly restrictive and inconvenient to the persons engaged in them.

“ 13. The Committee, therefore, consider that the law relating to the making, keeping, carriage, and importation of gunpowder, nitro-glycerine, ammunition, fire-works, and all substances of an explosive nature, does not make adequate provision for the safety of the public, or of the persons employed in such making, keeping, carriage and importation, and that further legislation is urgently required.

“ 14. The Committee desire to draw attention to the ‘ Summary of Suggestions ’ submitted by Major Majendie, which, with the modifications which the Committee have made in consequence of other evidence, seem to afford a sound basis for such further legislation.

“ 1. The existing Acts specifically relating to gunpowder, nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances, to be repealed.

“ 2. The provisions in existing local Acts relating to explosives to be repealed, except where the Secretary of State for Home Affairs, on application of the local authority, makes an order for continuing in force any power or provision, and such order is confirmed by Parliament.

“ 3. A new Act to be framed to regulate the manufacture, keeping, selling, carrying, and importing of explosive substances according to the foregoing classification.

“ 4. Power to be given to Her Majesty in Council to extend the Act from time to time, or any part of provision thereof, to any explosive not specifically named or defined in the same.

“ 5. The manufacture of explosives and the operations connected therewith to be carried on only under a ‘ common ’ or ‘ special ’ license, to be obtained as hereafter described, except such operations as the filling of small arm cartridges, the preparing of blasting cartridges, which should be permitted to be carried on without a license, but under certain precautions to secure safety.

“ 6. No person to keep any explosive above a certain limit to be defined by the Act without a ‘ common ’ or ‘ special ’ license, to be obtained as hereafter described, except a carrier carrying in accordance with the Act, and not keeping the same beyond the time actually necessary for his business, and except an importer who has explosives in his possession in the vessel which imported the same, and who complies with the provisions of the Act.

“ 7. No person to sell or deal in explosives unless he hold a ‘ common ’ or ‘ special ’ license to manufacture, keep, or import such explosives.

“ 8. No *chemical* explosives to be imported without a ‘ special ’ license; other explosives not to be imported except under ‘ common ’ license.

“ 9. Licenses, whether ‘ common ’ or ‘ special,’ to be personal as well as local.

“ 10. ‘ Common ’ licenses to be obtained as a matter of course, on application to the licensing authority, unless the person or premises be disqualified.

“ 11. In the case of manufacturers, ‘ common ’ licenses to be granted only for the manufacture of fireworks on a small scale, in accordance with certain conditions to be defined by statute; in all other cases ‘ special ’ licenses to be taken out.

“ 12. In the case of storage, ‘ common ’ licenses to be of two sorts:—

“ (a.) ‘ Common house ’ licenses to meet the case of the ordinary retailer.

“ (b.) ‘ Common magazines ’ license to meet the case of the mine owner, or person requiring to store more considerable quantities for industrial operations.

“ 13. The

“ 13. The ‘common house’ license to be on a sliding scale, and to authorise the storage by a retail dealer up to, say, 300 lbs. of gunpowder, or 1,500 lbs. if in cartridges, and proportionate amounts of fireworks, the scale being framed according to the conditions of storage.

“ 14. The ‘common magazine’ license to be on a sliding scale, and to authorise the storage of larger quantities, up to two tons of gunpowder or one ton of gun-cotton or dynamite, or five times the amount of gunpowder in small-arm cartridges, or 10 tons of fireworks, the scale being framed according to the conditions of storage, and the distance from protected places.

“ 15. Special licenses to be obtained for storage of either larger quantities than are allowed by common licenses, or for similar quantities under special conditions. No distances or quantities to be fixed by statute for ‘special’ licenses, which should be in each case fixed by the license, and with reference to the local circumstances of the case.

“ 16. ‘Special’ licenses for manufacture, storage, and importation to be granted by the local authorities, upon the report of an inspector in every case, and subject to such conditions as to area and description of licensed premises, quantities, distances, precautions, as the inspectors may recommend, and subject also to any bye-laws and rules made under the Act.

“ 17. The licensing authorities to be,—

*For Special Licenses :*

In the City of London - -	The Lord Mayor and Aldermen.
In the rest of the Metropolitan Board of Works District.	The Metropolitan Board of Works.
In Quarter Sessions Boroughs.	The Town Council.
In any Harbour - - -	The Harbour Authority.
In Counties - - -	Quarter Sessions.
In Scotland - - -	The Sheriff.

*For Common Licenses :*

The same, except in an urban sanitary district (not included in a harbour).	The Urban Sanitary Authority.
And instead of Quarter Sessions.	Petty Sessions.

“ 18. An appeal to lie to the Secretary of State for Home Affairs against the refusal of a special license, or the imposition of vexatious restrictions.

“ 19. ‘Common’ licenses to be granted for a limited term to be fixed by the licensing authority, and not exceeding 10 years, but without prejudice to the grant of a new license at the end of that time.

“ 20. ‘Special’ licenses to be granted either, (1.) for a limited term to be fixed by licensing authority, and not exceeding 50 years; or (where the applicant so desires, (2.) for such term as a surrounding danger area, to be defined in the license, is kept clear; but without prejudice, in either case, to an application for an extension or renewal of the license.

“ 21. Powers of compulsory purchase of clearance rights for the purpose of maintaining the danger area clear to be given to special licensees, where the duration of the license is made conditional on the keeping of such area clear, subject to the approval of the licensing authorities and the Secretary of State for Home Affairs.

“ 22. All premises licensed for manufacture or storage by special license to be passed by an inspector before use.

“ 23. The Secretary of State for Home Affairs to have power to grant permission to a person having a special license for a factory or magazine, or for importation, to vary the conditions as to matters of technical and internal detail, but not as to extension of area of licensed premises, alteration of distance of buildings from any protected work, increase in the amount of explosive to be manufactured, or any *substantial* change in the nature of explosive to be manufactured, kept, or imported.

“ 24. The destruction of a magazine by explosion to determine the license, and a magazine existing under a common license and so destroyed not to be again licensed, except by *special* license.

“ 25. If two or more buildings of a licensed factory, other than the incorporating mills of a gunpowder factory, are destroyed by explosion, the licensee not to re-erect more than one of such buildings without the written consent of the Secretary of State for Home Affairs, or otherwise than in accordance with such conditions as to mounds, or other precautions, as the said Secretary of State may impose.

“ 26. The carriage of explosives to be carried on without a license (except water carriage in harbours where bye-laws to that effect exist), but under certain statutory ‘general rules,’ and subject to any bye-laws made under the Act by competent authority (as hereinafter described).

" 27. All explosives carried to be duly labelled and declared, and no explosives (except small quantities for sportsmen) to be carried in public vehicles, or as cargo in passenger ships (except by permission of the Board of Trade).

" 28. Harbour authorities to have power to make bye-laws, to regulate the navigation and place of mooring of ships, safe stowing and safe keeping of explosives on board, regulating the kind of ship or barge, licensing the same, fixing the place, time, and mode of shipping explosives, and the precautions to be taken, for which the present Liverpool Gunpowder Act seems to afford a good model.

" 29. Railway and canal companies to have power to frame bye-laws for regulating the carriage of explosives over their rail or canal, the place and time and mode of loading, amount to be carried, and necessary precautions.

" 30. All bye-laws made as above to be confirmed by the Secretary of State for Home Affairs (or Board of Trade), and the said Secretary of State (or Board of Trade) to have power to enforce the making of bye-laws, or where not made to make them, in any place where it may be deemed necessary.

" 31. Harbour and conservancy authorities to have power to provide ships and barges for the carriage of explosives, and to provide magazines (to be licensed by special license in the usual way) for safe deposit of explosives.

" Urban sanitary authorities to have the latter power.

" 32. 'General rules' for the manufacture, storage, packing, and carriage of explosives to be enacted. These rules to be variable only by Order in Council.

" 33. 'Special rules' to be framed by every manufacturer (except small firework makers, who should be provided for by extra 'general rules'), and every holder of a special or common magazine license, or of a special importation license, if required by the Secretary of State for Home Affairs, for the conduct and guidance of the work-people in his factory or magazine or place of importation.

" 34. All 'special rules' made as above to be confirmed by the Secretary of State for Home Affairs, who may disallow or add to the same.

" 35. Inspectors to be appointed by the Secretary of State for Home Affairs.

" 36. An inspector to have power to make such examination, entry, and inquiry, as may be necessary to ascertain whether the provisions of the Act are complied with, and to take samples for analysis of any explosive, or supposed explosive, on tender of payment, and to require railway companies to carry such samples.

" 37. An inspector to have power in the case of his observing anything unnecessarily dangerous and defective to give notice to licensee, and require the same to be remedied, subject to an appeal to arbitration (as in the Mines Act); and, if the matter be, in the opinion of the inspector, urgent, and tend to the bodily danger of any person, and if it be contrary to the usage of the trade, to require the same to be remedied forthwith, provided that such power of requiring a matter to be remedied forthwith, shall not extend to matters affecting the premises or machinery.

" 38. If a licensee objects to the inspector's requisition he may (except where the matter is required to be remedied forthwith) object in writing within a certain time, and in that case the matter is to be referred to and decided by arbitration; and pending such appeal, it shall be optional for the manufacturer to comply with the requisition.

" 39. If the matter has been ordered to be remedied forthwith, the licensee, notwithstanding that he objects, must forthwith comply with such requisition; and if he feels aggrieved may apply to the county court for damages against the inspector; but no person shall be liable to any penalty for not complying with such requisition forthwith, if he can show that the practice or thing complained of was not contrary to the usage of the trade.

" 40. Licensing authorities to be empowered to appoint 'searchers' to ascertain if the provisions of the Act are duly observed in any premises licensed under a common license within the jurisdiction of such authority, except magazines which are subject to inspection by the inspectors of mines; and the case of harbours, to search ships and barges, such as appears to be provided in the Thames and Mersey by existing Acts.

" 41. Where a matter is urgent and fraught apparently with serious public danger, an inspector or a 'specially authorised' constable or 'searcher' may make the necessary inquiry or inspection, and take such steps in the way of the seizure of the explosives or otherwise (to be defined by the Act) as may be necessary to remove the risk or source of danger.

" 42. A constable or searcher to be 'specially authorised' by a warrant of a justice of the peace, or, when the case is one of emergency, and the delay in obtaining a warrant would be likely to endanger life, by a written order from an inspector or from the chief officer of police of the district, or, in his absence, from any officer of police not lower than a serjeant; a report of any proceedings taken under this provision to be made in all cases.

" 43. Proceedings against a licensee for offences under the Act not to be instituted except by an inspector, or by a licensing authority, a justice of the peace, a chief officer of the police, or a person authorised by the Secretary of State for Home Affairs.

" 44. Arbitrations under the Act to be as in the Mines Act, viz., one arbitrator to be appointed by the appellant, the other by the respondent, and the arbitrators to nominate an umpire.

" 45. Accidents

" 45. Accidents by explosion or fire in any licensed premises, or in any vehicle or vessel carrying an explosive, to be reported to the Secretary of State for Home Affairs.

" 46. Notice of any inquest about to be held on any person killed by an explosion or fire or any accident in connection with any explosive to be sent by the coroner to the Secretary of State for Home Affairs, so as to allow an inspector to attend.

" 47. The Secretary of State, Home Affairs, to have power to institute a formal inquiry (by an inspector with legal assessors, or *vice versâ*, as in the Railway Act) in any case where he considers it necessary.

" 48. Heavy punishments to be imposed for a substantial departure from any important condition of the license, or for making, or storing, or importing, an explosive without a license (where license is required), or otherwise than in accordance with the terms of such license, or for wilful neglect, or wilful act, tending to endanger life or limb, with power, if the case is tried on indictment, for the court to forfeit a licensè (except in the case of magazines and factories lawfully existing at the time of the passing of the Act).

" 49. An appeal to lie to a court of superior jurisdiction in all cases where any forfeiture or conviction is made by a court of summary jurisdiction.

" 50. Vested interests to be specially guarded and provided for, as follows :—

" (a.) All occupiers of factories and magazines lawfully existing at time of the passing of the Act (except as hereinafter named), to be entitled to obtain from the Secretary of State for Home Affairs, and without reference to the local authorities, a 'continuing certificate,' of unlimited duration (except to such extent as the duration may be actually limited by any existing license affecting the factory or magazine).

" (b.) Any difference as to the right to this certificate to be determined by a court of law.

" (c.) Occupiers of (unlicensed) mine magazine, and of magazines established in pursuance of a 'general license' under the Nitro-glycerine Act, to be required to take out a 'common license.'

" (d.) Licensed places, the license for which expires within 12 months of the passing of the Act to be allowed to run out.

" (e.) The Secretary of State for Home Affairs to be empowered to impose conditions on the 'continuing certificate,' and to fix quantities (as the licensing authorities may do in the case of new licenses), except that he may not impose any conditions which would have the effect of requiring the removal of any legally existing work or building, or to diminish the quantities below what the licensee is at present entitled to have, except that in the case of store magazines for unlimited quantities he may assign as a limit the quantity which the magazine would contain on a given date.

" (f.) Any difference as to the conditions to be settled by arbitration.

" 51. The Act not to apply to factories and magazines and explosives belonging to the Crown, or to volunteer storehouses.

" 52. The Act not to interfere with the law of nuisance.

" 15. The Committee believe that the legislation thus indicated, will add materially to the public safety, with a due regard to the necessities of the trade."

DRAFT REPORT proposed by the Chairman, read a second time, paragraph by paragraph.

Paragraphs 1—2, *agreed to*.

Paragraph 3.—Amendment proposed, in line 1, before the words "the Acts," to insert the words, "with the exception of the Liverpool Acts, as to which the Committee have received satisfactory evidence"—(Mr. *Whitwell*).—Question, That those words be there inserted,—put, and *negatived*.

Another Amendment proposed, in line 4, at the end of the paragraph, to add the words, "while some of them impose in some respects unnecessary restrictions"—(Mr. *Whitelaw*).—Question, That those words be there added,—put, and *agreed to*.

Another Amendment proposed, after the last Amendment, to add the words, "and consequently further legislation is required"—(Mr. *Whitwell*).—Question, That those words be there added,—put, and *agreed to*.—Paragraph, as amended, *agreed to*.

Paragraph 4.—Amendment proposed, to leave out the paragraph—(Mr. *Whitwell*).—Question, That the paragraph stand part of the proposed Report,—put, and *negatived*.

Paragraphs 5—6, *agreed to*.

Paragraph 7, amended, and *agreed to*.

Paragraph 8, *agreed to*.

Paragraphs 9—11, amended, and *agreed to*.

Paragraph 12, *agreed to*.

Paragraph 13.—Amendment proposed, to leave out the paragraph—(Mr. *Whitwell*).—Question put, That the words “The Committee therefore consider,” stand part of the paragraph.—The Committee divided:

Ayes, 6.	Noes, 5.
Sir Henry Selwin-Ibbetson.	Mr. Stevenson.
Colonel North.	Mr. Whitwell.
Mr. Edward Stanhope.	Mr. Dillwyn.
Mr. Knowles.	Mr. Whitelaw.
Mr. M'Lagan.	Mr. Arthur Vivian.
Mr. Hick.	

Another Amendment proposed, in line 5, to leave out the word “urgently”—(Mr. *Whitwell*).—Question put, That the word “urgently” stand part of the paragraph.—The Committee divided:

Ayes, 7.	Noes, 4.
Sir Henry Selwin-Ibbetson.	Mr. Stevenson.
Colonel North.	Mr. Whitwell.
Mr. Edward Stanhope.	Mr. Dillwyn.
Mr. Knowles.	Mr. Arthur Vivian.
Mr. M'Lagan.	
Mr. Hick.	
Mr. Whitelaw.	

An Amendment made.—Paragraph, as amended, *agreed to*.

Paragraph 14.—Amendments made.—Another Amendment proposed, at the end of Sub-section 3, after the word “classification,” to add the words, “the manufacture of gunpowder, ordinarily so called, being made the subject of separate provisions in such new Act”—(Mr. *Stevenson*).—Question put, That those words be there added.—The Committee divided:

Ayes, 9.	Noes, 2.
Mr. Stevenson.	Sir Henry Selwin-Ibbetson.
Colonel North.	Mr. Knowles.
Mr. Edward Stanhope.	
Mr. Whitwell.	
Mr. M'Lagan.	
Mr. Hick.	
Mr. Dillwyn.	
Mr. Whitelaw.	
Mr. Arthur Vivian.	

Another Amendment proposed, in Sub-section 5, line 4, to leave out from the word “license” to the end of the sub-section—(Mr. *Whitwell*).—Question, That the words proposed to be left out stand part of the sub-section,—put, and *agreed to*.

An Amendment made.—Another Amendment proposed, in Sub-section 8, line 1, to leave out the word “chemical”—(Mr. *Whitwell*).—Question put, That the word “chemical” stand part of the sub-section.—The Committee divided:

Ayes, 4.	Noes, 5.
Colonel North.	Mr. Stevenson.
Mr. Knowles.	Mr. Edward Stanhope.
Mr. Hick.	Mr. Whitwell.
Mr. Arthur Vivian.	Mr. M'Lagan.
	Mr. Whitelaw.

Amendments made.—Another Amendment proposed, in Sub-section 16, line 4, to leave out from the words “may recommend” to the end of the sub-section—(Mr. *Stevenson*).—Question put, That the words proposed to be left out stand part of the sub-section.—The Committee divided:

Ayes, 6.	Noes, 5.
Sir Henry Selwin-Ibbetson.	Mr. Stevenson.
Colonel North.	Mr. Whitwell.
Mr. Edward Stanhope.	Mr. M'Lagan.
Mr. Knowles.	Mr. Whitelaw.
Mr. Hick.	Mr. Arthur Vivian.
Mr. Dillwyn.	

Question proposed, That the sub-section, as amended, stand part of the paragraph.—  
The Committee divided :

Ayes, 8.  
Sir Henry Selwin-Ibbetson.  
Colonel North.  
Mr. Edward Stanhope.  
Mr. Knowles.  
Mr. M'Lagan.  
Mr. Hick.  
Mr. Dillwyn.  
Mr. Arthur Vivian.

Noes, 3.  
Mr. Stevenson.  
Mr. Whitwell.  
Mr. Whitelaw.

Another Amendment proposed, after Sub-section 16, to insert the following sub-section:—  
“Special licenses for importation to be granted by the local authorities, subject to any bye-law and rules made under the Act, the local authorities having power to ask for the report of an inspector in any case”—(Sir Henry Selwin-Ibbetson).—Question, That this sub-section be there inserted,—put, and *agreed to*.

An Amendment made.—Another Amendment proposed, to leave out Sub-section 18—  
(Mr. Whitwell).—Question put, That the sub-section stand part of the paragraph.—The Committee divided :

Ayes, 8.  
Sir Henry Selwin-Ibbetson.  
Colonel North.  
Mr. Edward Stanhope.  
Mr. M'Lagan.  
Mr. Hick.  
Mr. Dillwyn.  
Mr. Whitelaw.  
Mr. Arthur Vivian.

Noes, 2.  
Mr. Stevenson.  
Mr. Whitwell.

[Adjourned till Friday next, at Twelve o'clock.

*Friday, 26th June 1874.*

MEMBERS PRESENT :

Sir JOHN HAY in the Chair.

Sir Henry Selwin-Ibbetson.  
Mr. Whitwell.  
Mr. Stevenson.  
Mr. Edward Stanhope.  
Mr. Arthur Vivian.

Colonel North.  
Mr. Whitelaw.  
Mr. Hick.  
Mr. Dillwyn.

Paragraph 14, as amended, further considered.—Another Amendment proposed, in Sub-section 20, line 1, to leave out from the word “licenses” to the end of the sub-section, in order to add the words, “for the establishment of manufactories to be allowed when the proposing licensee can show that he owns or can control the land adjoining the intended site to such an extent as will secure a safety-area around the manufactory to the satisfaction of the licensing authority and the Home Secretary, such license to be liable to be revoked if such safety-area ceases to be kept clear”—(Mr. Whitwell).—instead thereof.—Question, That the words proposed to be left out stand part of the sub-section,—put, and *negatived*.

Words added.—Amendments made.—Another Amendment proposed, in Sub-section 23, line 3, to leave out the words “as to matters of technical and internal detail”—(Mr. Whitwell).—Question, That the words proposed to be left out stand part of the sub-section, put, and *negatived*.—Another Amendment proposed, in Sub-section 23, line 3, to leave out the words “but not”—(Mr. Whitwell).—Question put, That the words “but not” stand part of the sub-section.—The Committee divided :

Ayes, 4.  
Sir Henry Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Hick.  
Mr. Whitelaw.

Noes, 5.  
Mr. Stevenson.  
Colonel North.  
Mr. Whitwell.  
Mr. Dillwyn.  
Mr. Arthur Vivian.

Amendments made.—Another Amendment proposed, at the end of Sub-section 25, to add the words “ Provided that in the case of existing factories this section shall not apply except in regard to such buildings as an inspector has, previously to the explosion (in a written notice to the owner), pronounced to be in undue proximity ”—(*Sir Henry Selwin-Ibbetson*).—Question proposed, That those words be there added.—Amendment proposed to the proposed Amendment, after the words “ undue proximity,” to add the words “ subject to arbitration ”—*Mr. Whitwell*).—Question put, that the words “ subject to arbitration,” be added to the proposed Amendment.—The Committee divided :

Ayes, 5.  
Mr. Stevenson.  
Colonel North.  
Mr. Whitwell.  
Mr. Dillwyn.  
Mr. Arthur Vivian.

Noes, 4.  
Sir Henry Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Hick.  
Mr. Whitelaw.

Question put, That the words as amended be added to the sub-section.—The Committee divided :

Ayes, 7.  
Mr. Stevenson.  
Colonel North.  
Mr. Edward Stanhope.  
Mr. Whitwell.  
Mr. Hick.  
Mr. Dillwyn.  
Mr. Arthur Vivian.

Noes, 2.  
Sir Henry Selwin-Ibbetson.  
Mr. Whitelaw.

Amendments made.—Another Amendment proposed in Sub-section 31, line 2, after the word “ explosives,” to insert the words “ and to charge toll for the use thereof, according to scale, to be approved by the Secretary of State for Home Affairs ”—(*Mr. Whitwell*).—Question put, That those words be there inserted.—The Committee divided :

Aye, 1.  
Mr. Whitwell.

Noes, 8.  
Sir Henry Selwin-Ibbetson.  
Mr. Stevenson.  
Colonel North.  
Mr. Edward Stanhope.  
Mr. Hick.  
Mr. Dillwyn.  
Mr. Whitelaw.  
Mr. Arthur Vivian.

Amendments made.—Another Amendment proposed in Sub-section 37, line 2, after the word “ dangerous ” to leave out the words “ and defective ”—(*Mr. Whitwell*).—Question, That the words “ and defective ” stand part of the sub-section,—put, and *agreed to*.

Amendments made.—Another Amendment proposed in Sub-section 37, line 3, to leave out from the words “ Mines Acts,” to the end of the sub-section—(*Mr. Whitwell*).—Question put, That the words proposed to be left out stand part of the sub-section.—The Committee divided :

Ayes, 6.  
Sir Henry Selwin-Ibbetson.  
Mr. Stevenson.  
Colonel North.  
Mr. Edward Stanhope.  
Mr. Hick.  
Mr. Whitelaw.

Noes, 3.  
Mr. Whitwell.  
Mr. Dillwyn.  
Mr. Arthur Vivian.

Amendments made.—Another Amendment proposed in Sub-section 50, line 2, to leave out the words “ lawfully existing,” in order to insert the words “ duly licensed ”—(*Mr. Whitwell*),—instead thereof.

Question put, That the words “ lawfully existing ” stand part of the sub-section, put.—The Committee divided :

Ayes, 6.  
Sir Henry Selwin-Ibbetson.  
Colonel North.  
Mr. Edward Stanhope.  
Mr. Hick.  
Mr. Dillwyn.  
Mr. Whitelaw.

Noes, 3.  
Mr. Stevenson.  
Mr. Whitwell.  
Mr. Arthur Vivian.

Amendments made.—Paragraph, as amended, *agreed to*.

Paragraph



Paragraph 15.—Amendment proposed in line 1, to leave out the first word “The”—(Mr. *Whitwell*).—Question put, That the word “The” stand part of the paragraph.—The Committee divided :

<p>Ayes, 4.</p> <p>Sir Henry Selwin-Ibbetson. Colonel North. Mr. Edward Stanhope. Mr. Dillwyn.</p>		<p>Noes, 4.</p> <p>Mr. Stevenson. Mr. Whitwell. Mr. Whitelaw. Mr. Arthur Vivian.</p>
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Whereupon, The Chairman declared himself with the *Ayes*.

Paragraph agreed to.

Question, That this Report, as amended, be the Report of the Committee to the House,—put, and *agreed to*.

*Ordered*, To Report, together with the Minutes of Evidence, and an Appendix.

EXPENSES OF WITNESSES.

NAME OF WITNESS.	Profession or Condition.	From whence Summoned.	Number of Days Absent from Home, under Orders of Committee.	Expenses of Journey to London and back.	Allowance during Absence from Home.	TOTAL Expenses allowed to Witness.
Major V. D. Majendie	R.A. - -	For expenses incurred in attendance before the Committee.	- -	£. s. d. - - -	£. s. d. - - -	£. s. d. 3 - -
Major A. Ford - -	R.A. - -	For expenses incurred in attendance before the Committee.	- -	- - -	- - -	7 5 7
Dr. Anguste Dupré - -	- - - -	Westminster Hospital	3	- - -	9 9 -	9 9 -
				£.	- - -	19 14 7

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 MINUTES OF EVIDENCE.
 

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Tuesday, 5th May 1874.

## MEMBERS PRESENT:

Mr. Bell.  
Mr. Dillwyn.  
Sir John Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. Laird.  
Mr. M'Lagan.  
Colonel North.

Mr. Norwood.  
Sir H. Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Whitlaw.  
Mr. Whitwell.  
Mr. Vivian.

VICE ADMIRAL THE RIGHT HONOURABLE SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Major VIVIAN DERING MAJENDIE, R.A., and Major ARTHUR FORD, R.A., called in;  
and Examined.

*Chairman.*

1. You are an officer of the Royal Artillery, I believe?—Yes.

2. You are attached to the Home Office, are you not?—Yes.

3. In what capacity?—As Inspector of Gunpowder Works, under the Gunpowder and Nitroglycerine Acts.

4. How long have you held that post?—About three years.

5. Have you drawn up a summary of the conclusions that you have arrived at with regard to the necessity for an amendment of the law with reference to explosive substances?—Yes.

6. Will you kindly put the Committee in possession of that summary?—I have entitled it "Summary of Conclusions as to the necessity for Amendment of the Law relating to Explosives." It runs as follows: The further experience I have acquired strengthens the opinions I have expressed in former reports, and I may summarise my conclusions as follows: The first point is, Concurrence of testimony as to necessity for revision of existing law relating to explosives. From the time the Gunpowder Act of 1860 was passed, there has been a growing conviction of its inadequacy. This inadequacy, and the urgent necessity for its amendment, is testified to by the concurrent opinion of all who have been brought into official contact with the subject: Secretaries of State, lawyers, military officers, coroners' juries, members of various branches of the trade, chemists, chief constables, town clerks, various public bodies, and numerous private individuals

0.84.

*Chairman—continued.*

(Report, pages 9 to 12). The next point is, Coincidence of my own, and the prevailing opinion as to the necessity for amendment of the law. This opinion is confirmed by the results of my own observation and experience as an inspector, based upon (a.) Knowledge derived from 10 years' experience in the Royal Arsenal at Woolwich; (b.) Careful personal inspection of the various factories and stores of the United Kingdom throughout a period of about three years and a half, during which time over 800 inspections have been carried out; (c.) Replies received to inquiries relating to the subject, made personally or in writing; (d.) Public documents relating to explosives, successive reports which have been made upon the subject, presentations of coroners' juries, and expressions of opinion by magistrates, public bodies, and Secretaries of State; (e.) Close observation of the working of the Acts relating to explosives, and actual daily experience of their operation during three years and a half (Report, pages 3 to 7, 9 to 12, &c.). The next point is, "Chief defects of existing law." The existing law is open to criticism on an almost infinite number of points, the most conspicuous of which are as follows: (1. Large and important groups of explosives not provided for.) The manufacture, storage, transport, &c., of large groups of explosives are either not regulated at all, or are so inadequately regulated as to be practically unprovided for. Thus, the manufacture of gun-cotton, sawdust, gunpowder, and all nitro and chlorate explosives

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R.A., and  
Major  
Ford, R.A.  
5 May 1874.

Major  
Majendie,  
R.A., and  
Major  
Ford, R.A.  
5 May 1874.

Chairman—continued.

explosives (other than those which contain nitro-glycerine), and numerous varieties of explosive substances distinct from gunpowder, the majority of which have attained to practical importance since the Act of 1860 was passed, is only so far restricted that the manufacture must be licensed, if indeed a license is in all cases required. The storage, transport, and importation of these explosive substances are under no regulations whatever, and it has even been held that a person not being a manufacturer of them may store unlimited quantities of them, without any license and in any place. Some dangerous processes (as the breaking up of cartridges) are not provided for at all (Report, pages 15, 16, 24). (2. No provision for securing that proper conditions shall be included in the licenses.) The subject is a very technical one, and no means are provided for supplying licensing authorities with that technical knowledge which they cannot be expected to possess, nor is there even any obligation on licensing authorities to impose conditions. The effect of this is, that while some licenses are granted without any conditions at all, to the great danger of the public and of the workpeople, other licenses are overloaded with conditions, some of which are often quite unnecessary and unduly restrictive on the trade, while the really necessary conditions are too frequently missed altogether. This also necessarily produces the most contradictory and uncertain results in different districts, and this is the more unsatisfactory, as there is no appeal except in the case of gunpowder (Report, pages 18, 19, 37, 38). This defect is so far recognised, that in many cases the magistrates have voluntarily applied to me for advice and assistance, and manufacturers, in similar cases, have frequently done the same. The power of the licensing authorities as to imposing conditions is also unduly limited by the Act, and doubts have arisen as to the construction of the Act on this point. (3. No sufficient statutory provisions as to the precautions to be taken.) The absence of any provisions for securing proper conditions in the license is not compensated by the presence of statutory provisions requiring due precautions to be taken with regard to the tools or machinery, the construction or isolation of buildings, or the clothing of the workpeople, or requiring the separation of the operations and their attendant risks, the employment of competent persons only in sufficient number, the adoption of proper working rules, the erection of lightning conductors (except for the store magazines of gunpowder factories), or even the observance of the most elementary precautions, such as the exclusion of fires and naked lights from buildings in which explosives are present; and these safeguards, my experience shows, are very commonly and recklessly neglected, often with disastrous results (Report, pages 19 to 25, 28, 29). (4. Absence of adequate provisions as to transport, exportation, and importation.) The statutory provisions as to the transport, importation, exportation, and shipment of explosives are quite inadequate to provide for the public safety; these operations (except in the case of nitro-glycerine preparations) being carried on without any license and without any supervision, except here and there under local Acts, as in the Mersey. No adequate provision is made for the use of proper barrels and cases, or of proper

Chairman—continued.

vehicles, or for the proper storage of the explosives in the vehicles or vessels, or for the vehicles being in charge of competent and sufficient conductors only, or for reasonable limits on the quantity conveyed at one time, or for the labelling or declaring the nature of the explosives, or for loading and unloading in proper places and with due precautions, or for forbidding the transport of explosives by omnibuses and public conveyances. In short, this important part of the trade is, except as to nitro-glycerine preparations, practically unregulated (Report, pages 29 to 33, 45 to 49). On the other hand, some of the railway companies' restrictions are so severe as to lead to a good deal of surreptitious carrying of explosive goods. (5. Provisions as to distances and quantities unsatisfactory and inelastic.) The isolation of factories and magazines for explosives is very important; but the enactments with regard to it are very defective and incomplete, besides being in several instances unduly restrictive upon the manufacturers, and entirely deficient in elasticity. Thus, while limits of quantity to be kept in certain of the buildings of gunpowder factories are assigned, the distances of these buildings apart, which may be regarded as necessarily complementary of the limitation of quantity, are not fixed at all, and the converse is the case where the distances are fixed. The Acts are wholly silent with regard to the isolation of magazines and factories of gun cotton, sawdust powder, &c. In many cases, neither distances nor quantities are fixed; on the other hand, where distances and quantities are laid down, they are generally fixed without any power of alteration, and thus are often seriously and unnecessarily oppressive to the trade, in cases where the natural features of the ground, or the existence of artificial mounds would justify an extension of quantity or a reduction of distance. Again, no person may, under any circumstances, have more than 200 lbs. of gunpowder (or 300 lbs. for the use of a mine) within half a mile of a church, or one mile of the limits of any borough or market town, or within two miles of a palace; on the other hand, any quantity of gun cotton may be kept inside a borough, or next door to a church or palace. The conditions required to be fulfilled by firework-makers in regard to the isolation of their buildings from one another and from dwellings, are unnecessarily restrictive, and tend to discourage the smaller makers and to promote the illicit manufacture in dwelling-houses and unsuitable places. The law, if enforced, would put a stop to many firework-makers. Again, in the case of magazines for the use of mines, where certain distances are laid down, these distances are such that if the law were to be enforced a very large proportion of the mine magazines throughout the kingdom would have to be closed. Again, no provision is made for the temporary storing of gunpowder for use in the making of docks, railways, &c., and thus the material has to be kept illegally, and consequently in secret and without precaution. Again, the list of protected places is exceedingly incomplete. In the case of store magazines and gunpowder factories, there is no limitation of distance whatever as to dwelling-houses, while river and sea walls, canal and river banks, railways, highways, factories, schools, hospitals, cathedrals, and public buildings are not protected in

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in any case. The Act does not prevent licensees from storing unlimited quantities of powder, or from extending their magazines or buildings of limited capacity to a capacity which may cause considerable danger to the public; in short, the Acts are defective under this important head; on the one hand, in drawing too hard and fast a line (and in some cases an unduly restrictive line), on the other, in not protecting certain buildings and places where protection is absolutely necessary in the interests of public safety (Report, pages 34 to 39, 41 to 43; 68, 69). (6. Powers of inspection and search insufficient.) The power of interference in the case of suspected illegalities (*i.e.*, by means of search warrants, which can only be executed by day) is unsatisfactory and not adequate to provide for the public safety; no power is vested in an inspector to enforce the discontinuance of obviously dangerous practices, or the adoption of obviously necessary precautions, or to interfere summarily to prevent any urgent danger to the public which may come under his notice. In short, the absence of any really sufficient powers of inspection, whether local or central, constitutes a grave defect in the present legislation, a defect which is aggravated by the absence of any provision to ensure that the existence even of all factories and magazines shall be known at the Home Office (Report, pages 49 to 59). (7. Law as to retail trade unsatisfactory and contradictory.) The law with regard to the retail trade in explosives is exceedingly unsatisfactory and contradictory; in the first place, any person may constitute himself "a dealer," without license or even registration, and may thus acquire the right to keep 200 lbs. of loose gunpowder anywhere, and without any precautions or supervision, and without any reference to the suitability or otherwise of the place of storage. But of powder in cartridges (a form in which the risk is far less, and in some cases absolutely inappreciable), a maker may not keep more than 5 lbs. in an unlicensed place. Of gun cotton and similar explosives, it has been held that any person may keep an unlimited quantity if he be not himself the manufacturer. On the other hand, no person may sell a single squib or halfpenny cracker without a license; while the filling of cartridges (which is done by nearly every gun maker, and half the sportsmen in the kingdom) is forbidden to be carried on except by license, or within 100 yards of a dwelling-house (Report, pages 60 to 64). (8. Law relating to nitro-glycerine entirely out of harmony with law as to other explosives.) The law relating to nitro-glycerine, and explosive preparations containing nitro-glycerine is altogether out of harmony with the legislation relating to other explosives, and is as much too stringent as the gunpowder law is too lax. Thus, by the Nitro-glycerine Act it is enacted that any person who imports, exports, manufactures, sells, carries, or otherwise disposes of, or has in his possession any nitro-glycerine, or any substance having nitro-glycerine in any form as one of its component parts, without a general or special license issued by a Secretary of State, is guilty of a misdemeanour, and is liable to be imprisoned, with or without hard labour, for any period not exceeding one year, or to pay a penalty not exceeding 500 *l.*, and any nitro-glycerine so imported or exported will be forfeited; so that, while any person may keep 50 lbs. of gunpowder

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for his own use, or 200 lbs. if he deals in it, or two tons for mining purposes (under certain conditions), or an indefinite quantity of gun cotton (unconditionally), no one may have a single ounce of a nitro-glycerine preparation without a license from the Secretary of State. So, again, while gunpowder may be carried, imported, and exported without any license or restriction, no nitro-glycerine preparation may be carried, imported, or exported without a license, and no nitro-glycerine can be imported at all. While the maker or storer of gunpowder may (and frequently does) obtain an unconditional and unlimited license, the whole trade in nitro-glycerine preparations is absolutely at the mercy of the Secretary of State in regard to the conditions under which the manufacture, storage, transport, &c., shall be carried on; while a license once granted to a maker of gunpowder cannot be altered or revoked, a license granted under the Nitro-glycerine Act may be revoked at the discretion of the Secretary of State; while the penalties for offences against the Gunpowder Acts are in many cases ridiculously inadequate (and in some cases summary penalties are not provided at all), the penalty for offences of whatever description, against the Nitro-glycerine Act, is 500 *l.*, or a year's imprisonment with hard labour, or 100 *l.* for a breach of the conditions of the license. The effect of this marked distinction between the cases of gunpowder and nitro-glycerine preparations is, doubtless, extremely prejudicial to the interests and development of the nitro-glycerine industry; and it is apt to give, and in some cases to my knowledge has given, rise to the impression that an explosive which requires to be so exceptionally treated must be very exceptionally and alarmingly dangerous. This effect is increased by the fact, that as the Nitro-glycerine Act contains no statutory provisions whatever as to precautions, every condition requisite for safety, down to the minutest detail, has to be set forth in each license, which thus assumes a very formidable appearance. On the other hand, it may be noticed that the fact that only licenses can be so bound is exceedingly inconvenient. Further, the granting of all licenses under this Act, including all mineowners who desire to use or even to try nitro-glycerine preparations, throws a great mass of work upon the Secretary of State and his inspector, the ultimate growth of which cannot be contemplated without dismay. Under this system, even at present, the machinery provided for effectively enforcing the Act, and checking the quality of nitro-glycerine preparations in regard to their ingredients, chemical purity, and freedom from exudation, is altogether inadequate. As the trade expands, this machinery, unless greatly enlarged, must fail altogether to compass the important work which it is designed to perform. (9. Wording and construction of Acts exceedingly obscure and defective, rendering their effective administration a matter of extreme difficulty.) The various legal flaws and defects which have been found in working the Acts are both numerous and important, and the difficulty of construing some of the clauses has proved considerable. Some defects of this sort are noticed in my Report (page 72); but several others have since come to light. Indeed, Mr. Poland's opinion that "every case that arises under the Gunpowder Acts shows the difficulty of effectually working them," expresses succinctly

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succinctly the extent of this evil, an evil which becomes the more serious in view of the disregard of the law which, except in the establishments of certain leading manufacturers, has too commonly prevailed, and which is to be regretted alike in the interests of the public, of the workpeople employed, and of those traders who place themselves at a competitive disadvantage by endeavouring to observe the law (Report, pages 71 to 73). The consideration of the remedies to be applied, with a view to making adequate provisions for the safety of the public and of the persons engaged in the trade, is a separate branch of the subject.

7. Are there any other officers attached to your department under the Home Office for the same purposes?—No.

8. I understand you to convey that the opinions of the various officers with regard to the necessity for the amendment of the law referred to in your summary of conclusions are those which are enumerated in your Report?—Yes, those enumerated at pages 9 to 12, and 55 and 56 of my Report.

9. Will you be kind enough to state to the Committee of what nature were the inquiries which you addressed to the chief constables and others?—I should like to hand in a copy of the questions which I put to the chief constables of all the boroughs of England and Wales. Another paper shows the inquiry which I addressed to various manufacturers of gunpowder in the kingdom. Another paper is the inquiry which I addressed to the town clerks of a number of chief towns mentioned in my Report. Those were written inquiries, and there have been a number of verbal inquiries which I can hardly specify.

10. Have you, since that Report was written, received any confirmatory evidence of the existence of a wide-spread opinion that the present state of the law is unsatisfactory?—I have from various sources, especially from the people representing dynamite or nitro-glycerine interests. They have urged upon me very strongly the necessity of an alteration in the law, and persons using dynamite also complain of the restrictions of the Act of Parliament. Then, in conversation, and also in official interviews, some of the members of the gunpowder trade have expressed their desire for a modification of some of the provisions of the law, for example, the provisions with regard to quantities. Lately the Walworth vestry made strong representation in consequence of certain things which occurred within their jurisdiction with regard to the necessity for an amendment of the law with regard to fireworks. Several firework makers have also urged upon me the desirability of a modification of the law, so as to give them increased facilities. Only the other day a firework-maker wrote and expressed his hope that some alteration would be made in the mode of obtaining licenses, and as to the distances which they are required to observe, because those regulations in many cases were prohibitory, and in the course of my inspections I have had the subject continually coming up. There has been I might almost say complete unanimity on the part of various branches of the trade with regard to this or that matter in the Act requiring amendment.

11. Have you yourself had any personal knowledge other than that which you have derived from the Home Office, either at the Royal

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Arsenal at Woolwich or elsewhere, with reference to this subject?—I had an experience of 10 years in the Royal Laboratory at Woolwich, partly as captain instructor and partly as assistant superintendent; and I was also a Member of the Committee on Explosives.

12. Are you of opinion that the impression of the necessity of a change in the law is increasing rather than diminishing?—I think it is; I think it would have been more strongly expressed if there had not been a general impression that the law was going to be amended, or if there had been any attempt to enforce the law more strictly on all points.

13. Can you state to the Committee in detail how you acquired considerable knowledge of the subject in the Woolwich Arsenal?—The nature of the works in the Laboratory at Woolwich was such that I was daily engaged in connection with precautions to be taken for the avoidance of accidents from explosives; in fact, the department at the Royal Laboratory is one where the making of ammunition, and the manipulating of explosive substances, is one of the most important branches.

14. Will you be kind enough to state what was the number of the inspections which you have had to make which are set forth at page 75 of your Report?—There are over 800 inspections which have been made either personally by myself, or Major Ford, or my late assistant, Captain Smith, and the details of all those inspections have passed through my hands. I should like to hand in a Return showing the number of the factories in the various counties of England, Wales, Scotland, and Ireland, and the magazines for gunpowder and nitro-glycerine preparations which we know exists, and which we have inspected, as shown in the Supplementary Table at page 5 of my Report.

15. Have those inspections been very careful and of a minute character?—Exceedingly minute; every detail as far as practicable has been noted. To illustrate that, I should like to put before the Committee one of the forms used in my inspection of magazines, to show the character of the inspections.

16. You state that your opinion with regard to the necessity for the amendment of the law is also based on the replies received to the inquiries you sent out; from whom were the inquiries made?—They were made from those persons who are specially named at pages 3 to 7, and 9 to 12, in my Report. I have brought up the replies received from the various constables and the town clerks, but as those replies are very numerous and very voluminous, I thought it might perhaps assist the Committee if I abstracted them, and those abstracts I should also like to hand in. One abstract is that of the replies from the chief constables and superintendents of police of about 68 places, and the other is from town clerks, I think from about 25 places.

17. Those documents are the ones referred to in your Report, are they not?—Yes.

18. Have you had every opportunity during the time you have been inspector of observing the working of the present Acts of Parliament?—Yes; I have had full opportunity of observing the working of the present Acts of Parliament during the time I have been inspector. I have been daily engaged in it, and the whole business has been in my hands.

19. You

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19. You state in your Report, that large and important groups of explosives are either not regulated at all, or are so inadequately regulated as to be practically unprovided for; what explosives do you specially refer to?—To such explosives as gun cotton, cotton gunpowder, sawdust gunpowder, pyrolite, pudroline, nitro-mannite, picric powder, Horsley's original blasting powder. After the decision of the Court of Queen's Bench, in *Bliss v. Lilley*, it may be inferred that a license to manufacture is required for those substances; but with regard to the details of such manufacture, those clauses of the Act which relate to gunpowder proper do not apply at all, and any restrictions laid down with regard to gunpowder, or with reference to ammunition and articles of that kind, do not apply to any of those substances.

20. Taking the gun-cotton manufacture, for example; in what manner is the Act of Parliament defective, in your opinion, with reference to the regulation of that manufacture?—It is defective, first of all, in details—in no statutory provisions being made with regard to the details of the manufacture; and also in regard to the storage, transport, and importation being absolutely unregulated; that is to say (as I read the law, and as I am at present advised), so long as a man had a license to manufacture gun cotton on a given site, that site might be within 10 yards of a house or works from which gunpowder is required to be at considerable distance.

*Mr. Whitwell.*

21. Will you be kind enough to say whether those various articles which you mention, sawdust gunpowder and others, are all composed of some preparation of nitro-glycerine or chlorate?—No, not nitro-glycerine at all. I have excluded those.

22. Would they come within the Nitro-glycerine Act?—They would not come within the provisions of the Nitro-glycerine Act. I expressly exclude those which are provided for by that Act.

*Chairman.*

23. You state that the storage, transport, and importation of these miscellaneous explosives is not regulated at all; do I understand you to mean that there are no statutory restrictions with regard to them?—None whatever. Indeed in the Court of Queen's Bench, in the case of *Webbley v. Woolley*, it has been distinctly held that any person not a manufacturer may store any quantity of gun cotton, or sawdust gunpowder, or Horsley's blasting powder, without a license anywhere. This, no doubt, is due to the fact that for practical purposes those explosives were unknown in the year 1860, when the Gunpowder Act was passed, and the Nitro-glycerine Act of course does not touch them.

24. Have those explosives, which you say were practically unknown at the time of the passing of that Act in 1860, since attained to any practical importance?—Certainly, they have; the manufacture of gun cotton was proceeding on a considerable scale at the time of the Stowmarket explosion. It was suspended, but it has been resumed, and I believe that it is now resuming its position. Then, in addition to Stowmarket, there is a manufactory at Oare, near Faversham, the Patent Cotton Gunpowder Company. There is one recently licensed in Gloucestershire for

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gun felt, one in Hampshire for sawdust powder, and one recently licensed for sawdust powder in Lancashire; and I believe that there are other factories of this class which I have not yet visited. Then there are to my knowledge at least eight factories for the manufacture of blasting fuse for the use of mines. Those are not regulated at all by the Act of Parliament, or at all events not further regulated than in the case of the manufacture of gun cotton—that is to say, they only require to be licensed; so also as to the blasting cartridges of which numbers are manufactured, and they will be manufactured in an increasing number, in consequence of the Mines Act of the year before last requiring mineowners under certain circumstances to use cartridges instead of loose powder, so that they have attained a considerable footing in the country.

25. You also state that some dangerous processes (as the breaking up of cartridges) are not provided for; will you state why you consider the breaking up of cartridges should be regulated; is it an operation that has given rise to accidents?—It has given rise to several accidents, and it is recognised as a dangerous operation; indeed my attention has been called to it by the manufacturers of cartridges; one very serious accident at Greenwich in the year 1872.

26. Are there any other operations or manufactures which are not regulated, and to which you think the Act should apply?—I think, unquestionably, the law should apply to any manipulation of explosives, such, for example, as the drying of gun cotton. It is proposed to send gun cotton largely about the country in a wet state, which is very prudent, and then to establish places for drying it in different districts; but the persons doing that would at present be under no regulation whatever, and would require, as we are advised, no license. Then the preparation of straws for blasting involves the manipulation of quantities of powder; and that also, if regulated at all, is so imperfectly regulated, that it is practically under no control. Then there is the extraction of saltpetre from damaged gunpowder; that is an operation which might be so carried on as to incur a certain risk; at all events, it is one which should not be carried on except under some regulation or supervision.

27. I understand you to say that there is no obligation on the licensing authorities to make conditions in granting licenses; is this so in all cases?—Yes; it is entirely within their discretion to make conditions within the limits imposed upon them by the 13th section of the Gunpowder Act; there is no obligation on them whatever to make those conditions; and as in some cases they can hardly be expected to have an adequate appreciation of the necessity for conditions, in a very large proportion of cases they do not make any conditions.

28. You also state further on, that the power of the licensing authority to make conditions is unduly limited, and doubts have arisen as to the construction of the Act on this point; will you state of what nature the doubts and difficulties have been?—Yes. Only the other day, in Cheshire, where a bench of magistrates granted a license for an unlimited quantity of powder, the license proposed to establish a magazine to contain 500 tons of powder, which was about ten times as much as exploded at Erith in the year

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1864. I thought it my duty, as it had come accidentally to my knowledge, to call the attention of the Home Secretary to it. Steps were taken, and the Cheshire magistrates defended the grant, on the ground that they believed they had no power to impose limits with reference to capacity.

29. In what part of Cheshire was that?—The magazine was to be built at Ince. There was also a case in Essex where a license was refused, I believe, on the ground that the magistrate had no power to impose certain conditions which they thought, and which I thought, necessary in the public interest, and, therefore, they felt there was no alternative but to refuse the application altogether. Then there was a case which is stated in the Report which was presented to Parliament in the year 1865, where the magistrates in the neighbourhood of Coventry stated that as the application was not opposed they thought they were compelled to grant it, and they had not imposed in that case any conditions. Their attention was afterwards called to the dangerous situation of the magazine, and they desired to get rid of it, but there was no mode of doing that. I may also state that this view, that there is some limit with regard to the discretion of magistrates, is to some extent sustained by the opinion of the law officers of the Crown that one of the conditions which, at all events, they may not include is this: they may not impose a limit of duration to the license. That opinion was given soon after the passing of the Act of 1860.

30. You state, also, that no means are provided to supply the licensing authorities with the requisite technical knowledge; is no reference made to the Home Office or to an inspector in the case of grants of new licenses?—None necessarily; in some instances the magistrates, where they know of the existence of such a department as that of the Inspector of Gunpowder Works, have applied, but there is no machinery for insuring that they shall be supplied with the necessary information.

31. Is it the fact that a large proportion of the licenses are granted without any conditions?—A very large proportion indeed. I have taken at random the returns of 122 licenses of gunpowder magazines, and I find that in only six of them have any conditions been included. A similar observation holds good as to places licensed for the manufacture of fireworks, ammunition, &c. The result in some cases (I could give many instances) has been most unsatisfactory.

32. On the other hand, you state that where conditions are imposed they are often of an unduly restrictive and vexatious character; can you give the Committee any example of that?—Yes; where conditions have been imposed I find they have generally been imposed in districts where there have been explosions, and therefore the attention of the magistrate has been particularly directed to the necessity for imposing conditions, and they have in some instances gone too far in the other direction. There is the case of a license which I had to inspect a short time ago for a fog-signal factory; the license required the manufacturer to have his buildings 50 yards apart, and not to have more than four pounds of powder in those buildings; that was, in my opinion, an excessive restriction. The other day I found on examining the draft of a license

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which a bench of magistrates had submitted to the Home Office, that while the license had been tied down very tightly on a number of comparatively unimportant points of structural detail, all limitation of quantities had been omitted altogether, and a large number of conditions which really were necessary for the safety of the factory were also omitted, but which the magistrates subsequently adopted on my report. Then in another case there was a man who obtained a license for the manufacture of percussion caps; he was limited with regard to the quantity of caps, but there was no limit with regard to the quantity of fulminating mercury which he might keep.

33. Those restrictions appear to be generally imposed under the influence of panic?—I think so.

34. You appear to be of opinion that on so technical a subject it is desirable that the magistrates should in all cases be guided by the opinion of an expert; can you give any examples of any evils which have resulted from the magistrates not being so guided?—I think one of the cases which I have already mentioned, the case of that magazine at Ince, is a case in point; certainly I should not have recommended a license there to store such an enormous quantity of gunpowder as 500 tons. Then again, there is a case in Shropshire where the magistrates granted a license to place a magazine exactly in the middle of a village. It is a magazine which contains at least 20 tons of powder, being only 15 yards from the houses and cottages, and at the time I visited it the smoke from the cottages was passing over an open door of the magazine. That magazine was licensed after the village was in existence. Taking at random the returns of 123 licensed magazines, I find that 59, or nearly one-half of them, are within 200 yards of dwelling-houses. I have thought this point so important that I have caused to be prepared a table giving the distances of the different store magazines from houses, roads, railways, rivers and sea walls.

35. I presume the Committee may take it that the result of this, as you expressed it in your summary, is to produce contradictory and uncertain results in different districts?—It is so; in some cases, as we have seen, licenses are granted for excessive quantities, in other cases the restrictions are very extreme. So we find such contradictory results as those which are given in these reports; in some cases it will be seen that the distances from the houses are very good indeed; for instance, 12 tons and 600 yards; but in other cases we find there are 23 tons within 100 yards, and 13 tons within 50 yards; and the one I have before alluded to contains 20 tons, or more, at 15 yards, and is in the middle of a village.

*Mr. Whitwell.*

36. May I ask whether all the magazines which are not mentioned in the table as being limited, must be taken as not limited?—I am afraid I cannot answer that question positively; in some cases I am not aware, but I may say positively that in the very large majority of cases they are not limited. It is true that the capacity of the magazine affords a certain limitation, but there is no obligation on the license not to increase the magazine indefinitely.

*Chairman.*



*Chairman.*

37. You say that the necessity of obtaining technical advice is recognised in some cases, and that the magistrates have voluntarily applied for this assistance; have such applications been numerous?—I have had applications from magistrates in about a dozen cases; in the case of fireworks, I found that I was referred to so frequently for suggestions, that I was obliged to get a printed list of suggestions prepared to send out in answer to those inquiries.

38. Has your advice been taken in those cases, and has the result been satisfactory?—I believe that the results have been satisfactory, and that in every case my advice has been taken.

39. Have manufacturers also applied to you under similar circumstances, and have they had the benefit of your advice?—Manufacturers have applied, but I have been unable to give them the benefit of my advice; because in a case, for example, of gunpowder, where there is an appeal to the Home Secretary, I thought it was improper, and that view was shared by the late Home Secretary, that we should give advice to applicants where we were afterwards going to be the court of appeal. In the case of some other manufacturers I felt it was undesirable that they should be in a position to go to a bench of magistrates armed with a certificate from the Home Office recommending licenses. We have always, in every case where a manufacturer applies on that subject, said, "If you go to the magistrate and get him to ask our advice it will be given, but we cannot give it to you as an applicant for a license." That is one of the incidental disadvantages of the Act, in my opinion.

40. If a bench of magistrates neglects to impose necessary conditions, or imposes unnecessary and vexatious conditions, is there any appeal, either on behalf of the inhabitants or of the applicants?—Only in the case of gunpowder, and then only by the applicant; so that in the case of ammunition or fireworks, or any of the other substances for which a license is required, not being gunpowder, there is no appeal either by the applicant for the license or the opponents of it.

41. I believe the first Gunpowder Acts vested the licensing authority in quarter sessions for gunpowder factories, and in quarter sessions town councils for ammunition, caps, &c., and that petty sessions was afterwards substituted; was this change, in your opinion, an advantageous one?—I think that for licenses of this description, for the larger licenses, the application should certainly be made to the court of quarter sessions.

42. You state that the absence of any provisions for securing proper conditions in the license is not compensated by the presence of any statutory provisions with regard to the details of the precautions to be taken; will you state in what respects you consider the enforcement of precautions would be beneficial, and whether there has been any observed failure on the part of manufacturers, &c., to adopt the necessary precautions of their own accord with regard to those matters, taking the points in the order set down in your summary, and first with regard to tools and machinery?—The exclusion, as far as practicable, of iron or steel tools in buildings where the handling of explosive substances is going on is obviously necessary on account of the liability to striking sparks. That is generally recognised in the Mines

*Chairman—continued.*

Act, because no person is allowed to have in his possession in a mine an iron or steel pricker. An iron or steel tamping rod is forbidden to be used for ramming; but there is not a word in the Act of Parliament forbidding the use of iron in gunpowder factories, and in some cases it is very largely used. I have found it largely used in mine magazines for battering in the heads of the powder barrels, and boring into the barrels; in one case I found a man mixing his powder with an iron spade. The magazines frequently contain all kinds of iron articles, iron-nailed boxes, and so on, indeed many mine magazines are used as general stores, in which pickaxes, spades, and so on, are stored.—Then with regard to machinery, there is no power of interference in the case of improper machinery being used; there is nothing laid down as to that; there are many cases in which I have found machinery lamentably defective in use, and the machinery is sometimes in a condition in which it should not be kept, but it is not contrary to the law.

43. Now with regard to the construction of buildings, what have you to say to that?—That also is a point of very great importance; for example, some powder factories have only bare stone walls, which is a most dangerous state of things, because it tends first to promote explosion by friction, and next to cause grit to fall among the half-worked powder by abrasion from the walls. In some cases I have had the greatest possible difficulty in prevailing on the manufacturer to introduce wood linings; in fact, in one case if it had not been that we had observed an illegality which gave us a lever, in the shape of a threat of prosecution, we should, I believe, have been unable to enforce this generally recognised and very proper precaution. Since that has been done the manager of that factory personally thanked me for what had been done, and said that he felt much more safe than he did before, and that he believed that the factory had been greatly benefited by the change. Another point is the proper construction of buildings, so as to direct or control the effect of an explosion. In some mills there is no adequate protection of the building itself against incendiarism and unlawful entry; it is a very common thing to find a magazine which stands quite by itself in a field with simply a slate roof, and no wood lining. The consequence is, that anyone wanting powder, can take off a slate, and get in and take the powder. That was done at a magazine in Wales, at one at Newton Abbot, another at Redruth, and others, which I have got on my notes; it is frequently done; but there is nothing which is against the law in building a magazine so, and there is no real power of interference.

44. Then with regard to the isolation of buildings, what remarks have you to make to the Committee upon that point?—That is a point which I will speak of more fully when I come to deal with distances and quantities, but I may say that in my opinion the provisions with regard to securing proper isolation are quite inadequate. Though a man may work only 60 lbs. of powder in one mill at a time, he may have any number of mills close together, without any wall or separation between them, and, so far as I know, any number of mills within one roof; in one case there are a number of mills within one roof, so that an explosion of one of them would almost certainly communicate with the others; so also

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with regard to buildings generally, except in a few rare cases where distances are laid down, the limitation is generally made useless by there being no corresponding limitation with regard to the quantity. I should like to mention one case to show the terrible effects of undue proximity of buildings; I refer to the accident which happened at Birmingham in the year 1870, when three sheds were swept away by the explosion of one shed, and 53 women were killed.

45. Now, with regard to the clothing of the workpeople, what have you to say with reference to that?—That is a point on which I think there is a great deal too much neglect, which I hope is being gradually corrected. But first of all there is the question of unflammable clothing. In many factories, such as fireworks and ammunition factories, the injuries are rather of the nature of severe burns, and so in the incorporating mills; there have been instances in which persons lives have been saved by the use of unflammable clothing. An instance occurred only the week before last up in the north, near Kendal, where two men's lives were unquestionably saved by the fact of their having on unflammable clothing. On the other hand, many instances have occurred in which people have lost their lives through the continuous burning on them of the clothing which had caught fire. Then again, I should say in some of the most important factories it has been recognised that people should be properly clothed; but I know some places where this precaution is not observed, and the Act is silent. Then, with regard to the provision of clothes without pockets to prevent the inadvertent or neglectful introduction of matches; that is a point on which I have laid very great stress in my inspections, which, I believe, in many factories was attended to at one time, but is, I hope, being increasingly attended to. It is no doubt a precaution which there should be some power to enforce. I will quote the case of a man who was killed at Birmingham in the year 1872. He was mixing fulminating mercury, and making a cap composition with it, and we found afterwards his pockets were full of matches. An inquiry was made at the inquest, because it was reported that he had committed suicide; but we found that the matches had got into his pocket by inadvertence; that was clearly explained by his wife.

46. With regard to the shoeing of persons in factories of this kind, what have you to say to that?—Of course in entering any place where gunpowder is handled, all persons should use shoes without any iron in them, and they also should be careful to keep out grit; but I suppose that in 50 per cent. of all the store magazines in the kingdom there are (or were) no shoes provided; they are now coming more generally into use. In mine magazines the provision of proper shoes is, in fact, a very rare thing indeed. When I first started my inspection, out of 40 magazines that I went into, in only one magazine did I find a pair of shoes, and in another there was one old shoe in the back part of the magazine which had not been used for a long time. That was all I found. Certainly that point is not sufficiently attended to, in my opinion.

47. In Government magazines it is obligatory on every person, is it not?—Yes, always.

48. Now with regard to the separation of ope-

*Chairman*—continued.

rations, what remarks have you to make?—In some cases the Act of Parliament does prescribe that certain operations should be separate; for example, the filling of cartridges and filling fireworks, under the 6th section of the Gunpowder Act, may not be carried on within a certain distance of any other operation; but in the large majority of cases there is no restriction of that kind at all, so that persons manufacturing those substances may, so far as the Act is concerned, carry on as many operations as they please in one building. Take, for example, blasting fuzes: there is nothing to prevent a manufacturer from carrying on the whole operations of manufacturing his blasting fuzes in a single room. Practically this is done in some cases, and the result is, that instead of having one or two, or at most four workpeople, involved in the risk, you perhaps have 30, 40, or 50 women who run the risk of losing their lives in case of explosion. At one of the best conducted blasting fuze factories, a few years ago, there were eight women killed in one accident.

49. With regard to the employment of competent persons only, and in sufficient numbers, what have you to say on that point?—I must always be understood as taking the exceptional cases; I only speak of the worst cases; and it is fair I should say that my observations do not apply to a very large number of very excellently conducted factories, but there are several factories where I have found a tendency in some cases to employ perhaps an old workperson to supervise the works; but as this overlooker is paid piecework for the work produced, and is paid time-work for overlooking, the result is that he does not overlook at all, and continues to push on his work; that is a thing I have objected to very strongly, but I have objected to it without any legal power whatever to insist on its discontinuance. Then, with regard to the competency or incompetency of the overlookers or managers, certainly in some places there have been men employed for this work who have no business to be in that position at all, and who, by the answers which they gave, betrayed ridiculous ignorance of some of the very elements of the work which they were engaged nominally in directing and supervising. Then with regard to the employment of competent overlookers in sufficient numbers, that is a point which is very much neglected in some cases. I also think it is unquestionable that mere children should not be employed in some of the more dangerous buildings, certainly not without the constant supervision of some one of mature years. In firework factories, and in some of the ammunition factories, children have been very largely employed; indeed, I believe, with reference to the illegal fireworks trade nearly all that trade is done by the children of the persons so carrying it on.

50. Now will you be kind enough to favour the Committee with your views with reference to the adoption of proper rules?—With regard to that point, a manufacturer or storer of gunpowder is allowed under the 15th and 16th sections of the Gunpowder Act, to make rules for his workpeople. But first of all, I would call the attention of the Committee to the fact that it is not obligatory on him to make rules; secondly, that there is no supervision with reference to the sufficiency of the rules; and thirdly, whatever rules a man makes, whether they are absurd or harsh,

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harsh, or whatever they may be, he has the power to arrest the offender against those rules, summarily, without a warrant, and to take him before a magistrate and get him fined 5*l.* Now some of the rules are very absurd. There is one place where there is a rule that a workman may not keep poultry or pigs in his house. That has nothing whatever to do with the manufacture of gunpowder, but the Gunpowder Act apparently entitles a master to arrest any workman who violates this rule, without a warrant, and take him before a magistrate and get him fined 5*l.* Then with regard to the sufficiency of the rules, I could give instances to the Committee of rules which are totally insufficient, and which do not afford any adequate protection to the persons concerned. Again, in many cases where rules are made they are not circulated at all, and the workpeople have no knowledge of them.

51. Now, with regard to the erection of lightning conductors for the safety of premises, what have you to suggest?—The only provision in the Act of Parliament with regard to lightning conductors, is this; it says that store magazines attached to or connected with gunpowder factories shall have lightning conductors, but there is no provision with regard to other magazines. Now there is no more reason why a store magazine attached to a gunpowder factory should have a lightning conductor, than any other magazine. Obviously, a store magazine of an ammunition factory, or a store magazine of a firework factory, or an outlying district store magazine, ought to be protected in the same way, but there is no such provision in the Act of Parliament. Only last year a gunpowder house was blown up by lightning, and I thought it my duty to address a circular letter to the trade, suggesting to them that they would do well to fit conductors to all their more important powder buildings, as is done at all the Government establishments.

52. Has that recommendation been attended to in any cases?—Not so far as I have observed, but I have not re-inspected them all since.

53. Have you anything more to say with regard to the absence of provisions in the Act for securing the observance of the most elementary precautions?—Yes; it might seem unnecessary at first sight to forbid a man to take a fire or a naked light into his powder buildings. I suppose that the omission of any notice of this in the Act proceeded on the assumption that nobody would be foolish enough to do that; but as a matter of fact those things are done; for example, in the case to which I have referred, of the ammunition factory at Birmingham, where those 53 women lost their lives, it was shown in evidence (I attended the inquest) that they were in the habit of having open stoves, without even a fender, in the middle of each of the three sheds in which this powder work was being carried on, and they used to cook their dinners on the stoves; they were also in the habit of shaking the grains of powder off their aprons into the stoves. I have found several firework factories where open stoves were used; I have found naked lights inside, and even after I had remonstrated, that was, in one case, continued in a cap manufactory. There was a case in Scotland two years ago which came under my notice: on going to visit a magazine belonging to a quarry. I asked the

*Chairman*—continued.

man where his magazine was, and he told me it was in a very good place. We went down through a dark passage, and when we got a certain distance it became dark, and he lit a naked lamp, such as the miners wear in their hats. I said to him, "Where are you going to?" He said, "To the magazine." I said, "Have you any powder in it?" He said, "Yes, about five cwt. or six cwt." I wanted to see really how far imprudence would go, so I went to the place with him; the candle blew out just as we came to the door, but he had some matches in his pocket and he lit it again, and we went in; it was a cave containing a quantity of powder in open barrels.—I did not stay long, but I asked him one question. I said, "Who issues the powder to the workpeople?" He said, "I do." I said, "How do you do it?" He held the candle in his left hand and ladled the powder out of the barrel with the other hand. He said, "I do it just with this thing." The light played on the grains of powder, as he ladled it up once or twice, and there we were till I came out of the place. That was a case in which we were unable to proceed under the Act of Parliament. There was no offence committed, because he was a master and not a workman. At one of the large burgh magazines in Scotland last autumn, on our asking the people in the magazine what precautions they took to exclude matches, they looked at us as much as to say that they did not know what we meant. I said to one of the workmen, "Have you got matches on your person now?" He said, "Yes, sir," and produced them. He really did not appear to know that there was a risk, and he seemed not to have the least idea that that was a reckless and stupid thing to do. There have been other cases of almost a similar kind; for instance, the practice of opening barrels by smashing in the heads with iron crowbars, which is very frequently done in mine magazines; or battering them in with large stones; or boring into them with steel bits; these are all exceedingly dangerous practices. In my Report, at page 26, there is a case mentioned which is perhaps an extreme instance of recklessness, and which the Committee may well think incredible, but it actually occurred. It is the case of a man boring into the barrels with a red hot poker, until one day he found a thinner lid than usual; the poker went through, an explosion followed, and the man was killed. That was done in several instances in South Wales. Then there are the cases of people thawing dynamite; that has been done very commonly in spite of all kinds of injunctions and notices issued by those who sell the dynamite that it is dangerous; it has been done frequently, with fatal results, by putting it over stoves. In one case in North Wales it appeared that they were in the habit of putting dynamite on a shovel and holding it over the fire, until, as the man said, he began to see the oil running about the shovel, and then he knew it was properly done; that was a case in which two people lost their lives. Then there was a case in which a large cargo containing a nitro-glycerine preparation, came into the River Thames, and as this could not all be got into the bottom of the barge, for the barge was not large enough to hold it, they put some of it on deck, and covered over the preparation (but not by any means thoroughly) with tarpaulins, and at the time Major Ford visited that barge he found a fire on board, and the chimney within four feet

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of this destructive explosive material, and on a level with it, smoking away. I feel that I should really weary the Committee if I went through the number of instances which I have put down here, and perhaps it is unnecessary for me to do so, but I could add several cases.

54. Now, with regard to miners, have you anything special to say at this point of your examination?—I received a letter to-day from the chief constable of Wigan with regard to reckless storage in houses: "Thomas Green, Low-green, Hindley, near Wigan, was a working collier, and on the day named in the margin (19th February 1868, 3 p.m.) had a barrel containing about 7 lbs. of blasting powder in the bed room, with a piece of wood over the end of the barrel. Green went to work at 4 a.m., and his wife, who worked at a colliery, went about 6 a.m., taking their eldest girl, nearly 12 years of age, to work with her. They had five children, and two of them, boys, went to school; one boy came home ill about noon and went to bed. There was a box of matches in the room and it is supposed the boy exploded the powder with them. The boy was badly burned by the explosion and died in a few days. At the inquest the jury added to their verdict that it was not an uncommon practice for colliers to keep powder in considerable quantities in their houses; considerable damage was done to the house." There are other cases given here of the same sort: "James Burns was a collier residing at Hardybutts, Wigan, and at the time named in the margin (17th September 1873, 8 p.m.) was filling cartridges from a can containing 3½ lbs. of blasting powder, when a spark from the candle fell into the can and exploded the powder. The room window was blown out, and Burns and a young woman badly burned." On that point I have a good deal of evidence which I could produce to the Committee.

55. I understand that under the present Act the importation, transport, &c., of powder and other explosives (except nitro-glycerine) may be carried on without a license, and, in most cases, without any local supervision, is that so?—That is so. In some places, by virtue of local Acts of Parliament, there is a power of supervision, but in a large number of cases, in fact I believe in nearly all cases excepting Liverpool, or here and there, there is really no power of local supervision in case of transport, importation, or exportation.

56. You state that the statutory provisions as to the precautions to be taken in the transport, shipment, &c., of powder are inadequate in several particulars; and first you specify the inadequacy with regard to the use of proper barrels and cases; will you be good enough to illustrate your meaning on this point?—In the first place, the Act does say that powder shall be carried only in barrels, as it expresses it, "close joined and hooped," or in boxes without iron around them, and so that no powder shall be spilt in the passage. But, first this provision does not extend to quantities under 100 lbs.; and in the second place, powder carried coastwise or for exportation is exempted; and in the next place, there is no doubt that there has been a considerable amount of carelessness with regard to the use of barrels and cases of sufficient strength or of properly seasoned wood; the hoop breaks, or the head gets forced in, or a joint comes open from the wood shrinking. I should like to call the attention of

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the Committee to a case mentioned at page 25 of my Report, the report of the chief constable of Liskeard, who gives an instance of his finding two carts going along through the streets, one of the barrels had been broken, and there was a train of powder being laid along as the carts proceeded. In the course of my inspections I have come on a very large number of cases indeed of leaky and defective barrels, and I should like specially to instance a case which the Lord Lieutenant of Ireland brought under the notice of the Home Department last year. The Lord Lieutenant forwarded a report from the Comptroller, at Dublin, in which he says, with regard to gunpowder, a certain vessel arrived in Ireland containing a quantity of gunpowder: "On the ship's hatches being taken off, and after a few barrels were taken out, it was found that the powder was stored in the same hold with what is called hot cement; the staves of the wood had so shrunk that the fine-grained powder had run out, and a portion of it was lying loose with the cement; the whole of the barrels containing the fine powder had to be re-coopered. Besides this, 40 cases of powder were fastened with galvanised iron nails, and had to be placed in a temporary magazine away from the other powder." In that case, which was brought under our notice by the Irish Government, no steps, beyond a letter addressed to the manufacturers, were practicable; the manufacturers, I believe, took steps to prevent its recurring. But there were no powers to compel that, and we have really no assurance that it will not recur.

57. Now with regard to the nature of the vehicles to be used in the transport of gunpowder, what have you to say?—Such restrictions as there are apply only to gunpowder; none of the other explosives are regulated in any way; with regard to the carriage, or with reference to the cases. With regard to vehicles, though a covered cart is required for more than 30 barrels of gunpowder, under which quantity an uncovered cart may be used, there is nothing to require that the carts shall be properly made inside by the exclusion of iron, or by being tight fitting, &c. A cart conveying gunpowder is practically a moveable magazine, and it is quite clear that the precautions taken in magazines ought not to be neglected in the carts, especially as the cart, unlike the magazine, is moving through populous places. Similarly with regard to barges, they are under no restrictions with respect to their construction. In fact, the argument applies with greater force to barges, because barges may carry up to 500 barrels; whereas the quantity conveyed in a cart is of course much more limited. Then, again, they use ordinary country carts, which may have contained flint, and which generally have contained it, and I have found in them miscellaneous rubbish, with stone, or coal, and grit of all kinds, and those carts are used for the conveyance of gunpowder. There is no law against it. I had occasion last year to carry out an inquiry at Newhaven into the shipment of gunpowder, and there I found it was the practice to convey as much as 20 or 22 tons through the streets of Edinburgh in open carts. But I have lately had my attention called to the fact that it is not only at Edinburgh where this has been done, for I find that it is largely the case in London. I will give the Committee an  
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extract from the reply of the superintendent of the Metropolitan Thames Division of Police to some inquiries which I addressed to him. He says, "I beg to state that during the latter part of 1870 and beginning of the present year, immense quantities of gunpowder and other explosives were conveyed through the metropolis in open vans covered with tarpaulin from the different railway stations to Blackwall, and there transferred from land to water carriage. On the 27th December 1870, 15 vehicles loaded with barrels of gunpowder, about 20 tons, were sent from Camden Town to Blackwall Stairs (a densely populated place) to be shipped off, the whole of the loaded vans were detained in the street for some time, waiting for the arrival of the barge to take on the cargo. The whole of the operations being in compliance with the requirements of the law, the police had no legal power to interfere. I beg to submit that such a number of vehicles loaded with gunpowder passing through a crowded metropolis, and of necessity detained in the street for some time, as in the case just quoted, must be attended with great danger to life and property." Then he adds, "I respectfully beg to suggest, with a view to the safety of the public, that open vans be prohibited from conveying gunpowder through populous places, and when more than one van is employed, a limit should be put to the distance that each, when loaded, should be kept apart." Then he goes on to say, "On the 26th of November 1870, 100 barrels of powder" (that is to say, five tons) "were seized by the police of this division, brought from Camden Town railway station to Blackwall Stairs, in two open vans, for which offence the two drivers, with their master, appeared on summons on the 5th December following, before J. Paget, Esq., at the Thames Police Court," and were convicted. He complains of the fact that the penalty fell, not on the carrier, but on the person who owned the gunpowder, because there was only a forfeiture of the powder, and not a money penalty. He says, further, "the practice of transferring gunpowder from land to water carriage, and *vice versa*, at public landing places, namely, Wapping Dock Stairs, High-street Wapping, Bow Creek, and Blackwall Stairs, has been carried on for many years, but so far as it has come under our observation, has been in conformity with the regulations of the Gunpowder Act. Both places are in densely populated neighbourhoods, and it is a common practice for men to be standing about the spot smoking their pipes while such transfers are being made." In the course of the inquiry which I made at Newhaven, several cases were brought under my knowledge of great risk to the public. For example, the whole shipment was carried on at Newhaven Pier, which is practically the public fish market, and crowded with people; it was in evidence that on many occasions men had been seen smoking, and had objected to put their pipes out when requested to do so; one man was convicted for using, while the shipment of powder was going on, a red hot poker to bore a hole in the side of a boat next to the one which was receiving the powder. Evidence was also given that on one occasion a horse fell, and the cart was upset; a barrel of powder was tilted off, and it struck on an iron stanchion, and the powder was scattered about on the stones; as it happened there was no accident, but it obviously

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was very dangerous; I am told by a police officer that a case like that occurred within his knowledge not long ago in London.

58. Now, as to the proper stowage of explosives; will you be kind enough to favour the Committee with your views?—There is nothing under the present Act of Parliament to forbid a carrier from taking a mixed cargo in one van. In mining districts carriers think nothing of starting with a miscellaneous cargo, with gunpowder as one of the articles. We have seen by the report made by the Irish Government that gunpowder was stowed along with miscellaneous goods on board ships: in fact, there are examples given, I think, at page 30 of my Report; there is a report from one of the chief constables, in which he says that gunpowder is carried with no more care than any other article of commerce.

59. Now, with regard to the limitation of the quantities to be carried, what is your opinion?—There is a curious oversight in the Act of Parliament, at least I suppose it was an oversight, on that point; it limits the quantity of gunpowder to be carried in a given van, and so it is in a railway van or a barge, but there is no limit to the number of vans which may go in a line, or which may be in a train; and as I know on one occasion, on a leading railway, as much as 25 tons of powder was sent at one time in one train, which is nearly half the quantity of what exploded at Erith. It must be recollected, also, that accidents by collisions on railways are not altogether unknown; and in one of those accidents, in which about 10 tons of gunpowder exploded in Cumberland, there was a collision of two trains. There was a further instance, to which I should call the attention of the Committee, in the report of that police officer, of a train of carriages, containing in the aggregate 20 tons, travelling all at once through London, and I have no doubt that that is a usual practice.

60. Now, with regard to the labelling and due declaring of explosives, what have you to say?—The Merchant Shipping Act has rectified to a great extent that defect, but otherwise there is no requirement in the Gunpowder Act that a person shall label his explosive properly, or make it known that it is an explosive. A railway company may make bye-laws, and require under those bye-laws explosives to be declared, and I believe to be properly labelled; but for ordinary land carriage there is no such regulation, and of course the Merchant Shipping Act does not touch land carriage at all.

61. As to the regulations for loading and unloading only in proper places, what remarks have you to make to the Committee?—Except in the Mersey and above Blackwall, which is specified in an Act of Parliament, and perhaps here and there by virtue of local Acts of Parliament, gunpowder may be put on board ships, boats, and trains anywhere; and of course advantage is taken of that, and gunpowder is loaded and unloaded largely in the midst of very populous places. In the case of Liverpool, where they have a special Act of Parliament, I believe, they do not allow it to come into the town at all; but the Committee will have seen, from the Report which I have read, that it does come into London, and as a matter of fact it is loaded largely at various railway goods depôts in the heart of London. There are several passages in my Report, at page 32, with regard to that, and

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there are some quotations from the Report of General Boxer upon the subject.

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62. Will you state your view as to the precautions required to be taken in these matters?—As a matter of fact there are absolutely, we may say, no precautions required to be taken in the carriage of powder. Below 30 barrels, the carts may be of an ordinary description; for very small quantities, even the construction of the barrel, as I have shown, is not regulated in any way. Then, again, such practices as smoking while carrying powder are not forbidden. It is true that in the case of ships or barges, you must not smoke while the hatches are open, but the Act of Parliament is silent with reference to smoking on or near a cart containing powder. In a Report which I made on the state of things at Newhaven, and which I should like to be permitted to put in, I have gone very fully into the question of want of precautions.

63. With regard to the carriage of explosives in public vehicles, what have you to say?—There is nothing that I am aware of, to forbid the carriage of explosives in public vehicles, omnibuses, and things of that kind; indeed, when the new regulations were introduced for the dynamite licenses, a complaint was made to me that one of those regulations was very inconvenient, because it prevented that material being carried in omnibuses in the same manner as it had been before. I have had one or two representations made to me with reference to the desirability of relaxing that regulation. Then there is a case quoted in page 30 of my Report, which was given me by a chief constable, about a man getting on to an omnibus at Wigan, who was asked to put out his pipe because a man sitting next to him had 100 lbs. of powder in a barrel beside him; yet that was not illegal.

64. You state also that the restrictions of the railway companies are such, as in some cases to lead to surreptitious carrying?—No doubt there has been a very great deal of surreptitious carrying of gunpowder, fireworks, and various things of that kind. I had occasion about two years ago to have conferences at the Railway Clearing-house with the railway companies on this subject, and I pointed out to them that the very high rates which they charged for the conveyance of explosives, and the inadequate facilities afforded for their conveyance, had the effect of inducing people to send explosive substances disguised under all sorts of names; I have come across it in magazines labelled "Hungarian wine." The fact is the railways overdid it; they charged, for example, for the conveyance of a small case of fireworks as if it was half a ton; and a firework manufacturer showed to me that to send a box containing 5s. worth of fireworks to Aberdeen would cost him about 9l. The railway companies have lately been looking into this matter of the surreptitious carrying of goods; and I observe they have convicted two persons since I had those interviews with them for carrying goods in that way.

65. With regard to distances and quantities, you say that the enactments with regard to those points are very defective and incomplete, besides being in several instances unduly restrictive upon the manufacturers, and entirely deficient in elasticity; how would you propose to remedy those defects?—If magistrates were required to impose

*Chairman—continued.*

conditions in every case, and if they were supplied with the requisite technical knowledge to enable them always to impose the proper conditions, no doubt there would not be the same necessity for statutory provisions on the subject; but there is at present no obligation on the magistrates to impose conditions, and, therefore, we look to the statute, and we find that on many points the statute is altogether defective. Sometimes distances are laid down, but no quantities; and sometimes quantities are laid down, but no distances; sometimes the quantities and distances are laid down with a hard and fast line from which there is no possibility of variation.

66. Can you give examples of the nature of the omissions in the Acts with regard to these points, and illustrations of the ill effects of such omissions; let us take the first omission which you allege to exist with regard to the regulation of the distances of buildings apart?—For example, some of the buildings of powder factories, such as press and corning houses, are limited with regard to the quantities; you may not have more than a ton in one press-house, and you may not have more than 24 cwt. in one corning house; but there is no limitation with regard to the distance apart of the houses; though a man may not have more than a ton in a press house, he may have any number of press-houses in close proximity; then, while a manufacturer may have one ton in a press-house and 24 cwt. in a corning-house, he may have the two places close together; and in one factory they were so close that the explosion of one did cause the explosion of the other in the year 1871. There is also the case of a powder factory to which my attention has recently been called, where the quantity permitted by the Act of Parliament to be in the stoves is fixed, say, at about five or six tons, but owing to a number of stoves being collected together on one spot, under certain circumstances, they were liable to have as much as 27 tons of powder on that spot. I know a factory where the stove and the dusting house, two of the most important houses in the factory, are only 33 yards apart. In some cases I have had to address very strong remonstrances to owners with reference to the general proximity of their buildings.

*Mr. Whitwell.*

67. Have you any evidence to give to the Committee with regard to the distance to which inflamed air will convey an explosion?—I can give the Committee the limits of the effect of some of the more considerable explosions that have taken place, but they are so exceedingly capricious that we cannot deduce any positive rule from them.

*Chairman.*

68. Next, with regard to the omission of any limitation of quantities in certain buildings, what have you to state?—For glazing houses in powder factories and packing houses in powder factories the words which are used in the Act to limit the quantities are these: "What is necessary for the immediate supply and work of the house." That is an elastic limit; indeed, those houses may almost be said to have no limit at all, and the result is that in some cases there is, no doubt, an excessive accumulation of powder. In firework sheds in which the materials are mixed there

*Chairman*—continued.

there is no limit; where the fireworks are charged it is limited, but not where they are mixed.

69. Then you state that in some instances when distances are fixed, the quantities are not fixed, and this you regard as absurd?—Yes, I will take the case of store magazines, and expense magazines; the expense magazines of a powder factory must be 40 yards from any other building, the store magazine must be 140 yards from any other building, but that is quite irrespective of quantities. This is a very important omission, because the quantities kept in store magazines are very large, but whether it is 250 tons or 10 tons, the distance is equally 140 yards. Then with regard to the magazines of an ammunition factory, and a fireworks factory, the same observation applies. Some firework manufacturers require only 50 lbs., or even 25 lbs. of powder, but they are obliged to be 50 yards from any other building, just the same as if they had 10 tons of powder in store.

70. And in some instances it appears that neither distances nor quantities are fixed?—Yes, that is so in the case of those glazing and packing houses which I have referred to; having no quantities, they have also no distances assigned; the magazines though limited with regard to the distance from other powder buildings, are not limited as regards number, so that several magazines may be placed in a row; I know a factory where there are three magazines in a row a few yards from one another. With regard to gun-cotton and sawdust-powder, there is no limitation of any kind with reference to such details.

71. Then you go on to state, that while the Acts are in some cases too lax on this important point, they are in others unduly restrictive, unnecessarily oppressive upon the trade, and exceedingly capricious and inconsistent; can you give examples of these defects?—Yes, I can give a very good example, namely, the case of ammunition factories. No building connected with the manufacture of ammunition, may have more than 50 lb. of powder, whether in or out of cartridge, in it, and if this law were enforced with regard to those buildings in which cartridges are finished and packed, the manufacture could not be carried on at all. On the other hand, whilst filling cartridges must be done in places 20 yards apart, the other sheds may be quite close together; then, while the operation of filling cartridges may not be carried on within 20 yards of any other workshop, the operation of placing powder into canisters in unlimited quantities may be carried on next door to any other workshop, or, indeed, inside it; while the operation of introducing a few drachms of powder into cartridge cases must not be carried on, in the same workshop, the introducing of 100 lbs. into cannisters or barrels may be carried on anywhere; while the quantity in a cartridge factory is 50 lb. of powder, and in a fireworks factory the quantity is limited to 30 lb., the distance remains the same, namely, 20 yards. Now, firework competition is far less explosive than gunpowder, and therefore the quantities ought to be increased, and not diminished; there is but little danger of a communicated explosion where the composition is inside the fireworks, but by the Act, the composition whether in or out of the fireworks (just as in or out of cartridges) is treated as equally dangerous, and it is limited in quantity in the same way. Again, the Act says, that of a com-

*Chairman*—continued.

position which is more easily ignited by friction than ordinary gunpowder, only 10 lbs. is to be in one shed, and the shed must be 20 yards and not 30 yards from any other building, but this is founded on a total misconception of the subject. It does not follow because a thing is more likely to ignite that its effects would extend to a greater distance; therefore, I say that there is really no reason for increasing the distance, or for reducing the quantity. Then the line where it is fixed at all is absolutely hard and fast, without any reference to local circumstances. The magazines of ammunition factories are fixed at 50 yards distance from any workshop connected with the manufacture without any reference to the quantity (but some makers have 10 tons, and some have a few lbs.), and there is no power in the Home Secretary, or the licensing authorities, or anyone else, to reduce those distances. I have stated that the law if enforced would extinguish many of those factories. I mean especially small firework factories. I have got here, and will produce a Report which I have made on certain factories, and in which I have shown what the effect would be. A few weeks ago, I visited two firework factories near Bristol. The people in that case had provided themselves with a small piece of ground very well isolated from houses, and they had according to their means, and I may add according to their requirements, provided little sheds in which they were really honestly trying to carry on their business safely and properly; but it would have been perfectly impossible for them to put their sheds 20 yards apart, or their magazines 50 yards from those sheds, and it would have been quite unnecessary; but the Act of Parliament says that they must do it, and if the Act were enforced they must either give up working or else they must acquire, which they would probably be too poor to do, more ground than is really necessary, or else they would probably be driven back into houses to carry on their manufacture more unsafely and illegally there.

72. You also state that there is no statutory limitation of the quantities which may be stored in any place, and nothing to prevent licensees from increasing their magazines indefinitely; is it a fact that a magazine owner may store any quantity he likes, and increase the capacity of his magazine from time to time?—It is a fact that where there is no limitation of quantities, if it is not otherwise expressed in the license (and I have shown that in the great majority of cases there are no conditions), the licensee may increase his limitation indefinitely. In a Paper presented to Parliament in the year 1865 on this subject, the Committee will find a case referred to, a case in the Erith neighbourhood, where there was an extension, and Colonel Boxer, who reported on the extension, said it was such that it would increase the risk to life and property, but there was no power to interfere. In the case of the particular magazine, to which I have already twice referred, in Cheshire, when I wrote to the people to inquire whether they really meant, or whether I was not under some misapprehension, that it was their intention to store 500 tons of powder in one place: they said, "Oh, yes," their quantity was unlimited, but that they would for the present content themselves with constructing a magazine to contain 500 tons. The same observation applies to gunpowder factories, and with

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special force there, because the distance assigned in that case of 140 yards from the working building and the factory is very short, assuming the ground to be perfectly level, and the quantities large. There is one other point which I wish to bring under the notice of the Committee; I ought to have illustrated the case of mine magazines, and how they are affected by Act of Parliament. The Act says that no more than 300 lbs. of powder may be kept within 200 yards of a dwelling-house. First of all I would notice the inconsistency of that part of the Act. Any gunmaker, or any ironmonger, or, in fact, anybody who likes to sell a pound of powder, may, by that fact, constitute himself a dealer, and keep 200 lbs. in his house, in the middle of St. James's-street if he likes, but a mineowner desiring to have 300 lbs. of powder must go to the absurd distance of 200 yards to store it; whereas, on the other hand, if he wants to store two tons, he is not called upon to go any further; but by way of making the thing more ridiculous and impossible, he must, under any circumstances, be within 200 yards of his mine. Now the Committee are no doubt aware that, as a matter of fact, many mines have a number of cottages, almost a little village, around the mine, and to go at once 200 yards from those houses, and not to be 200 yards from the mine, is a physical impossibility. Then the distances bear no reference to the quantities; and if the Act of Parliament were enforced as against the mineowner, I really believe that half the mine magazines in the kingdom must be shut up. Take the case of a colliery, the Duke of Norfolk's colliery, known as the Nunnery Colliery, within the borough of Sheffield. The Act of Parliament says, that no one may keep more than 200 lbs. of powder within a mile of a borough; but this colliery is absolutely within the borough, and could not possibly be worked with so small a quantity of powder. When I inspected the magazine I found over a ton of powder there, and of course the Act of Parliament was largely infringed in that case. Then, while I am on the question of the borough limit, I wish particularly to call the attention of the Committee to the fact that this restriction, with reference to boroughs, is a most ridiculous restriction. There is no limit in the case of a store magazine, which may contain 30 tons, 40 tons, or even 500 tons of powder, with regard to dwelling-houses; but from a borough, of which a large portion may be an agricultural district, you may not come within a mile, or within a mile of the outside limits of the same. Then take the other protected places; you protect a parish church, but you do not protect cathedrals, or colleges, or chapels, or river banks, or sea walls, and the evil effects of that were shown most strongly in the case of the Erith explosion. Take again, for illustration, what happened at Stowmarket, where the magazines were 76 yards from the railway, and I think if the Committee will refer to the Table they will find that in a large number of cases railways are very near to magazines containing very large quantities of powder. There is No. 70, 20 tons of powder in the magazine, railway 26 yards off; No. 136, 40 tons of powder in the magazine, railway 70 yards off, and so on; in fact, railways were not considered at all in the Act of Parliament. There is one magazine that I am acquainted with in the north, within about 20 or 30 yards,

*Chairman*—continued.

I think, of the railway, and in that case I prevailed on the manufacturer to remove the door of the magazine to the side opposite the railway; but that was only a palliative. Then take highways, they are not protected at all. There is one gunpowder factory in the north which is actually on the side of a highway; there is one powder factory, much nearer home, where one very important powder building abuts on to a high road. Then there is the case of a factory which I believe is now sold or put up for sale at Ewell, where there was a right of way through the centre of the factory; in fact, those very important points are entirely unattended to. Then take the case of charitable institutions, schools, and hospitals; they are not protected. There is a large magazine at Londonderry which contains many tons of powder. That magazine was erected within 136 yards of Gwyn's Charitable Institution, and within 31 yards of the waterworks keeper's house, both being in existence before the magazine was established. I wish particularly to call the attention of the Committee to the inadequate protection which the Act of Parliament affords to certain places and things.

73. Your next point against the present Act is the insufficiency of the existing powers of inspection and search, and I understand that this objection applies alike to the powers of local search and to the power, or want of power, of the Secretary of State's inspector?—Yes; the Acts of Parliament, as I consider, are unsatisfactory under this head, whether considered with reference to the power of interference in case of suspected illegality, the power of local supervision, or the powers of the Secretary of State's inspectors.

74. Taking these points in the order you have stated them, will you state what powers at present exist to interfere in the case of suspected illegality?—In the case of suspected illegality there is no power of interference except on the Thames, where there is a power of search by the Conservators, or any superintendent or inspector of the Metropolitan Police; otherwise, and throughout the kingdom generally (always excepting Liverpool which has its own Act of Parliament, and, possibly, one or two other places which have local Acts), interference can only be had in virtue of a search-warrant, obtained on reasonable cause assigned on oath.

75. And this power you consider inadequate?—Yes, it is inadequate for many reasons; in the first place, it is not prompt enough for dealing with an evil of this description. In the next place it is suspended wholly at night, when a great deal of illegal making of fireworks and things of that kind goes on. Then, again, I suppose, it is suspended on Sunday, and it is of course always in suspense at such times as a search-warrant cannot be obtained; and the power also does not appear at all to apply to the case of gunpowder in transit. There is no power there at all. I have gone rather fully into this subject in my Report in pages 49 to 51, and I would especially call the attention of the Committee to the facts stated there from the report of the chief constable of Wigan, who gives examples of the impossibility of interfering under the present system.

76. I presume that you do not consider that any deficiency in this respect is supplied by the greater powers vested in the Secretary of State's inspector?



*Chairman—continued.*

inspector?—The powers vested in the Secretary of State's inspector do not supply this deficiency, because, of course, he cannot be everywhere at once, and even if the number of those inspectors were multiplied indefinitely, the evil would not be met. The local powers possessed on the Thames and Mersey apply only on those rivers.

77. Next, dealing with the question of local supervision; this, I understand, you regard as unsatisfactory, do you?—There is no machinery in the Act of Parliament for local supervision. In one or two cases the inspectors of nuisances have taken some measures under this Act, but they have no legal powers except by virtue of a search-warrant; and I believe, in two cases, a Secretary of State's warrant has been given to enable this supervision to be exercised. The Liverpool Act gives powers, but, speaking broadly, there is no local supervision whatever, and no machinery short of a search-warrant for finding out if the quantities are exceeded, and the Act generally observed.

78. Are there any special directions in which the want of some effective power of local supervision has been particularly experienced?—Yes; especially in the case of the illegal making of fireworks. I think I may say confidently, that so long as those people can be got at only by search-warrant, the illegal manufacture of fireworks will lead to disastrous explosions. At Lambeth, last November, eight people were killed; that practice cannot be put a stop to, and will not be got rid of unless you have some other machinery. I may also state that this omission has been pressed upon me by a very large proportion of the chief constables, and in the abstract of the chief constable's reports which I have handed in, the Committee will find that a very large proportion recommend a power of local supervision. You will also find that the reports of the town clerks show great unanimity. I think, without exception, the town clerks of the principal towns have recommended that there should be some such power.

79. Next, as to the insufficiency of the powers possessed by the Secretary of State's inspector; you have entered very fully into that matter in your Report at pages 51 to 60; have you any observations to add to what you have there stated?—I have very little to add, but the point which I endeavour to make in my Report is this, that there should be some power vested in the inspector to enforce the adoption of proper precautions, when he finds that his precautions are neglected. I will hand in a Return showing the results of the inspections made during the year 1873-74, from which it appears that in a great number of cases no attention whatever has been paid to the remonstrances which we have made.

80. But do not the present Acts particularly provide for a regular system of inspection?—To some extent they do, but without any power of actually interfering if an inspector finds anything wrong, which is not at the same time illegal. The kind of power I refer to is the power given to the inspectors under the Mines Act. Clause 46 of the Mines (Coal) Regulation Act says that, "If in any respect (which is not provided against by any express provision of that Act, or by any special rule) any inspector find any mine to which this Act applies, or any part thereof, or any matter, thing, or practice in or connected with any such mine, to be dangerous or defective, so as in his

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*Chairman—continued.*

opinion to threaten or tend to the bodily injury of any person, such inspector may give notice in writing thereof to the owner, agent, or manager of the mine, and shall state in such notice the particulars in which he considers such mine, or any part thereof, or any matter, thing, or practice, to be dangerous or defective, and require the same to be remedied; and unless the same be forthwith remedied, the inspector shall also report the same to a Secretary of State." That is the kind of power to which I was referring as the power which it appears to me should be vested in the inspector. At present we have no power to interfere, except there is an illegality. We may remonstrate, but that is all.

81. But I understand that, in addition to establishing the system of inspection upon a more substantial basis, you desire to give the inspector more power; in what directions, outside the mere enforcement of the law, would you advocate the utilisation of the inspectors?—In the direction that I have already pointed out, namely, that if he has found anything which he thinks a source of danger, or any important or generally recognised precaution omitted, he should have a power to interfere; also, that he should be made use of to give advice on essentially technical points to the licensing authorities, and also that he should be present at coroners' inquests, in the same way as is provided by the Mines and Railway Acts; also, that he should in certain cases be appointed to hold formal inquiries. The mines inspectors are always present at coroners' inquests, and they have a legal status at the inquiry, and they are very often able to render efficient assistance. In our case our services are sometimes asked for by the coroner; but if we attend without being asked, we have no legal position.

*Mr. Whitwell.*

82. Do you mean to suggest, by giving power to the Government inspector to advise the licensing authorities, that the Government inspector should have the power of attending on all occasions on which licenses are issued, with a view of giving advice?—I think, in every case where application is made for a special license, there should be a report made by the inspector on that application.

*Chairman.*

83. You complain in your summary of the inspector having no power to enforce the discontinuance of obviously dangerous practices, or the adoption of obviously necessary precautions; will you address yourself to this point?—In several cases, especially in firework factories, I find it quite impossible to get the manufacturers to adopt the precaution required. Then as to the magazines, the Committee will find in the Return which I have handed in, that in the second and third visits which we have made to certain magazines, we have still found the same defects which we complained of, or similar defects still existing. There is one magazine which is named in my Report, at page 29, namely, the magazine which Colonel Boxer (now General Boxer) visited in the year 1865; I think that magazine was found very much in the same state in 1871, and very much in the same state in 1872 as it was in 1871. I am unable to say, not having been there since, whether it is now altered; but in the case of mine magazines

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I am afraid that we have made very little impression indeed. This Return, I think, will show what I mean as to the extent to which precautions are regulated.

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84. Have you anything more to say on that point?—I could give a very large number of illustrations of cases in which we have remonstrated, but without any effect. In some instances, where a simple remonstrance has had no effect, we have been able to use the fact that an illegality had been observed as a lever to require a change to be made; but where we have not had that lever we have very often been unable to produce any satisfactory result at all. Here, again, I should like to say distinctly that my remarks do not apply to many of the large makers. I have said in my Report that from many manufacturers we have met with the most cordial co-operation and the readiest adoption of suggestions, but that has not been so in many instances, especially with regard to mine magazines.

85. You state that there is no machinery to enable the existence even of these places to be known to the inspectors; are no returns made either by local authorities or by the manufacturers themselves?—None whatever. In one case the local authorities made a strong objection to furnishing the return; and, as a matter of fact, I may state that I have frequently discovered the places quite accidentally. I found a firework factory the other day which I was not aware was existing, and there are two blasting fuze factories, which I discovered accidentally. I believe there is a company for the manufacture of explosives established, or about to be established, in Wales; I happen to know that the company has obtained a license, but at the present moment I do not know where the proposed factory is to be. I only accidentally found out on one occasion that a certain explosive material was being made in Middleborough; there there was a factory of another gun-cotton preparation which I found out accidentally. It is quite possible there are many places of the kind which I know nothing of at all, because there are no returns made.

86. In what principal respects do you think the law with regard to the retail trade is unsatisfactory and contradictory?—In three principal respects. First, the quantity allowed to be kept for a retail business is in some cases far too large, and in other cases far too small; and there is no correspondence between the quantity to be kept and the condition of the storage. Secondly, the regulations as to the retail trade are contradictory and inconsistent. Thirdly, the trade is not carried on under a license, and it is practically without supervision.

87. Now as regards the quantity permitted to be kept being too large in some cases and too small in others, will you explain more fully your objections under this head?—First of all, I would remind the Committee that gun-cotton, and other explosives, not being gunpowder, and not being nitro-glycerine, may apparently be kept anywhere, according to the decision in the Court of Queen's Bench, by persons who are not manufacturers, and in any quantity. In the case of gunpowder, a limit is fixed at 200 lbs. That quantity may be kept by any person who constitutes himself a dealer by the mere act of selling; no license is required, and no regulation has to be

Chairman—continued.

observed, but any person, whether he sells an ounce, or many tons, a year, becomes a dealer by the mere act of selling, and he may keep powder up to 200 lbs. anywhere; that is to say, whether he has got a dwelling-house or one room, or whether he has a garden and a tract of land, he may keep up to this limit, and no more than this limit. Now, 200 lbs. of powder in a dwelling-house, without special means of keeping it, is, in my opinion, far too large a quantity. I should like to ask the Committee to look at some photographs of explosions which have occurred with quite small quantities of powder. These will show what the effects are. Here is a photograph of an explosion which occurred at West Houghton, near Bolton, in the year 1872. The quantity of powder, so far as I was able to discover, was only 30 lbs., and that was very destructive. Here is a photograph of an explosion from between 25 and 50 lbs. (*producing photographs*). The next one is a case of between 25 and 50 lbs. near Wigan (we could not ascertain accurately). But one of the most striking is an explosion which occurred at Stowmarket, not the great explosion of gun-cotton, but an explosion of about 6 lbs. only of gunpowder, by which two people were killed, while the damage to the house was very considerable (*producing photograph*). Another example is the explosion which occurred at Lambeth last November, when the quantity of fireworks was very small indeed. Of course the result was in this case very greatly aggravated by the effect of the fire, which must be taken into account in judging of this photograph. Then another case of explosion was from 10 lbs of gun-cotton (*producing photograph*). Those photographs will illustrate, I think, the effects produced by comparatively small quantities of powder, and I think they go to support my view that in a dwelling-house a quantity of 200 lbs. of powder, kept without supervision and without reference to precautions, is too large. On the other hand there are many people who have little gardens, at the back of their premises running down, perhaps, for 50 yards, it may be to a river, with no houses at the back, and those people, in my opinion, might fairly and properly be allowed to have larger quantities of gunpowder. But at present there is no inducement whatever to a man to store outside, because he can get no benefit with respect to the quantity which he may store. Then when we go to Scotland, they have several local Acts, and some of the burghs are under almost absurd restrictions. While in England a man may keep 200 lbs. of gunpowder, the Edinburgh Act only allows him to keep 13 lbs., the Glasgow Act allows him to keep 26 lbs., and the Inverness Act allows him to keep 4 lbs.; now, of course, those quantities are not observed by the people. I happened to be present at a fire in Inverness in the year 1872, when at an ironmonger's shop some powder was discovered, which was not 4 lbs. only, as it should have been, but nearer 100 lbs. And I say, as a matter of fact, there is no doubt that those very restrictive limits are not observed.

Mr. Norwood.

88. Is the effect of an explosion in a dwelling-house, for instance, in proportion to the quantity of gunpowder; if there was a certain amount of destruction caused by 30 lbs. of gunpowder, would

Mr. *Norwood*—continued.

would there be 10 times as much if there were 300 lbs.?—No, it is not in any proportion like that at all. But the effect is in that case so much more likely to extend to the adjoining building. The local effect would be no doubt very much the same.

89. The explosion would probably extend upwards and carry off the roof of the building, and find vent in that direction, would it not?—That would depend entirely on the conditions of storage. In many cases the gunpowder is stored in the basement and the cellars.

Mr. *M'Lagan*.

90. Is it not the fact that those burghs in Scotland have the magazines under the superintendence of the burgh magistrates?—Some of them have, but in many cases the magazines are so far out that they are not used as they should be used. The Glasgow magazine is nearly five miles away.

*Chairman*.

91. You say that the regulations as to keeping are contradictory and unsatisfactory; in what respects is this so?—A dealer may keep of gunpowder, as I have shown, 200 lbs., but he may only have 5 lbs. in cartridges. In cartridges it is much safer than in loose powder, but for powder in the safer form he is restricted to 5 lbs., while in the unsafe form he may have 200 lbs. On the other hand, if he has not made those cartridges himself, he may have any quantity, according to *Webbley v. Woolley*. Then, apparently, if that is so, he may, if not the manufacturer, have the powder in blasting cartridges, which is practically, of course, in a less safe form than powder in tin canisters, of which he may have only 200 lbs., while he might have tons of powder in blasting cartridges if he liked. Then, no restriction is made in the Act of Parliament between powder safely packed in canisters and powder in barrels. Nor, again, if a man provides a fire-proof magazine does he have any advantage over a man who stores the gunpowder in a cupboard at the back of his shop, or under his counter. Then, again, the limitation of fireworks to 10 lbs., when gunpowder may be stored up to 200 lbs., is an obvious inconsistency. In fact even a non-dealer may store up to 50 lbs., whereas nobody may store, without a license, beyond 10 lbs of fireworks. Again, no person under 16 years of age may buy fireworks, but anybody may buy gunpowder; the result is, that as people require a license to sell fireworks, and do not require a license to sell gunpowder, it is the practice in many places for people, instead of selling fireworks, to make up small packets of gunpowder to sell to children. The chief constable of Perth called my attention to the fact that every year they had a large number of accidents, cases of children burnt and injured from that cause.

92. You complain in the next place of the absence of any system of licensing or local supervision?—Yes; but I may just interpose this very important observation; the Act of Parliament says that a certain process which is really done by half the sportsmen, and by pretty nearly all the gunmakers in England, shall not be done except under a license, except at 100 yards from a house; I mean the process of filling cartridges. But as a matter of fact, it is largely done every day. I

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*Chairman*—continued.

suppose there is hardly a gunmaker in the kingdom on any scale at all who does not violate this provision of the Act of Parliament. I may mention that in the year 1871, a gunmaker of St. James'-street was convicted for this offence. He had an explosion, and that directed attention to the fact that he was filling cartridges, and he was convicted and fined by Mr. Knox. Then again there is another point which it may be well to notice in passing. No one may carry on the operation of filling cartridges without a license, but the operation of weighing out powder like tea or coffee is not forbidden. At Tralee, in 1872, I saw a boy weighing out gunpowder like tea or coffee in a shop full of people. A similar thing occurred at West Calder some years ago; they were weighing out powder in a shop in that way, and had got a number of packages already weighed out on the table; there was a fire behind the shop, and a man who was half drunk came in and was abusive; he was turned out, but he came back and took up a packet of gunpowder and threw it at the boy's head; it went into the fire and blew the whole place up; it killed a man and wounded a boy, and the man was tried and convicted for the offence.

Mr. *M'Lagan*.

93. In that case the sale of the gunpowder was for mining purposes, was it not?—Yes.

*Chairman*.

94. You complain in the next place of the absence of any system of licensing or local supervision?—Yes. It is a fact that under the present Act of Parliament no license is required to deal in explosives except fireworks. A man may not sell a squib without a license, but he may sell explosives of any other kind, however dangerous, without any license. It is open to question how far the powers of a search warrant even would extend to the searching of premises where miscellaneous explosives were kept by a person who was not a manufacturer; that is brought out clearly in a memorandum on the law which I believe the Committee have before them; but the mere statement of the fact that any one may deal in gunpowder, may keep it up to the extent which I have named, anywhere and without any supervision or precaution whatever, is one which carries its own condemnation on the face of it. The Committee will find in the abstract of the reports by the chief constables and by town clerks, an almost entire concurrence in favour of licensing or registering persons who deal in those substances.

95. What are the principal grounds upon which you think some system of licensing or supervision should be established?—One ground, perhaps a small one, is this, that a person who keeps the gunpowder under the present system is not necessarily known to do so at all, and therefore firemen and others, in case of fire, are exposed to a considerable unknown risk. A case occurred in Chelsea about three years ago; they were engaged in putting out a fire when a quantity of powder exploded, and it caused considerable alarm; the horses belonging to the fire engine took fright and ran away, and a good many people were injured. I was afterwards directed to inquire into the case. There was a case in which the firemen were exposed to very considerable risk at Inverness, but happily the powder

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powder was accidentally discovered while the fire was in progress; had that not been so, and the fire had reached the gunpowder, the consequences might have been very serious. I may state that several superintendents of fire brigades have expressly called my attention to that point.

96. What is your next argument on this point?—The next argument would be this, that there is no means of knowing who deals in these things, and no means of knowing whether the statutable quantities are exceeded or not; I have reason to believe that in some cases, and perhaps in many cases they are very largely exceeded indeed; I found one day accidentally when in a country town, a small powder store belonging to an ironmonger; I visited it, and found in it three times the statutable quantity, namely, 600 lbs. of powder in all. I should probably not have found out this store at all, only it was in a yard next to a firework factory that had blown up, and when the people of whom I was making inquiries said, "It was very fortunate that the magazine did not go too," I made inquiries, and visited the magazine. In another case, in a gunmaker's shop in Ireland, I found about 400 lbs. of gunpowder or double the permitted quantity.

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97. How far was that magazine, which was not exploded, from the firework factory which was exploded?—I suppose about 30 or 40 yards. There was a wall between the two. It was a brick magazine. And then in the case of a certain maker of ammunition at Greenwich, I found and caused at last to be seized and confiscated no less a quantity than 3½ tons of powder; his license, I think, was for about 500 lbs. The Committee will perhaps observe that at pages 49 and 50 of my Report, there are cases mentioned by the chief constable of Wigan. In one case he says that he seized 1,375 lbs. of gunpowder; and in another case "several barrels." Then we received a Report at the Home Office last November, from the vestry of St. Mary, Newington, reporting four cases of people who had largely exceeded the quantity permitted. One man had three times the amount permitted by his license.

98. Have you any other reasons for desiring to see the retail traders brought more under control?—Yes, I have another and an important reason, namely, that by that means a proper standard of precaution might be enforced; at present, that standard in the case of retail traders is exceedingly low. I would particularly call the attention of the Committee to the examples given in my Report at pages 61, 62, and 63; there are several strong cases there. Since that Report was written, only a few days ago my attention was called by a chief constable to the case of a publican, who stored his powder among his beer barrels. The chief constable objected, but there was no power of interference. I have visited some retail places, and I have generally found an utter absence of any precaution whatever. In one of the towns which I went to, I found that the whole of the powder in the various shops was kept among all the other goods; kept, not as powder at all, but just as if it were seeds. Here and there you find, as in the case of the particular magazine which I named just now, a trader who has taken the trouble and gone to the

*Mr. Whitwell*—continued.

expense of building a proper magazine. In Ireland, where supervision is much more stringent, (by virtue of the special Irish Acts,) and where no one may sell powder without a license, I find a very much improved state of things. There, in nearly all cases, the traders have separate receptacles at all events, if not separate stores.

99. Is that done in consequence of any law?—The magistrates will not grant the license unless they have them.

100. You further state that the law relating to nitro-glycerine and its preparations is as much too stringent as the gunpowder law is too lax; will you explain what you mean by preparations of nitro-glycerine?—I mean such preparations as dynamite and substances of that class, which have been passed, as we may say, and allowed as being safe. At the present time we have licensed five nitro-glycerine preparations. There is dynamite, dynamite No. 2, which is a variation of the ordinary dynamite; there are two descriptions of Horsley's blasting powder, A and B; and there is Brain's blasting powder. One other preparation is now before us with an application for a license, and will of course be considered; but those five are the only ones at present for which licenses are granted.

101. Does your observation with regard to the undue stringency of the law apply to the law in its bearing upon liquid nitro-glycerine, or merely in its relation to what you call nitro-glycerine preparations?—It does not apply to liquid nitro-glycerine. There is a very general agreement with regard to the undesirability of allowing trade in liquid nitro-glycerine, because it can be so much more safely employed in the form of dynamite, and it is in itself so exceedingly unsafe, that I do not think anyone would wish to try liquid nitro-glycerine.

102. Then you are not of opinion that the passing of the Act in 1869, so far as liquid nitro-glycerine was concerned, was unnecessary?—Certainly not.

103. But do you consider that, with our present knowledge, the law with regard to nitro-glycerine preparations of safe and approved character may be properly relaxed?—With regard to safe nitro-glycerine preparations, I think the present law is unquestionably too stringent, and may be safely relaxed.

104. I gather from your Report, at page 78, that you consider that the dealers in nitro-glycerine preparations enjoy some advantages under the Act which are not shared by the dealers in gunpowder; will you have the goodness to state what the present practice actually is?—The point that I refer to is that of the facilities for obtaining licenses. Suppose a dealer desired to establish a magazine to serve a given district with dynamite, if it were gunpowder, he would, under the Gunpowder Act be required to give notice a month in advance, and to put the notice on the door of every church in the district. He would then have to appear before a magistrate, and he would have to fight any local opposition there might be. But in the case of dynamite, he merely has to send an application to the Home Secretary for a form on which to make a formal application for his license. He receives his form, which asks him certain questions with regard to situation, construction, and all details which are held to be necessary; and, in the large majority of cases, we are able to grant

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grant licenses on those forms at once; that is to say, within a day or two, and that without any expense whatever to the applicant, without any charge; so that, with respect to obtaining his license, he is certainly in a better position than the gunpowder maker.

105. But you are, I think, of opinion that these advantages are more than counter-balanced by the disadvantages under which the nitro-glycerine preparations labour, and which appear to consist chiefly in the invidious distinction which the legislation has drawn between the two; a distinction which I understand you to say, is very marked indeed?—Very marked; I can hardly add anything to what I have said on that subject, at pages 78 and 79 of my Report. What I would beg particularly to call attention to, is this striking contrast; any one may keep the quantity of gunpowder which I have named without a license, and a mine owner may, in certain cases, go up to two tons without a licence, whereas no one may have a pound or an ounce of nitro-glycerine without a license. We have issued licenses for quantities as small as 10 or 20 lbs., many for 50 or 100 lbs., those being for mining purposes; of course that places the dealers or users of nitro-glycerine preparations in a very disadvantageous position as compared with dealers in gunpowder. Before he buys the dynamite, or even before he tries it, he must obtain a license. It is a new thing to him to have to take out a license, and he fancies that it must be a very dangerous substance, particularly when he sees the conditions on his license, whereas there are none in case of gunpowder; he either considers that they are idle conditions which are altogether unnecessary, and either neglects to observe them or writes angry complaints to the Home Office, or he concludes that they point to the material as being of a particularly dangerous character. One case of the kind came under my notice a very few weeks ago; we had given a license to a man to import at a certain place, where the quays and wharves belonged chiefly to a private individual. This gentleman saw the license, and wrote up to say that he objected entirely to allowing the licensee to land the material, because he said it was quite clear from the conditions that were held necessary in the license, it must be a very dangerous thing indeed. Whether he has now relaxed his orders I do not know, but when I last heard of it the man was not able to import his dynamite, and on that account.

106. Do I understand you to complain of the existence of any legislative distinction between, say, dynamite and gunpowder, or only of an excessive distinction?—I think there must be always a distinction between dynamite and gunpowder, and indeed between all chemical explosives, such as guncotton and dynamite on the one hand, and gunpowder proper, and all things in which there is merely a mechanical mixture, on the other hand.

107. Of what nature are the special risks which you think should be provided against, in the case of chemical explosives?—There are, I think, three special points to be considered, and to be provided for in the case of any legislation being passed on the subject. First of all there is the purity of the material; there is no doubt whatever of the importance of that; in fact we have the one salient example of Stowmarket to

Mr. *Whitwell*—continued.

show the effect of impurity; I say, then, there is no doubt whatever, that an impure chemical explosive is liable under certain conditions to spontaneous ignition, and therefore impure chemical explosives must be guarded against. Then there is the question of the exact proportions or the exact nature of the ingredients employed. For example, in the case of dynamite compounds, samples have been submitted containing nitrate of soda instead of nitrate of potash. Now, nitrate of soda being a deliquescent salt, it was found on trial that when the material was exposed to a damp atmosphere it melted away and left you practically with liquid nitro-glycerine. So, again, it is always very important to check any departure from the precise character of the material as passed by the chemist. Then there is, in the case of nitro-glycerine preparations, the question of exudation. The main merit of dynamite as compared with liquid nitro-glycerine, consists in the fact that it absorbs the nitro-glycerine and transforms it, so to speak, into a solid body; but if it does not hold it permanently in absorption, if the nitro-glycerine is liable to exude, then you get back to a very dangerous state of things; you have provided for a solid, and you are really dealing with a liquid; I hope the Committee may give Major Ford an opportunity of stating what he actually did find with regard to a case of exudation which came under his own knowledge; because while I am venturing to press on the Committee the desirability of making this law less stringent, it is very important that I should guard against the idea that I am proposing to place these substances exactly on the same footing as gunpowder.

*Chairman.*

108. (To Major *Ford*.) Will you kindly state your experience, Major Ford, on this point?—When visiting a magazine which was at Holmes' colliery, near Sheffield, while I was inspecting and writing down on the form the details of the outer portion of the magazine, one of the men who accompanied me had taken up a box containing dynamite; I noticed that some liquid was running from it, and I saw on the floor several drops of a substance which I then concluded, and afterwards proved, was nitro-glycerine. The man was about to step out of the magazine towards me as I was standing at the door; and on the same floor and by the side of the nitro-glycerine there were lying some loose grains of powder. Now, in all probability, if he had trodden on the nitro-glycerine it would have exploded.

109. Have you seen other instances of a similar character?—Yes, I have seen other instances of exudation, but never such a dangerous case as that. (Major *Magendie*). In consequence of that we took steps which led to an inspection being made of various magazines containing dynamite, and considerable quantities were found in a state which warranted, and indeed rendered necessary their destruction. I think it is most important that this point should not be overlooked.

110. (To Major *Magendie*.) Assuming that these risks are effectively provided against, would you propose that dynamite, guncotton, and other chemical explosives should be placed in all other respects on the same footing as gunpowder?—No, I would not, because I think that persons who deal in the more powerful chemical explosives cannot reasonably object to having the quantities reduced

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duced which may be kept, or the distances increased. If 200 yards is a safe distance with regard to gunpowder, it would hardly be considered safe with regard to an equal quantity of guncotton or dynamite; therefore some variation must be made.

111. Is that the only point in which you would draw a distinction?—No; I do not think it is desirable or necessary to endeavour to establish or even to legalise the establishment of a retail shop trade in those explosives. In the case of gunpowder to a great extent, we must take things as we find them. The trade does exist, and there is a special reason why it should exist, for sportsmen of course must go to the shops for those things. But with regard to dynamite and things of that kind which are only wanted for blasting operations, there can be no reason for creating a retail trade, which is always difficult to control; and therefore I would propose that retailers should not be allowed to deal in dynamite or guncotton or any substances of that class, except to such an extent as might be necessary for sporting purposes. Take, for example, Schultze's powder. I believe that is mainly used for shooting purposes; you must allow that article to be sold, and you must put it so far on a footing with gunpowder, but it is not so with regard to dynamite.

112. You stated in your Summary that the mass of work thrown upon the Home Office by the present Nitro-glycerine Act is excessive; can you give the Committee any idea of the extent of this work?—The extent of that work is indicated by the number of licenses which have been issued. The number is stated at page 77 of my Report. It will be seen that up to the present time there have been issued really about 450 licenses. Some of them have expired or have been surrendered or been revoked, and that leaves now in force 392. All the work and responsibility connected with those licenses is centred in the Home Office, and I need hardly inform the Committee that granting those licenses is not the only thing, for there is a great deal of correspondence to be gone through which arises out of the applications. For example, a man makes a proposition which is not admitted; a question has to be asked, and so on; or else you find, on visiting his magazine, that certain things are there which ought not to be there. That all leads to correspondence; then the work of inspecting those places is very heavy indeed; in fact, Major Ford and myself are really quite unable to keep up with it. It will be found, on referring to the Table which I have handed in, that we have inspected, as to nitro-glycerine preparations, only 61 magazines out of the 392 which are in existence, and that has been a year's work, and working very hard. Major Ford points out to me that we have really only got rid of 52, because in the case of some of those 61 there have been second and third inspections rendered necessary by the defects found to exist on the occasion of the first inspection. There is another return which will help to show the number of magazines existing and what progress has been made in their inspection. Take, for example, the magazines in England, of which there are 277, and of which we have inspected only 61; in Scotland there are 75 licenses, but we have not inspected one; in Ireland there are 15, but we have inspected none

*Chairman—continued.*

there; so that the work of inspection is very heavy indeed under the present circumstances.

113. Therefore you are in arrears?—Yes, there are arrears, and there must always be increasing arrears.

114. Is the present machinery satisfactory as far as it goes; that is to say, does it afford you all needful facilities for controlling these substances as you would wish?—No, I think not. In the first place there is this great difficulty, that you can only bind the licensee; you cannot bind any one who does not choose to take out a license. Take, for instance, the case of a carrier: it would be most inconvenient to attempt to make him responsible that the material was packed in a particular way; in fact, that would entail the opening of every box in order to examine it. All we can do is to require him to refuse to convey the goods, if he has reason to suspect wrong packing; that is very unsatisfactory. With regard to importation, a similar remark applies if the captain of the ship is the importer, but if he is not the importer there is another difficulty; the importer, who may be a merchant in London, takes out the license, but he cannot well see to the berthing of the ship, and such-like things. Then, again, I am placed in a great difficulty with regard to the inspection of those substances, and the control of them, by the fact, that the railways have hitherto refused to carry my samples; what we do is this: we take, on visiting some of the magazines, a sample, and we have it examined in London by Dr. Dupré of Westminster Hospital; then the question is, how to get it to London; that is often very difficult; I must either come up to London myself, or else go on accumulating quantities of samples while my inspection goes on. I am anxious that railways should be required under certain regulations to carry samples properly and safely packed, as they certainly could be, and so facilitate the inspection. It comes to this, that the time has come when properly approved descriptions of nitro-glycerine preparations might be placed on a footing, more closely resembling, though not entirely on the same footing, as gunpowder and other explosives, such as gun cotton, and substances of that class.

115. Then, in short, the Committee are together from what you have said (and from your Report) that you are distinctly of opinion that the time has come for relieving nitro-glycerine preparations of such unnecessary restrictions as the Nitro-glycerine Act imposes upon them?—Yes, I am distinctly of that opinion, that the time has quite come for relieving safe nitro-glycerine preparations from such unnecessary restrictions as the Nitro-glycerine Act imposes upon them.

116. Now have you any observations which you would like to make to the Committee with regard to the defects of the Acts considered from the legal point of view?—I would merely observe that as the officer charged with the carrying out of the Acts of Parliament, I am perpetually finding very great difficulty owing to the imperfect wording and defective construction of the Acts of Parliament. On that point I have made some observations in my Report, at pages 72 and 73. I believe the Committee have before them a memorandum pointing to some of those defects. I could mention many instances, but I will only take one. After the accident at Birmingham by which those 53 women lost their lives, we thought

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*Chairman*—continued.

proceedings should be taken against the owner of the factory, for introducing into the factory a thing tending to cause an explosion, namely, a stove. There was no doubt that the stove had actually caused the accident, but when the case came on it was found that the Act was so worded, that though it was forbidden to "any servant or workman, or any other person" to do those things, those words, "any other person," were to be construed as *ejusdem generis* with "any servant or workman," and so the owner was held not to be liable at all. That is as to Section 16 of the 23rd and 24th Viet., c. 139. I believe that view is sustained in the legal memorandum that is now before the Committee.

117. What are the Committee to understand from the concluding expression in your Summary as to the desirability, in the interests of the trade, of removing all hindrances to the enforcing of the law?—What I mean is this. I have endeavoured throughout my examination to draw a distinction between those who are striving honestly to observe the law, and those who do not wish to pay any attention to it. There can be no doubt that if the law stands as it is and cannot be adequately enforced, those who observe the law are placed at a great commercial disadvantage. Take for example, the particular case of the mill-charges in a gunpowder factory; practically the mill power of any given factory is the measure of its producing power; but if the manufacturer chooses to work, say double charges, he is doubling the productive power at the factory, and in some cases, in one case, at all events, double charges have been used, and in some other cases where we obtained convictions, charges very much in excess of those permitted by the statute were being worked. And when that is the case it is to the disadvantage of the person who is working the lower legal charges. The same kind of observation applies all round. It will be observed in my Report, at page 73, that one powder manufacturer informs me that his firm spent about 7,000 *l.* in order to comply with the requirements of the Act of 1860, and after making that expenditure they had the mortification of observing a rival firm in the immediate neighbourhood treating the law as a dead letter and neglecting to comply with some of the clauses. It has been very strongly pressed on me by members of the trade that it ought to be such a law as could be enforced; and the present law, independently of other objections, is very difficult to enforce owing to the difficulties of construction.

*Mr. Laird.*

118. Let me ask you generally whether your opinion amounts to this: that some more definite legislation should be passed to secure more safety in the storing and transport with full power to enforce the legislation?—Yes.

119. That is your view, is it not, taking it broadly?—Yes, distinctly so.

120. Would it be possible to make legislation to prevent many of the dangers from carelessness named in your evidence?—Many of these dangers might be got rid of, no doubt.

121. Do you think that the regulations which you propose would be an obstruction to the trade if the law were made more definite on the subject?—I think that it would be no obstruction to the trade, and I hope to have an opportunity of explaining fully what I should propose; I

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*Mr. Laird*—continued.

believe it may be done without any serious disturbance of the trade, and indeed in some respects with positive advantage to it.

122. You have discovered in your inspections various causes of accidents?—Yes.

123. Do you think it advisable that all manufacturers of the substances should be obliged, before commencing work, to take out licenses?—Certainly, I think so with regard to all explosives.

*Mr. Whitwell.*

124. I should like to ask you whether in any case you have known a license to be withdrawn which had once been granted?—It cannot be withdrawn; I believe there is no power to withdraw it; I think I may illustrate that by referring the Committee to the case of the magazine at Coventry. The magistrates' attention was called, after they had granted the license, to its dangerous proximity to the canal bank, and they wished very much to annul the license, but they could not do it, and the magazine was only got rid of at last by the licensee voluntarily surrendering it.

125. Then, in view of the fact that any licenses were granted for a stipulated time, I infer that if the circumstances altered the surrounding locality you would give power to the magistrate or licensing authority to withdraw the license?—I would propose that in every case of a license it should either be for a limited period, or else for such a period as a certain danger area surrounding the place should be free from houses.

126. Should that limitation, in your opinion, extend to the manufacture as well as the storage?—Yes. With regard to licenses being revoked, I should say that under the Nitro-Glycerine Act licenses can be revoked; and they have been revoked.

127. You referred specially to the imperfect nature of the packets in which gunpowder was sent. Have you any suggestions to make upon that point?—Yes, I think a suggestion which I accepted, and which I believe emanated from the trade, was a very good one; it was that every manufacturer should submit for approval, and should use only pattern cases for the conveyance of his explosives, so that the thickness, strength, and stability of the case would be proportioned to the character of the wood used, an oaken barrel representing far more strength than one made of weaker wood.

128. Would you recommend the adoption of such cases as would encourage their use on a second occasion?—I am not prepared to reply to that question; the sort of case which I should propose, would be one considered with reference to its first use; I should not think it necessary to consider the question of second use in fixing the strength of the case.

*Mr. M'Lagan.*

129. I think you mentioned that it would be in your opinion advisable for the licensing magistrates either to possess technical knowledge themselves, or to be advised by persons possessing technical knowledge in granting licenses?—Yes.

130. And I think you gave the Committee an instance of the necessity of such a technical knowledge in one case where there were 20 tons of gunpowder stored in the middle of a village?—Yes.

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Mr. *M'Lagan*—continued.

131. Do you think it requires much technical knowledge to say that 20 tons of gunpowder should not be stored in the middle of a village?—No, I think that is an extreme case; but I am quite sure that if the inspector had had to make a report on that, the license would never have been granted.

132. But surely no man of any common sense would have done such a thing?—It is a matter of fact, at all events.

133. Then do you not think that it would be better to take the licensing power entirely out of the hands of the magistrates, and put it into the hands of the Home Office?—No, that would be in my opinion over-centralisation.

134. Would it not produce more uniformity?—I think you could attain sufficient uniformity if all licenses were granted on the report of the Home Office Inspector, without the over-centralisation which would result from that course.

135. You would not, in that case, recommend that there should be a person having technical knowledge appointed to advise the local authorities?—The inspector would be that person.

136. But he would be paid out of the Government funds, I suppose?—Yes, certainly.

137. And not out of the local rates?—Not out of the local rates. I was only going to make obligatory that which several benches of magistrates have done voluntarily.

138. I think the plan you propose would be the best, namely, to have magistrates giving the licenses advised by the Home Office Inspector; that is what you mean?—Yes; and that plan has been recommended by a large number of people; Colonel Boxer, Sir Henry Thring, and other authorities, who are named in my Report.

139. You spoke of the absence of certain rules among miners and others as to the storing of gunpowder, and you spoke of certain rules which were in practice at some colliery, such as the workmen not being allowed to keep poultry and pigs, and so on; I presume that, in all workmen's houses connected with collieries and gunpowder factories, there are rules of that kind connected with the cleanliness of the people, and not at all with the manufactory?—I do not know; they have not come under my observations.

140. Are you not aware that in many cases the men are obliged to sign rules forbidding their keeping poultry, dogs, and so on?—No, I was not aware of that; but what I quoted applied, not to a colliery, but to a gunpowder factory, and the rules were the rules of a gunpowder factory made specially under the Gunpowder Act.

141. You know, do you not, that there are no regulations in the Gunpowder Act similar to those in the Mines Regulation Act?—None at all; the making of rules is voluntary, and there is no control with regard to efficiency or insufficiency.

142. Are there many cases like that which you spoke of, such as a man putting a red hot poker into a barrel of gunpowder?—There are very many cases of great recklessness. I think the sooner you pass some more stringent regulations by Act of Parliament the sooner we shall have fewer accidents from such causes.

143. You know, do you not, that the rules are very strict in mines?—Yes.

144. Is it not the fact that men, in violation of those rules, do most imprudent acts?—Yes, that is so.

Mr. *M'Lagan*—continued.

145. And even though we had very stringent rules under an Act of Parliament, should we not still have accidents from imprudence, and probably the ignorance of the men?—Yes, no doubt; but the effect of such legislation, as I contemplate, would probably be found to be this, that instead of having the powder distributed in colliers' houses, we should have it in properly constructed magazines, concentrated, and taken more out of the hands of those people.

146. If I rightly understand your evidence, you would prohibit a miner keeping powder at all?—No, I do not go so far as that; but the quantity to be kept by the non-dealer, in my opinion, should be reduced, and there should be an increased power of local supervision where there is a suspicion of excess. If the effect of legislation were to establish proper magazines at the different mines, that would take the powder out of the colliers' houses.

147. You are aware, are you not, that colliers are generally obliged to supply their own powder?—Yes, I am aware of that; but there would be no difficulty in meeting that case.

Mr. *Knowles*.

148. You have not told the Committee, I think, how many inspectors there are?—Major Ford and myself are the only two inspectors appointed.

149. Then practically you are no use as the law stands, except to inquire into accidents after they have occurred?—I think we are of some use. We can see that the law is observed, and we can, and do, remonstrate with persons who are carrying on the thing in an unsatisfactory way, and I am happy to say in a certain number of cases our remonstrances are of some effect.

150. What are your powers over a dealer with regard to whether he shall keep gunpowder in his bedroom or cottage?—None whatever; in fact we do not practically touch the retail trade at all.

151. As the law stands at present, a man can keep 200 lbs. of powder in his house, have a fire in the same room, and have his bed or his children in the same room?—Yes, he may.

152. Of course you are aware that in the mining districts the colliers always keep some gunpowder in the house?—Yes; it is a very common practice.

153. They keep eight or ten pounds, about as much as will last them for one week?—Yes.

154. And some of them become dealers?—Yes.

155. Some of those photographs which you have produced apply to such cases, do they not?—Yes.

156. There is no law to prevent that, is there?—None at all; there is no limit except 200 lbs.

157. There is no law to prevent every cottager becoming a gunpowder dealer, is there?—No.

Mr. *Norwood*.

158. Do you suggest that the retail trade in dynamite and similar explosives should be put an end to?—It does not exist all; all I propose is, that it should not be created, because it is not necessary,

Mr. *Stanhope*.

159. I notice that under the existing law, there is a power of appeal from the licensing authority to the Secretary of State?—That is so in the case of gunpowder only.

160. Has



Mr. Stanhope—continued.

160. Has that power of appeal been made use of to any extent?—No, I do not know that it has; I have not known any case of a new gunpowder manufactory being licensed since I have been carrying on this work, therefore no such case has been before me.

161. Therefore, as far as you are aware, the present system of licensing under the magistrates has given satisfaction, seeing that there has been no appeal from applicants?—I have not known of any persons taking out such licenses as would give them a right of appeal, except a few cases of gunpowder magazines, when, as a rule, no conditions are included; all the gunpowder licenses date from a good many years back.

162. Supposing you give the licensing magistrates the power of calling in a skilled inspector to advise them, would you propose to retain the power of appeal to the Secretary of State?—Yes.

163. Would not that place you in this difficulty, that the appeal would be from the licensing magistrates, with a skilled inspector, to the Secretary of State, who would be practically advised by the same person?—It might be provided that the Secretary of State may or shall refer it to some person other than the person who made that report, or refer it to arbitration.

164. Would it be easy to find any other person who would be sufficiently skilled?—I think so.

Mr. Hick.

165. I think you spoke of several cases where accidents had occurred, and where it had been very often from want of precaution on the part of private individuals, but not in Government establishments?—Yes.

166. Are you of opinion that the precautions adopted by the Government, and for the most part enforced, do prevent accidents?—I think it is impossible to prevent accidents altogether; they will occur in the best regulated places to the end of time, but everything is done in a Government factory to reduce the risk to a minimum.

167. Now with regard to the removal of the workmen's clothes, is that plan now generally adopted by the Government; I mean to insist on the men changing their clothes on leaving work and on coming back?—Invariably.

168. That is by no means always done elsewhere?—No, certainly not.

169. Is not that a matter of the greatest importance, knowing how many accidents happen in that way?—Yes, it is.

170. At what stage does powder in a manufactory become explosive and dangerous?—It is so from the very first, although not in the same degree.

171. I thought it was not so until it got into the incorporating mill?—That, practically, is the first stage; the ingredients are previously mixed together in a crude way by machine or by hand, but practically the manufacture may be said to commence when it gets into the incorporating mills, and from that moment the danger begins.

172. You will no doubt recollect a very serious accident which took place at Waltham Abbey some years ago, which was supposed to have originated in the incorporating mills?—There have been very grave accidents at Waltham Abbey, and necessarily several accidents in the incorporating mills; but I do not remember the accident which you refer to particularly.

173. It is the most dangerous work, is it not, 0.84.

Mr. Hick—continued.

in the granulating process?—There have been more accidents in the granulating process than in any other part of the process, I believe.

174. Has any accident happened by the carelessness of strangers visiting the place carrying matches and things of that kind?—Not that I know of; but it is often very difficult to say how they arise.

175. Are the precautions taken very stringent with regard to visitors?—Generally they are very strict indeed; but in some cases there is a difficulty, owing to the position of the mills. The factory I named at Ewell is a case in point, which has a right of way through it, and the late proprietors of that place complained very much of that right of way. Then there is another factory which I know of in the North, one of their powder buildings was situated on the high road, and one day they found a man smoking his pipe there.

176. I am aware that visitors on entering powder mills are forced to take off their shoes, and that slippers are provided; but are they examined to see whether they have matches or cigar lights in their pockets?—At Waltham Abbey they are very strict, I know; and at some other large places a visitor would hardly get in with anything dangerous about him.

Mr. Dillwyn.

177. You spoke of some places having special Acts of Parliament with regard to the sale, transport, and storage of gunpowder; are there many such Acts?—I believe that there are a good many in Scotland. In England, I know of only one, namely, the Mersey Act.

178. Is there not a local Act for that purpose in Swansea?—It is quite possible there may be.

179. Do you know whether the general conditions of those Acts of Parliament are more or less stringent than the general Act?—Generally the local Act is very much more stringent. The Scotch Acts and the Mersey Act are very much more stringent than the general Act; that is to say, with regard to giving power of local supervision and control.

180. Will you kindly put in a list of those local Acts of Parliament?—I am unable to do so. I find in the legal memorandum, which the Committee have, of the state of the law, that the Law Officer of the Crown says he has not a list of them.

181. With regard to keeping dynamite, supposing that the chemical decomposition of dynamite could be arrested, would it be more or less safe than gunpowder, in your opinion?—That is a very difficult question to answer; there would still be another risk peculiar to dynamite, namely, the risk of exudation. I think if you could eliminate that risk as well as the risk which you have named, that it certainly would be free from certain risks to which gunpowder is liable.

Chairman.

182. Is there no process of glazing it to prevent that exudation?—It is generally controlled by a careful selection of the absorbent material, and by the form of the packing. I never heard of glazing.

Sir H. Selwin-Ibbetson.

183. One of the honourable Members wishes me to ask what the extent of the importation of dynamite

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Sir H. Selwin-Ibbetson—continued.

dynamite and other preparations of nitro-glycerine has been during a given period?—The extent of the importation from abroad has been comparatively small within the last year; in fact, for use in England, I do not think there is at present any importation from abroad; but there is a large trade going on from a dynamite factory which exists in Scotland, which is established under the Nitro-glycerine Act, and which came into working operation at the beginning of last year. That factory is doing a considerable business; in fact, I fancy it does all the business that is necessary for England. There have been, however, importations for transshipment to foreign-going ships, but none for use in England.

184. With regard to the question asked you by one of the honourable Members with reference to the interference of the inspector from the Home Office with the local authorities, I suppose you would propose that that should be carried on in the same way as the Government at present interfere with certain explosive substances by inspectors. You would propose that on application to the local authorities they should refer the case to the Home Office, and the Home Office should submit it to the inspector, on whose report the local authorities should be authorised to grant the license?—Yes.

185. With regard to the rules which you have spoken of for workmen in factories as to their keeping poultry, and so on, those rules, I suppose, need not be made at all?—Just so.

186. In your Report you state that one objection, which is a practical objection, is, that rules made in this voluntary way are seldom observed, is that so?—The rules are very often not ob-

Sir H. Selwin-Ibbetson--continued.

served at all; and I have found cases where rules existed but the workmen, practically, knew nothing about them. In some factories, however, great care is taken on that point. In one of the gunpowder and dynamite factories every person receives a copy of the rules annually.

187. With regard to another question put to you as to the carelessness of workmen in using certain tools and instruments, I suppose we might hope that to the extent which any fresh legislation forbade the use of iron tools and instruments that were dangerous under the circumstances, we should put a stop to such carelessness in future?—Yes, certainly.

188. Although your inspections are not always under legal powers they have tended very much to encourage better regulations in many cases, in consequence of bringing public opinion to bear upon these matters, I suppose?—Yes, I think they have done much good; many of the manufacturers have themselves expressed that opinion to me.

189. In fact, manufacturers encourage any notice that is taken of such matters by the inspectors, do they not?—Yes, in the better conducted factories nothing can be more ready than they have been to adopt the suggestions of the inspector.

190. If it were part of the law that certain inspections were legal instead of voluntarily, as they are now, you believe that the manufacturers would throw no great obstacles in the way?—I think I may say that I am satisfied the trade would not object to that. I have made some observations in my Report, quoting the opinion which different branches of the trade have expressed on this point at various times.

Friday, 8th May 1874.

## MEMBERS PRESENT:

Mr. Bell.  
Mr. Dillwyn.  
Sir John Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. Laird.  
Mr. M'Lagan.  
Colonel North.

Mr. Norwood.  
Sir H. Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Whitelaw.  
Mr. Whitwell.  
Mr. Vivian.

VICE ADMIRAL THE RIGHT HONOURABLE SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Major VIVIAN DERING MAJENDIE, R.A., and Major ARTHUR FORD, R.A., re-called;  
and further Examined.

*Chairman.*

191. You, in your evidence the other day, spoke of the very great recklessness that prevails very generally among people in mine magazines; are the Committee to understand you to say that similar recklessness prevails in the larger store magazines?—From time to time there are striking exceptions, but in a very great number of cases the standard of precautions in store magazines is far below what it should be. I would refer, for example, to the instances quoted at page 29 of my Report; but there is one case which I should like specially to refer to, which has occurred since that Report was written. I thought it my duty in this instance to write to the proprietors, and I wrote in these terms: "I have the honour to call your immediate attention to the dangerous condition of your magazine. I deputed Captain Smith to inspect this magazine; a duty which he carried out yesterday, and in a report which I received from him this morning, he speaks in very strong language of the state of things which he found there. The following extract from his report will sufficiently indicate to you the necessity for immediate action: 'The magazine is in a most disgraceful and dangerous condition. The barrels have been allowed to lie in the magazine till the hoops and staves have rotted, and the powder has consequently escaped on the floor; large heaps of powder lie on the floor. The floor is strewn with bricks, fragments of mortar, old hoops and staves, &c., and is in a filthy condition. Not the slightest attempt is made to keep it clean. The keeper stated that the agent of the company had advised him to let it alone; I told him the same. The only possible course to be taken with the magazine is to require the owner to send a thoroughly qualified gunpowder workman and cooper to remove and drench all the loose powder on the floor, and in the broken casks, and to re-cooper all the casks which require it.' When to this I add that no magazine shoes are provided, and that the keeper walks upon this powder and grit-covered floor in his iron-shod boots, you will, I am sure, recognize the extreme urgency of the case. I quite agree with Captain Smith that the

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*Chairman—continued.*

magazine should not be interfered with, except under the direction of a thoroughly experienced and very careful powder-man (which the keeper evidently is not), and in my opinion it would be proper that you should communicate at once with your agent, directing him not to allow the magazine to be entered by *any* one until the person or persons deputed by you arrive. The first thing to be done is clearly to remove the existing element of danger; and after that to provide against the recurrence of such a state of things." I do not think I have ever found any magazine quite so bad as that; but I have found a similar state of things, only less in degree, prevailing at some other magazines. I would venture to call attention also to a Return which I handed in to the Committee on the last day of my examination headed, "Result of inspections of store magazines for gunpowder." That Return shows that out of 51 store magazines visited for the first time, during 1873-74, no less than nine were so bad as to require almost entire remodelling. Only one of those magazines could be considered to be really satisfactory. I only a few weeks ago went to inspect a large magazine, and I there found a number of workmen employed in repairing the floor of the magazine without having taken the precaution not only of not removing the powder from the building, but not even removing the powder from that part of the building where the work was being carried on, and not having taken the precaution to wet the floor, so as to drown any powder which might have been about. Another case came under my notice exactly two years ago, which was the case of a magazine belonging to the burgh of Montrose. That was a very peculiar case. I found that the door was iron-plated inside. I asked the reason of that, and the keeper explained that the object was to prevent bullets from entering. I asked him how bullets could enter there, and he said that it had been the practice of the volunteers to discharge their rifles at the magazine as they returned over the Links. I found several holes through the door and in the magazine. I was then

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then reminded that Captain Smith had reported the same thing some years before, when he inspected the magazine. This sort of amazing recklessness has prevailed even among experienced powder hands, who have been at it some time and there was a fatal accident two or three years ago, owing to a man getting on the roof of a powder building; it was an iron roof, and he proceeded to punch holes in it with a steel instrument; the result was that there was an explosion, and three men were killed. I instance those cases because they show that this recklessness has unhappily not been limited to those magazines which have been carried on by colliers or miners.

192. You complained of the omission in the Act, in certain cases, of any provision with regard to distances where the quantities were fixed, and you gave some instances. Is it the fact, that in consequence of this omission instances of such undue proximity are very numerous?—Yes, very numerous, and in some cases to an extent which is very alarming. There is one powder factory where, I believe, if an explosion of any importance were to occur (and such explosions may be looked for even in the best regulated factories) that the whole of the buildings, or pretty nearly the whole, would go down like a pack of cards. I have addressed strong remonstrances to the owner, but I fear that it is of no good, because the whole thing is so exceedingly unsatisfactory that unless the factory is either extinguished or else extended very largely, the mischief cannot be rectified. There are other factories where two or more of the important powder buildings are at least so near as to be practically involved in one and the same risk. In fact, as there is no statutory provision on this point, it is easy to understand that in many cases the houses have been really put up with regard to the exigencies of the moment only, and so the factories have grown up in a very unsatisfactory manner.

193. Is there any limitation with regard to the number of workpeople who may be present in any one building?—None; and that was a point to which I should have called the attention of the Committee last Tuesday, because in some cases, independently of the question of the undue proximity of the buildings which frequently brings the people unnecessarily within one risk, the result is that there is a very large number of people involved in a single risk within one building; I know one factory where 20 or 30 women are employed in one building, and in another 40 or 50; I mentioned the other day the case of factories for blasting fuses where very little attention is paid to that point, and where a great number of workpeople are very often brought within the one danger building of the factory.

194. If a factory or magazine is once lawfully existing, and if houses or churches come near it, or public buildings come near to it, or extend towards it, would the factory become illegal?—I believe that if any works specified in the statute as protected works were to encroach on a magazine, the magazine would become illegal; for instance, I believe a firework factory would become illegal if a house came within 50 yards; I believe an ammunition factory would become illegal if a house came within 100 yards; in the case of a gunpowder factory it would not be so, because practically there are no protected places with regard to powder factories.

195. Do the users of powder for the making of

*Chairman*—continued.

docks and railways enjoy the same advantages as are enjoyed by mine owners?—No, they do not, and that is a point of some importance. Of course persons making docks, or railways, or tunnels, or engaged in industrial works of that description which require the use of powder for blasting, always have to store very considerable quantities of powder. In fact, the quantities are as much, in many cases, as mine owners use; but they are not provided for, because the Act of Parliament says that the owner of a mine, quarry, or colliery, may have in his magazine, under certain circumstances, up to two tons without a license; but the maker of a dock or railway may not have, without a license, more than 200 lbs.; he must either limit himself to 200 lbs. or else take out a license. Indeed it is a question whether he should not limit himself to 50 lbs. (as a non-dealer); but he must either limit himself to 200 lbs. or he must take out a license, or he must store it illegally. He cannot limit himself to this small quantity, and taking out a license for a magazine, which is here to-day and gone to-morrow, or at least in a few weeks, is quite impracticable; therefore the powder is stored without any license, and with out any outside knowledge even of its existence. I have accidentally come across some of those cases, and no doubt they must exist in large numbers.

196. With regard to the illegal manufacture of fireworks, I understand you to say that you have reason to believe that this goes on to a large extent?—Yes, I have reason to believe that it goes on to a very large extent indeed. My attention has been directed to that subject for some time, and I should like to read to the Committee an extract from a Report which I made as far back as the 23rd of January 1872, after I had found a man illegally making fireworks, on a very large scale indeed, who was afterwards convicted. I said this, "This establishment is, I fear, only a type of a large number of existing illegal firework factories. The legitimate makers complain strongly, and with great reason, of those factories. They urge that people who manufacture in their private houses, employing their children for the purpose, and observing none of the restrictions enjoined by law, are able to undersell persons who go to the expense of establishing legal factories away from towns and houses, who obtain licenses and otherwise endeavour to place themselves within the law. I have at this moment a long list of persons who carry on this unlicensed trade in unsafe and unsuitable places; and one of the leading firework makers assures me that the 'November trade' (as it is called) in fireworks is almost entirely carried on in the garrets, dwelling-houses and other unauthorised places. It is at factories of this sort that accidents most frequently occur; such accidents as that at 20, Baker's-row, White-chapel, last October, when the proprietor was killed. The impunity with which this extensive unlicensed trade is carried on is necessarily most disadvantageous to the legitimate trade. Indeed the legitimate traders are compelled in self-defence to purchase their cheaper goods from unlicensed makers, the result being increased prosperity to the unlicensed and dangerous trade, and discouragement to those makers who try to observe the law; the broad result is, that the whole firework trade is at the present moment in a most lax and unsatisfactory condition; and I believe from what I have seen and heard that until a few convictions are obtained no improvement will take place;

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place; indeed my inspections at the present moment are unfavourable, to some extent, to the legal trade; for if I confine myself to visiting those places which are returned as licensed, and in which I generally find "some infraction of the law which requires to be amended; the result must be that the better class of makers would be forced into strict compliance with the law, while in the absence of any convictions among the unlicensed makers, the persons who carry on the trade in improper places would be relatively placed at a further competitive advantage." I may state that in consequence of inquiries and some convictions which we obtained, it appeared to us, and to the Chief Commissioner of Police, that the illegal manufacture of fireworks was going on so extensively in London that Colonel Henderson thought it right to issue a warning notice on the subject.

197. You gave some examples the other day of the carriage of large quantities of gunpowder through towns; through London, for example; and their trans-shipment at public wharfs. Have you reason to believe that those cases are numerous, or did they occur exceptionally only during the time of the Franco-German War, which was the date of the instances you gave?—I have reason to believe that the carriage of gunpowder through London in carts, in which the material is covered only with tarpaulin, in accordance with the Act of Parliament, and its subsequent shipment, or *vice versa*, in populous neighbourhoods, goes on to a very large extent indeed, and is continued up to the present time. In support of that I should like to put in a Return, which I have received of the quantity of powder shipped or unloaded during the years 1868 to 1873, at Blackwall Stairs. (*The same was handed in, vide Appendix.*) There are other shipments of which I have no full information, that go on at Wapping, Collier Docks Blackwall, and Bow Creek. In the year 1868, there was either not a very large quantity or it was not noticed; at all events, there were only 14 tons recorded; in 1869, there were three tons; in 1870, the quantity goes up to 241 tons; in 1871, it fell to 75 tons; in 1872, it came up to 132 tons; and last year it was 122 tons. Those shipments were made in quantities varying up to as much as 20 tons, and they were all conducted quite in accordance with the present law; but, as I have observed, it was carried in open carts, which are, in my opinion, quite unsuitable for the conveyance of powder through populous places; also, in putting the powder into barges or taking it out of barges, I am told it is a common thing for the barrels to break and the powder to be spilt, and no special precautions are taken by laying down cloths, proper boats, or otherwise; add to that, that there is no power of interference on the part of the police in the case of people smoking in the neighbourhood. And this is a point to which I wish to call most particular attention.

198. I believe you have prepared a summary of suggestions as to the amendment of the law relating to explosions?—Yes.

199. Will you kindly state to the Committee what those suggestions are?—The remedies in which I would suggest to correct the defects and to supply the deficiencies of the existing law relating to explosions are broadly as follows: 1. The existing acts specifically relating to gunpowder, nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances to be

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repealed. 2. The existing local acts relating to explosives to be repealed, except where the Secretary of State, on application of the local authority, makes an order for continuing in force any power or provision, and such order is confirmed by Parliament. 3. A new Act to be framed to regulate the manufacture, keeping, selling, carrying, and importing of gunpowder, nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances to be named in the Act. 4. Power to be given to Her Majesty in Council to extend the Act from time to time, or any part or provision thereof, to any explosive not specifically named or defined in the same. 5. The manufacture of explosives and the operations connected therewith to be carried on only under a "common" or "special" license, to be obtained as hereafter described, except such operations as the filling of small-arm cartridges, the preparing of blasting cartridges, &c., which may be carried on without a license; but under certain precautions to secure safety. 6. No person to keep any explosive, above a certain limit to be defined by the Act, without a "common" or "special license," to be obtained as hereafter described, except a carrier carrying in accordance with the Act, and not keeping the same beyond the time actually necessarily for his business, and except an importer who has explosives in his possession in the vessel which imported the same, and who complies with the provisions of the Act. 7. No person to sell or deal in explosives unless he hold a "common" or "special" license to manufacture, keep, or import such explosives. 8. No *chemical* explosives to be imported without a "special" license, other explosives under "common" license. 9. Licenses, whether "common" or "special," to be personal as well as local. 10. "Common" licenses to be obtained as a matter of course, on application to the licensing authority, unless the person or premises be disqualified. (Such licenses would amount to little more than registration; but they would have this advantage over registration, that the conditions under which the manufacture or storage was to be carried on would be set forth in the license.) 11. In the case of manufacturers, "common" licenses to be granted only for the manufacture of fireworks on a small scale, in accordance with certain conditions as to quantities; in all other cases "special" licenses to be taken out. 12. In the case of storage, "common" licenses to be of two sorts; (a.) 'Common retail' license, to meet the case of the ordinary retailer; (b.) 'Common magazine' license, to meet the case of the mine owner or person requiring to store more considerable quantities for industrial operations. 13. The 'common retail' license to be on a sliding scale, and to authorise the storage by a retail dealer up to, say, 300 lbs. of gunpowder, or 1,500 lbs. if in cartridges, and proportionate amounts of fireworks, the scale being framed according to the conditions of storage. 14. The 'common magazine' license to be on a sliding scale, and to authorise the storage of larger quantities, up to two tons of gunpowder, or one ton of gun-cotton or dynamite, or five times the amount of gunpowder in small-arm cartridges, or 10 tons of fireworks, the scale being framed according to the conditions of storage and the distance from protected places. 15. Special licenses may be obtained for storage of either larger quantities than are allowed by common

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licenses, or for similar quantities, under special conditions. No distances or quantities to be fixed by statute for 'special' licenses, but to be in each case fixed by the license, and with reference to the local circumstances of the case. 16. 'Special' licenses for manufacture, storage, and importation, to be granted by the local authorities upon the report of an inspector in every case, and subject to such conditions as to area and description of licensed premises, quantities, distances, precautions, as the inspector may recommend; and subject also to any bye-laws and rules made under the Act. 17. The licensing authorities to be, for special licenses: In the City of London, the Lord Mayor and Aldermen; in the rest of the Metropolitan Board of Works district, the Metropolitan Board of Works; in quarter sessional boroughs, the Town Council; in any harbour, the Harbour Authority; in counties, Quarter Sessions; (or in Scotland, the Sheriff). For common licenses: The same, except in an urban sanitary district (not included in a harbour), the Urban Sanitary Authority; and instead of quarter sessions, the Petty Sessions. 18. An appeal to lie to the Home Secretary against the refusal of a special license, or the imposition of vexatious restrictions. 19. Common licenses to be granted for a limited term to be fixed by licensing authority, and not exceeding five years, but without prejudice to grant of new license at end of that time. 20. 'Special' licenses to be granted either (1) for a limited term to be fixed by licensing authority, and not exceeding 30 years; or, (2) for such term as a surrounding danger area, to be defined in the license, is kept free from houses, but without prejudice in either case to an application for an extension or renewal of the license. 21. Powers of compulsory purchase of clearance rights for the purpose of maintaining the danger area free from houses, to be given to special licenses, subject to the approval of the Secretary of State. 22. All premises licensed for manufacture or storage by special license to be passed by an inspector before use. 23. The Secretary of State to have power to grant permission to a person having a special license for a factory or magazine, or for importation, to vary the conditions as to matters of technical and internal detail, but not as to extension of area, of licensed premises, alteration of distance of buildings from any protected work, increase in the amount of explosive to be manufactured, or any substantial alteration in the nature of explosives to be manufactured, kept, or imported. 24. The destruction of a magazine by explosion to determine the license, and a magazine existing under a common license, and so destroyed, not to be again licensed except by *special* license. 25. If two or more buildings of a licensed factory are destroyed by explosion, the license not to re-erect more than one of such buildings without the written consent of the Secretary of State, or otherwise than in accordance with such conditions as to mounds, &c., as the Secretary of State may impose. 26. The carriage of explosives to be carried on without a license (except water carriage in harbour, where bye-laws to that effect exist), but under certain statutory general rules, and subject to any bye-laws made under the Act, by competent authority (as hereinafter described). 27. All explosives carried to be duly labelled and declared, and no explosives (except small quantities for sportsmen) to be carried in public

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vehicles, omnibuses, &c., or as cargo in passenger ships (except by permission of Board of Trade). 28. Harbour authorities to have power to make bye-laws, as in present Liverpool Gunpowder Act, to regulate the navigation and place of mooring of ships, safe stowing, and safe keeping of explosives on board, regulating the kind of ship, barge, &c., licensing the same, fixing the place, time, and mode of shipping explosives, the precautions to be taken, and so on. 29. Railway and canal companies to have power to frame bye-laws for regulating the carriage of explosives over their rail or canal, the place, and time, and mode of loading, amount to be carried, and so on. 30. All bye-laws made as above to be confirmed by the Secretary of State (or Board of Trade), and the Secretary of State (or Board of Trade) to have power to enforce the making of bye-laws, or where not made, to make them in any place where it may be deemed necessary. 31. Harbour and conservancy authorities to have power to provide ships and barges for the carriage of explosives, and to provide magazines (to be licensed by special license in usual way) for safe deposit of explosives. Urban sanitary authorities to have the latter power. 32. General rules for the manufacture, storage, packing, and carriage of explosives to be laid down, either by statute or by Order in Council, subject to veto of Parliament, and to be observed by persons manufacturing, storing, and carrying explosives. These rules to be variable only by Order in Council, subject to the like veto. 33. Special rules to be framed by every manufacturer (except small fire-work makers, who should be provided for by extra general rules), and every holder of a special or common magazine license, or of a special importation license, if required by the Secretary of State, for the conduct and guidance of the work-people in his factory or magazine, or place of importation. 34. All special rules made as above to be confirmed by the Secretary of State, who may disallow or add to the same. 35. Fit persons to be appointed inspectors under the Act by the Secretary of State. 36. An inspector to have power to make such examination, entry, and inquiry as may be necessary to ascertain whether the provisions of the Act are complied with, and to take samples for analysis of any explosive or supposed explosive on tender of payment, and to require railway companies to carry such samples. 37. An inspector to have power in the case of his observing anything unnecessarily dangerous and defective to give notice to licensee, and require the same to be remedied, and if the matter is in the opinion of the inspector urgent, to require the same to be remedied forthwith. 38. If a licensee objects to the inspector's requisition he may (except where the matter is required to be remedied forthwith) object in writing within a certain time, and in that case the matter is to be referred to and decided by arbitration (in manner to be provided by the Act). 39. If the matter has been ordered to be remedied forthwith, the licensee, notwithstanding that he objects, must forthwith comply with such requisition; and if he feels aggrieved may apply to the county court for damages against the inspector. 40. Licensing authorities to be empowered to appoint searchers to ascertain if the provisions of the Act are duly observed in any premises licensed under a common license within the jurisdiction of such authority; and in the

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the case of harbours to search ships and barges (as provided in present Gunpowder Act in the case of the Thames). 41. Where a matter is urgent, and fraught apparently with serious public danger, an inspector or a specially authorised constable, or searcher may make the necessary inquiry or inspection, and take such steps in the way of the seizure of the explosives, or otherwise (to be defined by the Act) as may be necessary to remove the risk or source of danger. 42. A constable or searcher to be specially authorised by a warrant of a justice of the peace, or when the case is one of emergency, and the delay in obtaining a warrant would be likely to endanger life, by a written order from an inspector, or from the chief officer of police of the district, or in his absence from any officer of police not lower than a sergeant; a report of any proceedings taken under this provision to be made in all cases. 43. Proceedings against a licensee for offences under the Act not to be instituted except by an inspector, or by a licensing authority, a justice of the peace, a chief officer of the police, or a person authorised by the Secretary of State. 44. Arbitrations under the Act to be as in Mines Act; namely, one arbitrator to be appointed by the appellant, the other by the respondent, and the arbitrators to nominate an umpire. 45. Accidents in any licensed premises, or in any vehicle or vessel carrying an explosive, to be reported to the Secretary of State. 46. Notice of any inquest about to be held on any person killed by an explosion, or fire, or any accident in connection with any explosive to be sent by the coroner to the Secretary of State, so as to allow an inspector to attend. 47. The Secretary of State to have power to institute a formal inquiry (by an inspector with legal assessors, or *vice versa*, as in Railway Act) in any case where he considers it necessary. 48. Heavy punishments to be imposed for a substantial departure from any important condition of the license, or for making, or storing, or importing an explosive without a license (where a license is required), or otherwise than in accordance with the terms of such license, or for wilful neglect or wilful act tending to endanger life or limb, with power if the case is tried on indictment, for the court to forfeit a license (except in the case of magazines and factories lawfully existing at the time of the passing of the Act). 49. An appeal to lie to a court of superior jurisdiction in all cases where any forfeiture or conviction is made by a court of summary jurisdiction. 50. Vested interests to be specially guarded and provided for as follows: (a.) All occupiers of factories and magazines lawfully existing at the time of the passing of the Act (except as hereinafter named) to be entitled to obtain from the Secretary of State, and without reference to the local authorities, a continuing certificate of unlimited duration (except to such an extent as the duration may be actually limited by any existing license affecting the factory or magazine). (b.) Any difference as to the right to this certificate to be determined by a court of law. (c.) Occupiers of (unlicensed) mine magazines and of magazines established in pursuance of a 'general license' under the Nitro-glycerine Act, to be required to take out a 'common license.' (d.) Licensed places, the license for which expires within 12 months of the passing of the Act, to be allowed to run out.

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(e.) The Secretary of State to be empowered to impose conditions in the 'continuing certificate,' and to fix quantities (as the licensing authorities may do in the case of new licenses), except that he may not impose any conditions which would have the effect of requiring the removal of any legally existing work or building, or to diminish the quantities below what the licensee is at present entitled to have, except that in the case of store magazines for unlimited quantities, he may assign as a limit the quantity which the magazine would contain on a given date. (f.) Any difference as to the conditions to be settled by arbitration. 51. The Act not to apply to factories and magazines and explosions belonging to the Crown, or to Volunteer-storehouses. 52. The Act not to interfere with the law of nuisance." Those are the suggestions I have to make.

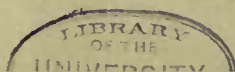
200. I will now trouble you with questions under each of these heads, and will commence with No. 1: what Acts of Parliament would you propose to repeal?—The Acts of Parliament which I should propose to repeal are, the 23 & 24 Vict. c. 139, which is the Gunpowder Act proper; the 24 & 25 Vict. c. 130, which is an Amending Act; the 25 & 26 Vict. c. 98, which is another Amending Act; the 32 & 33 Vict. c. 113, which is the Nitro-glycerine Act; the 29 & 30 Vict. c. 69, which is the Dangerous Goods Act; the 14 & 15 Vict. c. 67, which is the Liverpool Floating Magazine Act, and the 28 & 29 Vict. c. 278, which is the Liverpool Gunpowder Act.

201. Would you propose to repeal the local Acts without reference to whether they are good or bad?—No, I would draw this distinction, that existing local Acts, where they could be shown to be good, and where the local authorities applied to have them continued, should be allowed with the approval of Parliament to continue; but it is necessary to observe that the majority, and probably the whole, of those Acts of Parliament are open to this very serious objection, that they do not comprehend or include the new explosives at all, such as dynamite, gun cotton, &c. The Liverpool Act, which is the most comprehensive one, says nothing with regard to those substances.

202. Now to go to Section No. 3; what explosives would you propose to specify in any Act of Parliament?—In any Act of Parliament passed on the subject I would propose to divide the explosives into six classes: first, the gunpowder class; secondly, the class to which I would give the name of nitro-explosives; thirdly, the chlorate explosives; fourthly, the fulminate class; fifthly, the ammunition class; and sixthly, the fireworks class. The first of these classes, namely, the gunpowder class, would consist of all gunpowder proper, that is to say, mechanical mixtures of nitrate with any form of carbon or substance possessed of carbonaceous properties, whether with or without sulphur; gunpowder of course would come under that class; also pyrolithe and pudrolithe, and poudre saxifragine, and there may be others of the same character. The nitro-explosive class would consist of all those chemical explosives which are produced by the chemical action of nitric acid, or a nitrate mixed with sulphuric acid upon any carbonaceous substances. There would be two divisions in the nitro-explosive class; the first would be practically a nitro-glycerine class, that would include nitro-

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glycerine itself and its preparations, such as dynamite, lithofracteur, Horsley's blasting powder, dualine, glyoxiline, and no doubt from time to time others; in fact, that division would include all explosives which have a liquid, or semi-liquid, or possibly liquid, character. The second division of that class would be what I would call the dry nitro-explosives, or gun-cotton class, which would include gun-cotton, gun-paper xyloidine, gun-sawdust, cotton-gunpowder, Schultz powder, and so on. Then the chlorate class would consist of any explosive preparation which contained chlorate mixed with any form of carbon, or any carbonaceous substance, such for example as Horsley's original blasting powder; that would come under that class; or chlorated gun-cotton would come within that class. Then when a substance of either of those classes became of so highly sensitive a character as to be adapted for use in percussion caps or detonators, and therefore requiring special regulation, I would place it in a class by itself, namely, the fulminate class, No. 4. Then ammunition, which is the 5th class, would be a very comprehensive one, and that class again would be divided into two: the first part would consist of all those articles which are not liable, or which are only very remotely liable to communicate explosion from one to the other; for instance, the breach-loading cartridges are not liable to explode *en masse*; you may explode one or more in a barrel, or even a quantity of powder, but you will not fire off the cartridges, and therefore they should be placed on a different footing from, for example, the chassepôt cartridge, or the skin cartridge, where the explosion of one would communicate with the others, and where in fact they would constitute merely so much gunpowder, *plus* the means of firing it, so that the ordinary sporting cartridges would be in this first or safety class; then the safety blasting fuzes, usually known as Bickford's fuze, for mining purposes, that is not liable to cause an explosion from one part to another; railway fog signals and safety fuzes for shells; then in the second division, which would contain those varieties of ammunition which are liable to explode *en masse*, there would be the non-safety cartridge, the detonators, non-safety fuzes for blasting, war-rockets, tubes for firing guns, and things of that kind which have, in a greater or less degree, the dangerous quality of communicating explosives; percussion caps I would not include at all as caps, except when they grow into detonators; I mean the ordinary percussion caps, a number of which will not explode *en masse*; but when percussion caps become big, and take a large charge like detonators, there is danger; otherwise ordinary caps should be regulated, I think, merely with regard to their manufacture. Fireworks would be simply articles intended to produce pyrotechnic effects and firework composition. The great principle which I would observe with regard to the classification of those explosives is that of recognising the distinction of risk in the different classes; they are therefore ranged in those classes, and the treatment which they should receive in any law should be based on a recognition of the fact, that one explosive requires to be treated in one way, and another in another way, to ensure safety.

203. I observe that you do not include petroleum?—I do not consider that petroleum could

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properly be included in an Act of Parliament relating to explosive substances; practically it is not an explosive substance at all; petroleum *per se* is not explosive, but when the vapour, which it gives off at different temperatures, according to the degree of volatility of the particular petroleum, becomes mixed with a certain portion of atmospheric air, then an explosive mixture is formed; in short, petroleum is very much on the same footing in this respect as coal-gas, which by itself is not explosive, but which becomes so when combined with atmospheric air; it is merely an ingredient of an explosive mixture; so petroleum is really not an explosive substance at all, and should no more find a place in legislation relating to explosive substances than coal-gas. I would also urge, that if the fact that explosions have been occasioned by the presence of petroleum is a reason for including it, the same argument should prevail to secure the introduction of steam, or even compressed air into the Bill; indeed, we might push it further and include flour mills, on the ground that explosions have occurred in them. In the year 1872, one of the most destructive explosions that I ever saw, occurred in a flour-mill, killing 18 or 19 people. Further than that, petroleum is already provided for by Special Act of Parliament; whether that Act is altogether satisfactory or sufficient is another question; but it is very much in advance of the Gunpowder Act; but even if it were considered that the existing law with regard to petroleum required amendment, such an amendment should, I think, be effected quite independently of the Act relating to explosive substances, because the provisions of the Gunpowder Act would be to a large degree absolutely unsuitable to petroleum.

204. Is the object of provision No. 4 to bring new explosives within the scope of the Act?—The object of provision No. 4 would be to prevent a recurrence of what has happened under the present Act with regard to gun-cotton, &c., which, as I have stated, is not effectually regulated, and to which the Act of Parliament cannot be applied. I am also anxious that any new risks should be able to be recognised and dealt with as they are discovered, and also as to risks which may be now supposed to exist, but which may hereafter be proved to have no such existence, that there should be power to modify the rules in order to relieve the trade of unnecessary restrictions with reference to those risks.

205. Turning to the 5th head of your suggestions, do I understand that the terms "common" and "special" license are convertible, or that the two licenses are different?—The two licenses are totally different; the common license is a license of which the details would be fixed by statute, and will be obtainable, as a matter of course, by all who can comply with them. The special license is a license of which the details would in each case be specially considered and settled by the licensing authorities.

206. Why do you exempt the filling of small arm cartridges and blasting cartridges. Are not these operations attended with some danger?—Certainly; I would not propose to exempt them from the operation of the Act; on the contrary, I think special statutory provisions to secure safety ought to be included, but I would exempt them from the necessity of a license.

207. Why would you do that?—Because I think it would be unwise to burden the Act of Parliament



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Parliament with any restriction where it is not really necessary or useful; in those cases the license would be neither necessary nor useful. The aggregate risk is not sensibly increased provided certain provisions are observed. The risk consists rather in the possession of a given amount of explosives than in its introduction into cases. I do not fix the license on the doing of the work, but I fix it on having the material stored.

208. Are there any exemptions which you give of this sort?—Yes, the small firework makers, making explosives not included in the fireworks class, but specially for use in or as a firework. It might be necessary for a firework maker to manufacture gun cotton; it would be very improper that under a license to manufacture fireworks he should be manufacturing largely gun cotton or some explosive substance; but if he could show that he was making it specially for his firework business he should be exempted, I think. Again, it would be unreasonable and inconvenient to tie down a manufacturer who was licensed to one kind of explosive, not to carry on experiments with varieties of it. Therefore I would propose that he should be exempt from the necessity of taking out a special license for such experimental varieties; and then in the same way, magazine owners who store for trial, I think also, should be exempt from the necessity of license for those particular experimental explosives.

209. Now going to Section 6; what limits would you impose?—The limit of powder to be kept without a license, I think might be fixed somewhere as follows: Of gunpowder, 30 lbs. if packed in canisters, which is the usual way; the limit is at present 50 lbs. I think it should be 20 lbs. if it was loose. I should be glad as a matter of prudence to reduce it below that, but I think we cannot go farther; nitro-explosives and chlorate explosives, which are much more powerful, 10 lbs. With regard to the fulminates, I do not think anybody should keep any one of them without a license; no one can want it, and if exceptionally they do want it, there is no great hardship in taking out a license. In ammunition, recognising the distinction between the safety class and the non-safety class, I would propose to allow a person to keep fivetimes as much powder in safety cartridges as he would be allowed to keep out of cartridges; for example, he would be allowed to keep 150 lbs. in safety cartridges, which would be, of course, a large increase on what could be kept now, considered as powder. That is reversing the principle of the present Act of Parliament, which prohibits putting more than 5 lbs. of powder into cartridges. Then in the case of non-safety cartridges I treat them as so much gunpowder simply; fireworks 10 lbs., except when they are got and intended for immediate use; there must be some elasticity there; if it could be shown that a man had got some fireworks for display on his own premises, no limit should be imposed. Then there is this to be observed, that the effect of this arrangement would be, that a person might keep in any one place without a license those quantities; and with regard to this 150 lbs. of powder in cartridge, that represent 15,000 cartridges, which is a very large and quite sufficient number. If a man has two or more places of occupancy not adjoining, or only separated by a road or a public place, or a road over which he has a right of way, the same

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amount might be kept in each of the two or more cases.

210. Why would you exempt carriers?—It is necessary, to enable them to carry on their business. A case occurred under the present Gunpowder Act, which was tried in the Court of Queen's Bench some time ago, and it was then ruled that the word "keeping" in the present Act, cannot be held to apply to persons keeping it merely for such time as was necessary for the purpose of carrying it and depositing it in a warehouse. Although I think those persons should be under some restriction, I would not require them to take out a license for a definite quantity.

211. Why do you exempt importers?—In the case of importers, the importer would be already licensed to import, and an extra license to have a quantity in his possession would be unnecessary if he complied with the conditions of the importation license, or with the conditions of the Act of Parliament as far as they related to him.

212. Now, going to Section 7; I find you make the condition to sell in every case contingent on the holding of a license to keep, and you do not require a special selling license?—Yes, exactly. In the present Act, as I explained the other day, fireworks cannot be sold without a license; other explosives may be sold without a license. I propose to sweep away all licenses to sell, and to fix the license on the risk which is really in the keeping of those things. The risk is not in the act of selling, but in the Act of making, keeping, or importing. At the same time, the act of selling may fairly warrant the assumption that a person is keeping or making, or importing, a more or less considerable quantity, therefore I think the onus should be on the seller to show that he is duly licensed to keep, import, or make.

213. Coming to Section 8; what are the Committee to understand by chemical explosives?—By chemical explosives I mean such explosives as dynamite, gun cotton, gun sawdust, in fact Classes 2 and 3, and some of those which I have named of Classes 3 and 4: explosives distinguished from simple mechanical mixtures like gunpowder.

214. Why do you make that distinction?—Because there is here a totally different class of risk to be considered. In some cases a very slight variation in or departure from the ingredients in, or the proportions, or the introduction of new substances, may make all the difference between safety and non-safety, but with regard to gunpowder, no alteration in the proportions can affect its safety; if nitrate of soda is used instead of nitrate of potash, in No. 2 dynamite, the ultimate result in damp would be that you would be left with liquid nitro-glycerine, which would be very dangerous; but if nitrate of soda was substituted for nitrate of potash in gunpowder, the only difference would be that the explosive property of the gunpowder would be destroyed by a damp atmosphere.

215. Now going to No. 9, I will ask you this: are licenses under the present Act personal?—No, they are not, except the selling licenses for fireworks.

216. Why do you propose to make them so?—Because I think that in granting a license the personal character and habits of the proposed licensee are matters which may fitly influence the

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the licensing authorities; I am speaking here of special licenses. In the case of common licenses, it is desirable, I think, to have a complete registry of all persons who carry on this trade, and as a license could not be refused except a person were disqualified on conviction, this really could not be objected to.

217. I suppose you would give facilities for transfer, would you not?—In special licenses I would give facilities for transfer, and that should be provided for; in those cases the licensing authority should be required to sanction the transfer; in the case of a common license I would give no power to transfer; but the licensee could surrender his license, and the proposed licensee could get another at a nominal cost, merely by asking for it.

218. Now passing to No. 10, I understand that any person, not personally disqualified or whose premises are not disqualified, may obtain a "common" license merely by applying for it?—Yes, simply on application; it is, as I have explained in the note to No. 10, really little more than a registration; a person, I should say, should be disqualified only on conviction, and the premises I consider would only be disqualified provided they were already carrying another license.

219. Would the license be gratuitous or paid for?—I think there might be a small fee just to pay the expense; but I would recommend that the fee should be something very small, in fact, a registration fee, practically. It has been suggested to me that it would be desirable that the fee should be 5 s. or 10 s., on the ground that it is undesirable that everyone should be able to take out a license, but I think on the whole it would be better to keep the fee as small as possible, because I think that it would tend to prevent people from attempting to evade the law in this respect.

220. You state that this would amount to little more than registration; why do you prefer a license?—Because it would enable all the statutory conditions, whatever they might be, which affected the keeping on this small scale to be set forth in the license; but I may say at once that I am really not at all wedded to its being a license. If registration should be thought preferable, I think registration could be made to answer all purposes. As a matter of fact, the Liverpool people do proceed on the principle of registration; but that there should be either registration, or some sort of license, I feel very strongly.

221. Do you think such a system would be a substantial improvement on the present system?—Yes; but only if it were coupled with supervision; of course the granting of the license by itself would practically be of no value; it is only valuable as a means to an end; that end being that you should have a knowledge of all the dealers in explosives.

222. I think I understood you to say on the last occasion that a very large number of recommendations had been made to you on this head?—A very large number; I handed in on the last occasion Returns giving an abstract from the reports of the chief constables and the various clerks, and a reference to that Return will show that there is very considerable unanimity on the part of those gentlemen in recommending such licensing or registration for dealers. (See *Appendix*.)

223. Now, passing on to No. 11, why do you

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draw a distinction in the case of fireworks licenses?—I have done that, because I think it will avoid multiplying applications, and the detailed consideration of those applications. There is really such a very wide distinction between a man who proposes to make fireworks on a small scale, and a man who is going to manufacture an abundance of them, or to make other explosives on a large scale, that I do not think the machinery which is necessary in one case is necessary in the other.

224. How would you provide for small firework makers?—I would provide for small firework makers by means of statutory provisions, variable only by an Order in Council, and these provisions would assign the distances from the dwelling-houses, the distances of the sheds apart, and so on, assigning considerably less distances than at present, because they would be adapted specifically to a small scale of manufacturers.

225. Do you think this arrangement would tend to diminish the present illegal trade in firework making?—I believe it would, because the present distances and restrictions are, as far as the small makers are concerned, excessive and prohibitory, and impose on the small maker an extravagant and unnecessary outlay, to say nothing of the expense of getting a license, with the chance of its being refused on application; I think it would immensely facilitate the making of fireworks, and would do much to remove the temptation to manufacture illegally.

226. Up to what sort of an extent would you allow persons to manufacture fireworks under a common license?—Up to the extent which would be indicated by the storage; that is to say, I would let him manufacture within these limits, 100 lbs. of any explosive proper, or 500 lbs. of fireworks, and for those quantities I think the distances from the houses might be reduced from the 50 yards at present in use to 30 yards, and the sheds, if screened from one another, might be 10 yards apart instead of 20 yards.

227. Now, to come to No. 12, a common retail license would be, in fact, a shop license?—Yes; that would be for a small dealer.

228. A common magazine license would only be taken out by mine owners?—By mine owners chiefly, but also by that class of consumers which I have referred to this morning, namely, any person engaged in industrial operations, such as making docks, railways, roads, &c.; in fact, it would be a consumer's license.

229. Now, to come to the 13th head, why do you propose a sliding scale in the case of retail licenses?—In order to avoid the evil of a hard and fast line, and in order to adapt the quantity permitted to be stored, to meet different cases. Take the case of a man who could only store in his house, and the case of a man who had a garden or back yard. I propose that the quantities to be stored should vary according to the man's circumstances in that respect; and the effect would be rather to encourage persons proposing to deal in explosives to acquire premises with some regard to their suitability for the business. At present there is no advantage to a dealer in getting a place with a back yard or field, because he can store just as much in the house as in a field.

230. What sort of scale do you contemplate?—For the common retail license, I would propose to begin thus: of gunpowder inside a dwelling-house,

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house, if he did not choose to provide a proper fireproof safe he should be only allowed to keep 50 lbs., but if he proposed to provide a safe, I would allow him to keep up to 100 lbs. If he kept a store outside the house, I would let him go to 200 lbs., even in his back yard. If the powder were loose, I think those quantities should be rather reduced. It is very desirable to encourage the storing powder in closed and proper packages. As to the nitro-glycerine explosives, I would propose, of a class intended and adapted for use in fire-arms for sporting purposes, that a man might keep 30 lbs. inside a house, or 50 lbs. outside. Chlorate explosives the same; and I would not advocate a fireproof safe in the case of those explosives, for the best thing, if there was a fire, would be that it should at once communicate with the gun-cotton and blaze away rapidly. Of fulminate, again, I would allow none under the common retail license. Ammunition of the safety class, I would allow a quantity containing five times the amount of the explosive which the man might keep, or five times the amount of any part which he did not actually keep; for example, say he kept of his allowed 50 lbs., 10 lbs. in the form of powder and 40 lbs. in the form of cartridge; he might multiply that 40 by 5. As to the non-safety class, the same as before, that is to say, the same as if it was powder.

231. Would a retailer be placed in a less or a more advantageous position under this arrangement?—In order to answer that question, I must explain to the Committee that there are, practically, two classes of retailers; there are the gun-makers, and there are the oilmen, ironmongers, and other persons who deal in powder. As regards gun-makers, I consider that they would be, on the whole, decidedly benefited; even if we take the worst case of a man having only his dwelling-house, as is usually the case in London, he might keep under the new arrangement 100 lbs. of powder loose, or 500 lbs. in cartridges, which is equal to 50,000 cartridges; or he might keep a portion, say 50 lbs. of powder, or 50 multiplied by 5, which is equal to 250 lbs., in cartridges. Then if he had a garden, or even a back yard, he might keep of loose powder, say 100 lbs. in his house, and 200 lbs. in his garden, that is to say, 300 lbs. in all, whereas at present he is limited to 200 lbs., or he might keep 1,500 lbs. in cartridges, which is equal to 150,000 cartridges. Now, with regard to a dealer in powder proper, he would be unquestionably in some cases, but not in all, injured. Thus, where a man can now keep 200 lbs. of powder, he would only be able to keep 100 lbs., and then only provided his powder was stowed away in a proper manner; but, on the other hand, if he had even a back yard he might keep up to 300 lbs., which would be more than at present. The effect would be to put a certain pressure upon the retailer of powder proper, first, to provide premises suitable for his business, which is a point of great importance, or else to allow the business to fall into the hands of men who have such premises; and, secondly, it would put a pressure on him to provide proper receptacles for his powder; I think that would be a legitimate object to aim at.

232. You speak of "fireproof safes;" what sort of contrivance do you mean, and have you good reason to suppose such a contrivance would be effectual?—Yes, I carried out some very considerable experiments with fireproof safes in the

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year 1872, and, without going into the details of the experiments, I may state that on that occasion we placed gunpowder in four safes, three of which had been specially designed to resist the action of fire for six hours; two of them resisted it for 16 and 18 hours respectively; another was opened unexploded after six hours; then as to another safe which had been made to resist the action of fire for 10 hours, after 22 hours we got tired of waiting, and opened the safe, and found the temperature inside had not risen above about 212° to 220°, though the safe had been exposed for 22 hours to a fire of extraordinary intensity.

233. Now, proceeding to head 14, I suppose you propose a sliding scale for common magazine licenses on similar grounds to those which you have stated as applicable to other cases?—Yes, because I think the quantity stored should be proportioned to the circumstances of the storage; at present, for want of some flexible provision, a large proportion of the mine magazines in the kingdom are actually illegal; many of them indeed could not be made legal, but it would be quite safe to legalize them. I propose to carry out these objects by a sliding scale.

234. What sort of sliding scale do you contemplate in this case?—I would propose something as follows: I would lay down certain classes of protected works; there would be three classes of protected works, and I would say that a person might keep up to two tons of gunpowder, provided his magazine was distant 100 yards from works of Class 1, 200 yards from works of Class 2, and two miles from works of Class 3; and then I would have 2,000 lbs. of powder, that is to say, one ton, if the distances were respectively 80 yards, and 150 yards, and one mile; 1,000 lbs. for distances of 50 yards, and 100 yards, and half a mile; then I go down to 300 lbs. for distances of 30 and 50 yards, and a quarter of a mile. In nitro-glycerine explosives, which are much stronger, and therefore the effect of which might be supposed to be greater, I would halve those quantities for those distances. As to ammunition, I would deal with it as I have dealt with it in the case of retail licenses, namely, five times the quantity which might be kept in the form of powder; in the case of fireworks, when you come to those large quantities, you might almost allow any quantity to be kept; taking the biggest distance, you might go up to 10 tons of fireworks.

235. What do you mean by protected places?—Those protected places or protected works I would divide into three classes. In Class 1, I would place all dwelling-houses, shops, and workshops belonging to the licensee or the occupier of which gave his written consent to the same being considered in that class, or any mineral railway, magazine, or store for explosives similarly occupied by the licensee or by a consenting party; then any highway, market, or open place of public resort, canal, navigable river, dock, river wall, sea wall, pier, jetty or reservoir; this would be Class 1, which would require the least amount of protection. Then with regard to Class 2, that would be any dwelling-house, shop, workshop, &c., not included in Class 1; and any factory, church, chapel, college, public school, town hall, theatre, or place of public resort, where an accident might be attended with circumstances of panic. Then Class 3, any of the Queen's palaces, Houses of Parliament,

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ment, Courts of justice, any Government factory, or Government magazine, any Government office, or large public buildings, or public works.

236. Would the mine owner be worse or better off than at present?—In very many cases he would be considerably better off; at present, he is often absolutely illegal. He will be allowed under any circumstances, under this scale, to keep two tons at the 200 yards distance from houses, and less quantities at less distances, which at present he cannot do; and if any of the new protected works interfere with any existing magazine, I would give power to the Secretary of State to grant a continuing certificate in any case where it could be shown that it was safe.

237. Now to come to the 15th Clause, you fix no scale whatever for special licenses, do you?—None whatever either as to distances nor quantities; the scheme of special licenses, as the name implies, is essentially that they should in each case be considered specially on their merits, and with reference to local surroundings. So that in this way we get rid entirely of any hard and fast line with regard to special licenses. If we fixed a line by statute, it appears to me that it would be really necessary to give the Secretary of State a dispensing power with regard to those licenses, or give it to somebody else; and it appeared to be better not to attempt to fix the distances and quantities where they might have to be altered to-morrow.

238. What sort of local circumstances would determine a special license?—Specially the configuration of the ground, or the manner in which the magazine is disposed, that is to say if the magazine was sunk in the ground, or surrounded by substantial traverses or built into the side of a hill, then the distances might be diminished or the quantities increased.

239. Would you allow licenses to be granted for unlimited quantities?—No, in no case should the license be granted for unlimited quantities. I would not propose to fix a limit in the Act, but I would require the licensing authorities in every case to assign the limit.

240. Now to come to point 16; what is the exact course of procedure which you would recommend in the case of the grant of a special license?—I think it should be somewhat as follows: a certain time before the hearing of the application, say six weeks perhaps, a notice should be sent by the applicant to the clerk to the licensing authorities, setting forth such particulars as may be necessary, such as the name and address of the applicant, his occupation, the nature of the explosive which he wishes to manufacture or store, what kind of license he requires, the maximum quantity proposed to be kept, the situation and character of the premises proposed to be licensed, and (unless considered unnecessary in any particular case) I think it should be accompanied by plans of the proposed premises, and at the same time a duplicate of such application and plan should be sent to the Secretary of State, and notice of the intended application should be affixed on the premises proposed to be licensed and advertised in papers circulating in the district, which would be a much more convenient mode than fixing it on every church door, which is the present plan; then the Secretary of State would require the inspector to consider and report on the application, and this report would go to the licensing

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authority. In this report, I think the inspector should state whether, in his opinion, the license should be granted or refused, and if granted, upon what conditions, if any, with regard to distances of buildings, quantities, mounds, and screen as to the precautions to be taken, and so on.

241. Would it be open to the licensing authority to reject the inspector's report?—Certainly, to this extent: if the inspector recommended that it should be granted it should be perfectly open to the licensing authority to refuse it; also it should be open to such authority to make such additions in the way of conditions as might be thought necessary; but I do not think that where an application is reported against, the licensing authority should grant the license or strike out conditions which were considered necessary.

242. Now, coming to Section 17, I see you revert to the quarter sessions as the licensing authority in counties; why do you do this?—The quarter session was the authority up to the year 1861, and I think, for considering a matter of this kind, it is a more suitable tribunal, both on account of its greater importance and the larger number of magistrates usually present, and also, I think I may add, because it is comparatively free from all pressure of local interests and prejudices.

243. Will you now be good enough to turn to Section 18, you say that an appeal would lie to the Home Secretary against the refusal of a license, or the imposition of vexatious conditions; but might not that appeal in some cases be against the decision of the Secretary of State's Inspector, by whom, in such cases, if the appeal were on a technical point, would it be decided?—There is no doubt a difficulty on this point, but the difficulty might, I conceive, be met by making it obligatory on the Secretary of State in such a case, if required by the appellant, to refer the matter to an independent arbitration; or a larger discretion might be left to him by simply enacting that he should refer the appeal in such cases to some person other than the inspector whose report is appealed against. But I think it is a question for consideration whether it would be desirable, or whether it is really necessary to introduce any such restriction; whether in fact the matter may not be safely and properly left in the hands of the Minister to be dealt with in such manner as he might consider just and equitable. With regard to appointing an arbitrator in those cases there is this difficulty, that it would practically in some cases amount to over-ruling the decision of the quarter sessions by two arbitrators, which might perhaps be considered objectionable; but if the difficulty is considered one which it is necessary to deal with, I think it might be so dealt with.

244. Would you grant an appeal to the opponents of a license against the grant?—That is also a point of some difficulty; I was at first strongly disposed to recommend that the opponents should have an appeal; but on consideration I came to the conclusion that on the whole it is perhaps unnecessary. A license would only be granted in the event of both the quarter sessions and the inspector concurring with regard to the propriety of granting it, and I think they might be trusted to represent the interests of the public as distinguished from the interest of the appellant. Moreover, as it is very undesirable to multiply appeals,

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appeals, I think that any appeal by opponents might be omitted.

245. Now, will you be good enough to come to the 19th point; why do you propose to limit common licenses to five years?—First of all, because such licenses would involve no great expenditure of capital, they being for comparatively small magazines, or for comparatively small firework factories; secondly, in this way I think we should get rid of the necessity for providing against encroachments, which is a difficult question in cases of common licenses. And in the third place, as a common licensee, can always, if his place continue to be suitable, renew his license, or get a new one by the payment of a small fee at the end of five years, it really would be no hardship to the licensee to be compelled to take out a new license.

246. Now, to come to the 20th section; in the case of special licenses, do you think it desirable that some limit of time should be assigned in every case?—I think so, because the site may in time become quite unsuitable. Some time ago there was a case of a firework maker in Bethnal Green; I believe he dated from the year 1700 and something; at that time Bethnal Green was I believe really a green, but it is now very unsuitable for the manufacture of fireworks, being a densely populated neighbourhood. Then there was the case at Stowmarket, which I referred to in my last day's evidence. The factory there has no doubt become a less suitable place for carrying on the manufacture of explosives than when it was built, owing to the approach of the houses; and there are some magazines on the Thames which the Committee may see, from the return which I handed in the other day, have been approached by houses in all directions.

247. Why do you fix a limit of 30 years?—I do not specially wed myself to that term, but I think it is desirable to indicate a sufficiently long limit, because in those cases of special licenses the expenditure of capital might often be considerable, and I think the licensee should have time to get it back; moreover, if a very short time is indicated or fixed, there is a natural tendency to shrink from the expense of putting up really good and satisfactory works, and adopting all those refinements of precaution which are something highly necessary for safety.

248. But you also suggest an alternative limit, do you not?—Yes, a limit fixed with reference to the freedom from houses or other works in a surrounding area, which I have called here the danger area; so long as that area continues to be free from houses and works, and so long as the works are suitable for carrying on the manufacture, there would be no objection to the license being renewed on those conditions and with that limitation.

249. Now to go on to point 21, I see you propose to confer powers of compulsory purchase in certain cases?—Powers of compulsory purchase did exist in the Act of Geo. 3, and existed up to the year 1860; the Act of Geo. 3 is the Act of 1772; powers of compulsory purchase were given there which were quite different to those which I propose; there was a power given in that case to the magistrates to compulsorily acquire lands for the purpose of building powder works on them; what I propose is merely a power of compulsorily acquiring, with the approval of the Home Secretary, clearance rights

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to maintain an existing danger area free from buildings, not to create a clear area; but, if a man is fixed on the spot, that he should have the power to acquire the right to prevent any one from running up little houses, perhaps, and so ousting his factory altogether.

250. Now with regard to Section 22, I suppose that the object of provision No. 22 is simply to ensure the compliance of the licensee with the terms of his license, and with the requisite conditions of safety before manufacture is commenced?—Yes, that is all.

251. Be kind enough now to come to Section 23. You say that the Secretary of State should have power to vary the conditions of special licenses in matters of "technical and internal detail;" do you mean without reference to the licensing authorities?—Yes, without reference to the licensing authorities. I think, in all such matters, that the discretion had better be vested in the Secretary of State; for example, in such matters as the erection of new mills. I mean within the licensed area, the enlargement of certain buildings, and the re-distribution of buildings and such like matters which are essentially technical. Then there is the matter of varying the material, and there also, I think, the Secretary of State should have some discretionary power; in fact, the distinction I draw is this, that while the licensing authorities are the proper persons to determine the suitability of a given area for carrying on the manufacture, the Secretary of State is the proper person to deal with all matters of detail within the factory or magazine, so long as the aggregate external risk is not increased. I imagine that in such cases the licensing authorities would be guided almost entirely in the first instance by the opinion of the inspector; and there is therefore no necessity for going to them again on such points, and it would be most inconvenient and unduly restrictive upon the manufacturer to require him to do so, as he would have to make a fresh application for every little alteration in the factory. At the same time I think no alterations should be permitted without the cognizance of some one.

252. Will you now turn to Section 24. Why do you propose to make the explosion of a magazine determine the license?—Because, *prima facie*, there must have been gross carelessness to bring about the explosion of the magazine, and then it seems right that the licensee should be required to establish, to the satisfaction of the licensing authority, that he has not been guilty of disqualifying carelessness before being allowed to resume business.

253. But why do you forbid a magazine existing in virtue of a common license, and which is blown up, from being re-erected, except under a special license?—Because as a common license can be had for the asking, there would be no investigation as to the fitness of the licensee for a renewal of the license, and I think it desirable that the question whether he has been guilty of carelessness should be reviewed; the only way to meet this, would be to make him take out a special license and then all the circumstances would come under the cognizance of the licensing authority.

254. Now to come to point 25, will you state what is the object of that provision?—That is really the outcome of a discussion which I have had with some members of the trade on the subject. My first idea was, that when a building

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was blown up, it should not be allowed to be re-erected without approval; that was strongly objected to, and then I proposed that if two buildings were blown up simultaneously by one explosion they should not be re-erected. Ultimately I do not think we came to any real agreement, but I could not concede further than this, that I would suggest that where two buildings were blown up, no more than one of them should be without approval, re-erected; this was to enable the manufacturer to resume work with the minimum of inconvenience.

255. But why not, then, in this case determine the license, as you propose to do in the case of a magazine?—For this reason: in the case of a magazine, I consider that an explosion, as I have said, can hardly arise except from gross carelessness; but in the case of a working building, such accidents do not establish a *prima facie* case of carelessness, therefore I do not think it necessary to throw on the licensee the onus of disproof of carelessness. But, on the other hand, if one building is blown up by another, it does establish a *prima facie* case of undue proximity, and I think the onus should rest on the licensee to prove that the proximity is not so great as to make the place unsuitable.

256. Now to come to Section 26. I gather from your report, at page 30, that you were disposed to recommend that all vehicles for the conveyance of explosives above certain limited quantities should be licensed; but in this summary you say that no license should be required for land carriage; why is this?—Because I do not wish to have more licenses than are necessary, or to impose any unnecessary restrictions; and on thinking it over, I came to the conclusion that, notwithstanding that the licensing of vehicles has been recommended by several authorities, we could do really all that was necessary in the case of land carriage by statutory provisions, or bye-laws in the case of railways or canals. At present nobody may carry dynamite without a license at all, and I propose to relieve them of that restriction.

257. But you draw a distinction in the case of water carriage?—Yes; because in that case the quantities carried are very much larger; up to 500 barrels may be carried in one barge, or you may have a ship containing 100 tons, or more than that. The harbour authorities have in some cases pressed this very strongly. I would refer the Committee to the Report of the Thames Conservancy in the Parliamentary Paper on the Gunpowder Act of 1865, with regard to this subject. Under the Liverpool Act, the power of licensing barges and vessels is given, and is exercised, and I have no doubt that the harbour authorities generally would desire that power.

258. Will you be kind enough to proceed to point 27. You say small quantities might be carried by sportsmen in public conveyances; what sort of quantities do you mean?—With regard to sporting cartridges, provided they were all of the safety class, and they are nearly all so in breech-loading guns, I would put no limit on the carrying of them, because there is really no danger from them *en masse*. But with regard to explosive substances proper, such as gunpowder, I think a limit of about 5 lbs. might be imposed, and then that it should only be carried on condition of express notice thereof to the person in

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charge. That would apply to railways, omnibuses, ferries, &c.

259. Now, coming to Section 28, you recommend that the harbour authorities should have power to make bye-laws, "as in the present Liverpool Gunpowder Act." What powers have they under that Act?—Powers are given in Section 4 of the Liverpool Gunpowder Act (28 & 29 Vict. c. 278), to the following effect: the Corporation and the Mersey Dock and Harbour Board, with the approval of the Secretary of State, can within their respective jurisdictions make bye-laws for regulating the vessels laden with gunpowder, navigating or mooring in the River Mersey, the construction and licensing of vessels used for the conveyance of gunpowder to or from the floating magazines, the loading and unloading of gunpowder, the storing, keeping, loading, and conveyance of gunpowder within the borough of Liverpool, and the circumstances under which the police of the borough, may without a warrant enter any vessel or place in which gunpowder is reasonably supposed to be stored or deposited.

260. Will you proceed to Section 29, if you please; you propose to give railways and canal companies power to frame bye-laws for regulating the carriage of explosives?—Yes, and I think they should have full power in that respect.

261. Now Section 30. You propose that such bye-laws should in every instance be confirmed by the Secretary of State or Board of Trade?—Yes, that is in order that the sufficiency of those bye-laws may be secured.

262. You say you think the residue should be either by the Secretary of State or Board of Trade. Which department do you recommend?—I think the Board of Trade would be the proper department with regard to railways and canals. No doubt that would entail some inconvenience, because it would involve some division of authority, but practically the difficulty would not be very great. For what would happen, no doubt, would be that the Board of Trade would consult the inspectors, and would consult the Secretary of State for the Home Department. On the other hand, if it were placed in the hands of the Secretary of State, his department would have to go to the Board of Trade for a good deal of information, and the result would be, as far as the railways were concerned, that they would be brought under two departments instead of one.

263. I observe that you give the Secretary of State power to enforce the making of bye-laws when not made voluntarily?—Yes, that power is one which is given under the Petroleum Act. I merely follow the Act in that respect; the Petroleum Act is 34 & 35 Vict. c. 105. In Section 4, the Home Secretary is empowered to enforce the making of bye-laws; it is also a similar power to that which is given in the Coal Mines Act, 35 & 36 Vict. c. 76, ss. 54 and 55, which gives the Secretary of State power to enforce rules where they are not voluntarily made.

264. Now to proceed to Section 31: why do you propose to give local authorities the power to provide magazines?—Because I think it is very desirable to encourage their establishment in towns, or the neighbourhood of towns, where there are large quantities of powder. This is in practice to a large extent in Scotland. I have there seen the excellent working of the system. Some of the magazines are models of good management;

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agement; those, for example, of Glasgow (which is, probably, the best private magazine in the kingdom), Edinburgh, Aberdeen, Banff, Dunfermline, and other burghs have got magazines which leave scarcely anything to be desired. And instead of having very large quantities of powder scattered through the towns, in all sorts of unsuitable places, and without proper control, you have it concentrated, or nearly so, in one well-built, well-kept magazine, well isolated from houses. I think it would be very advantageous if this system could be extended to England, where it is necessary, and I believe it is very desirable. I would call the attention of the Committee to the fact that, as will be seen in the abstracts of the reports from town clerks, many of them approve of that idea. (See *Appendix*).

265. Now to come to Section 32; with regard to the "general" rules which you say should be established; of what nature would these be?—They would be rules generally applicable, in fact, universally applicable, to the manufacture of all explosives, their carriage, packing, &c., just as in the Mines Act the general rules are rules which are applicable to all mines. For example, the general rules as to manufacture might define certain general regulations as to danger buildings, as to the non-taking of dangerous articles into the same, as to the work-people not taking their meals in danger buildings, as to the admission of visitors, as to the observance of cleanliness and freedom from gritty substances, and from iron, as to the non-accumulation unnecessarily of the materials for manufacture, as to the posting up of the quantities allowed to be kept in such buildings, in fact, such general regulations as are at present, with few exceptions, voluntarily observed in the better conducted factories. Then, as to packing, some general rules defining the nature of the cases and packages to be employed should be laid down, due regard being had to the particular class of risk. Regard should be had to the nature of the vehicle to be used in the carriage; and as to what explosives might be carried in the same compartment of the vehicle; for example, detonators should not, of course, be carried with other explosives; and there is the provision of sufficiently competent conductors, and other points really necessary for the public safety, and which it stands to common sense should be observed.

265.\* You further say that these provisions should be enacted by statute, or by Order in Council, subject to the veto of Parliament; which plan do I understand you to recommend?—I should personally prefer that the rules should be enacted by statute, but there is no doubt this great difficulty, that it introduces into a Bill a quantity of detail, and would, I fancy, tend to complicate the passing of it very much. I think, at the same time, it would be a convenience to the trade that they should have all those enactments in one measure; but if this consideration is one of any weight, then the only plan would be to enact them by Order in Council, and to lay them on the table of the House for a certain period, at the end of which time they could be considered as law.

266. You propose that these rules should be variable by Order in Council, subject to the like veto?—Yes, I do; because it is a great defect in the present Act that there is no power of adaptability to new branches of trade, or new varieties

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of explosives, or new risks. Take the case of the manufacturer of ammunition; I believe safety cartridges were practically unknown at the time of the passing of the Act of 1860, and so the Act was framed with regard to the non-safety of cartridges, and there is no power to alter it. Then take the new modes of preparing substances; new modes of filling caps, for instance, have come into vogue, which are far safer than the mode prescribed by the Act. I would propose that there should be some machinery of that kind to enable it from time to time to be varied.

267. Now will you be kind enough to proceed to Section 33; I suppose the special rules are to supplement any deficiencies of the "general" rules in their application to particular factories and places?—Yes, exactly as in the Mines Act; in fact, I have followed the Mines Act. I think the arrangement in that Act is a very good one; general rules applicable to all mines and special rules applicable to particular mines. I refer to the Mines Act, 35 & 36 Vict. c. 76, ss. 52, 53, &c.

268. I see you do not give all magazine owners or importers the power to make these rules, but only if required by the Secretary of State. Why is this?—Because I am anxious to avoid the unnecessary multiplication of references of special rules to the Secretary of State. As a matter of fact, in a very large proportion of cases the statutory provisions would meet all reasonable requirements; where they did not do so, it would be open to the occupier of the magazine to represent the case to the Home Secretary, who could thereupon require him to make rules.

269. I understand that you propose to make general rules, variable only by Order in Council, but special rules are to be variable at the discretion of the Secretary of State?—Yes; there again I propose to follow the Mines Act.

270. Now to come to Section 34; in all cases you propose that these rules should receive confirmation?—Yes, in all cases, because it is necessary to guard on the one hand against the introduction of harsh or unnecessary, or even in some cases ridiculous restrictions; and on the other hand, it is necessary to guard against the omission of important provisions.

271. Will you proceed to Section 35 if you please; I presume by "fit persons," you mean persons competent by reason of their technical knowledge to perform the duties of inspectors?—Not only that they should possess the requisite technical knowledge, but that they should be qualified by reason of being in no way connected directly or indirectly with the trade, or holder of a patent directly or indirectly connected with the same; in certain cases also, I would give power to the Secretary of State and Board of Trade respectively, to appoint the mine and railway inspectors to act as inspectors under the Explosives Act, in the case of mines and railways respectively. That would get rid of the necessity for multiplying officers.

272. To proceed to Section 36; what powers of entry and inspection would an inspector possess?—He should have full powers of entering and inspecting all licensed premises, and the power of requiring the licensees to weigh the explosives, and otherwise to enable him to observe if the Act is complied with, and he should have similar powers with regard to vessels and vehicles in which explosives are being carried.

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273. With regard to taking samples of an explosive, or supposed explosive, what is the precise object of this power?—The object of this power is to enable the inspector to obtain evidence as to the precise nature of the substance which he finds being manufactured or carried or stored; in the case of some explosives it is very difficult, in fact impossible, to detect without a careful chemical examination, whether it is what it professes to be; take the case of some of the nitro-glycerine preparations; I could show two samples to the Committee where it would be impossible to detect which was which; I would remind the Committee, also, that it may be of the essence of safety that the material should be precisely what it professed to be, and which had been allowed.

274. You propose the inspector should be empowered to require railways to carry such samples; might not this be in some cases attended with danger?—I would guard this power by a provision that the sample must be carried only if packed in such manner as the Secretary of State may by order from time to time direct; and considering the small amount of a sample (I should say at the outside about four ounces), and the care which might easily be taken in the packing of it, I think there would not be the slightest risk in carrying.

275. At Section 37, I observe that you propose to give the inspector power to interfere where he observes anything unnecessarily dangerous and defective; and that you draw a distinction between things required to be remedied, and things which require to be remedied forthwith?—The power which I propose to give to the inspector of interference in the case of anything unnecessarily dangerous or defective, but not expressly provided for by the Act, is the same power as is given to mines' inspectors under the 46th Section of the Mines Act; but I make this difference, that as in some instances the danger may be of a very urgent character, I empower the inspector in such cases to require the thing to be remedied forthwith, but only where the matter is really one of grave urgency.

276. Will you please now come to point 38; if the licensee objects to the inspector's requisition he may appeal to arbitration?—Yes, there would be an appeal to arbitration in every case except where the matter was ordered to be remedied forthwith.

277. Let us now come to Section 39. As I understand, you would not give any appeal to arbitration when the matter was required to be remedied forthwith?—No; because, where it was a matter of urgency and to be remedied forthwith, there would be danger in allowing it to continue for the time which would be necessary for an appeal to arbitration, and therefore in such cases I would not allow such an appeal; the sort of cases to which I refer are such as the discovery of a quantity of gun-cotton in a state of active decomposition, or the use of a machine or implement apparently of an exceedingly dangerous character. In one case I had the greatest difficulty in persuading a man to give up the use of an iron crowbar for opening his barrels; it was only when I called on the mine owner himself that he ceased doing so.

278. In such cases as we have just referred to the licensee would obtain his remedy in the shape of damages, would he not?—In all such

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cases the licensee should have a remedy against the inspector by an application to the county court for damages, when, if he could show that the inspector had interfered unnecessarily, and to his pecuniary loss or disadvantage, damages should follow.

279. The next point is Section 40. The granting to local authorities a power to appoint searchers, is a new power, is it not?—No, not altogether a new power, because it is already embodied in the Gunpowder Act, 23 & 24 Vict. c. 139, in the case of vessels on the Thames (Section 27). It also appears to be provided for in the Liverpool Gunpowder Act, 28 & 29 Vict. c. 27 8, s. 4. I may further mention that it has been strongly recommended to me, as the Committee may see from the abstract, by a very large proportion of constables and chief clerks. (See *Appendix*).

280. Would the powers of a searcher extend to places existing under a special license, or to unlicensed places?—No, the powers of local supervision should not in my opinion extend to places existing under a special license, or to unlicensed places, except where a constable or searcher was specially authorised in the manner which I will immediately describe; in fact, I think the powers of local supervision should, except under the exceptional circumstances of extreme urgency, extend only to places licensed by the local authorities who have appointed the searcher.

281. Now, to come to Section 41; this provision is, I suppose, suggested in order to meet those cases where the ordinary machinery of search by warrant would be inoperative?—That is so. I do not propose to abolish or even to supersede in any way the ordinary machinery of search by warrant, but merely to supplement it to meet special cases in which the ordinary machinery would be inoperative. I would call attention to the fact that this arrangement, or some equivalent, has been strongly pressed on me by the various chief constables and town clerks, and I would also call attention to the remarks which I have made on this subject at pages 49 and 50 of my Report, and also to the observations which I made on the same subject on Tuesday last, which tended to show that without some such supplementary machinery it would be impracticable to cope with the large amount of illegal firework making and illegal storage of explosives, which we have reason to believe exists.

282. Will you be kind enough next to take Section 42; I gather that you propose that a constable or searcher should be "specially authorised" primarily by a warrant; but failing that, by a written order from an inspector of police?—Yes, the normal mode of specially authorising a constable or searcher, I think certainly should be by means of a warrant; but where a warrant could not be obtained without a dangerous delay, then, but then only, by a written order from the Secretary of State's inspector, or from the chief officer of police of the district, or, in his absence, from any officer of police not lower than a serjeant; but I wish particularly to call attention to the fact that two qualifications would be necessary to justify a departure from the ordinary practice of search by warrant; namely, first, that the case should be one of dangerous emergency; and secondly, that the warrant could not be obtained with sufficient promptness to meet the emergency.

283. Would



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283. Would a Secretary of State's inspector require to obtain a search warrant, or to be specially authorised to act thus?—No, I consider that the inspector should, by virtue of his warrant, obtained as inspector under the Secretary of State, have powers, as he has now, to enter in every case places where he has reasonable cause to believe that illegal explosives are being manufactured or kept in contravention of the Act; it will be observed that the 17th section of the existing Gunpowder Act specifically authorises the entry by an inspector, not only into places where gunpowder, ammunition, and fireworks, &c., are manufactured or kept, but also into places where they are supposed to be manufactured or kept.

284. You say that a report should be made in every case where this power is exercised; to whom should this report be made?—To the Secretary of State, if done by an inspector; to the chief officer of police of the district, if done by a constable; and if made by a searcher, to the authority who appointed the searcher.

285. Will you be kind enough to take next Section 43; what is the object of preventing licensees from being proceeded against except by inspector, licensing authority, justice of the peace, chief officer of the police, or a person authorised by the Home Secretary?—That is to prevent vexatious prosecutions by workpeople or others. Several members of the trade have strongly urged on me the desirability of introducing into any new Bill a limitation of this kind. Of course this limitation would only extend to proceedings before a court of summary jurisdiction.

286. Is there any such limitation in the present Act?—No, none; and it is open to anybody to institute proceedings before a magistrate for offences under that Act.

287. Will you be kind enough to state to the Committee what the provisions as to arbitration are?—Yes, the provisions are very elaborate in their details in Section 49 of the Coal Mines Act; practically, however, it comes to this, that each party to the arbitration may, within a specified period after the date of the reference, appoint an arbitrator; and these arbitrators may conjointly appoint an umpire.

288. To take the next point, 45; do you propose that all accidents, however slight, should be reported to the Home Secretary?—I would only propose that accidents on licensed premises, or in vehicles or vessels carrying above a certain quantity of an explosive should be reported, and I would give power to the Secretary of State from time to time to make an order exempting any particular class of accidents from being reported to him. On the other hand, I would require that in any licensed premises, a report should be made, not only of accidents, but of any circumstance, whether actually resulting in an accident or not, which nearly produced, or was likely to produce, fire or explosion; I consider this important, because a great deal of information may frequently be obtained from a narrowly escaped accident, perhaps more than from those that actually occur; I may say, for example, that if the existence of a quantity of actively decomposing gun cotton in the magazines at Stowmarket, had been discovered a day or two before the accident, the circumstances would have been quite as instructive as the case was afterwards. As a matter of fact, the discovery which was

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made at Upnor, led to the accident there being averted.

289. The next is Section 46; I suppose you require the coroner to give notice in order to ensure an inspector having cognizance of the inquiry?—Yes, at present I have no necessary cognizance of the inquests held on persons killed by explosions. In some cases the coroners write and inform me, and invite me to attend. In other cases where we happen to hear of inquests, we attend under an order from the Home Secretary. But I think there should be an opportunity given for an inspector to attend every such inquest, which would follow exactly the Mines Act, Section 50, where that provision is made.

290. Will you kindly now go to Section 47; of what nature would the "formal inquiry" be that you propose to empower the Secretary of State to institute?—The inquiry should be precisely of a similar character to that for which provision is made in the Railway Regulation Act, 34 & 35 Vict. c. 78, s. 7, under which the Board of Trade are empowered to appoint an inspector to hold an inquiry with some person possessing legal or special knowledge as his assessor, or *vice versa*. This provision has already been put in force in several cases of railway accidents.

291. You are of opinion that such inquiries would in some cases be useful?—I believe that in some cases such inquiries would be exceedingly useful. At present we have no means of formally investigating the cause or circumstances of an accident which may or may not have proceeded from gross carelessness. In some cases the coroners afford every facility for our inquiries; in other cases they refuse to afford any facility whatever, and the result is that we are at the mercy of any individual coroner in that respect.

292. Now, going to Section 48; you propose that heavy punishments should be attached to certain classes of offences; upon what principle would you proceed with regard to the assigning of punishments?—The principle on which I would proceed is this; that wherever the offence is one which entails danger to the public, or where there has been a wilful violation of the provisions of the Act, heavy punishments should follow; for example, the importing of liquid nitro-glycerine; that is at present punished by a very heavy fine, 500*l.*, or one or two years' imprisonment. The same danger would exist under any new Act of Parliament, and it would be equally necessary to have heavy penalties. In the same way any nitro-glycerine preparation, other than that licensed to be imported, would be, practically, almost as dangerous as liquid nitro-glycerine, and that also should be under a heavy penalty. Then, again, the making or storing of explosives in unlicensed places, or the importing of the same without licenses, would be offences which might tend to grave public danger, and which should be punished very heavily; and further, any wilful neglect or wilful act tending to cause accident should also be severely punished.

293. You would also, I think, give a power to forfeit a license?—Yes, I think that in some cases it might be expedient to have the power to forfeit a license after conviction on indictment, but I would not give this power to any court of summary jurisdiction.

294. But you would not extend this to factories and magazines lawfully existing at the time

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of the passing of any new Act?—No, I think not; I think this liability to forfeiture of a license could hardly be fairly extended to factories lawfully existing at the time of the passing of any new Act, and I would therefore propose not to subject such factories to this liability.

295. Will you now kindly refer to Section 49; you propose that an appeal should be in all cases from a conviction by a court of summary jurisdiction?—Yes, in all cases.

296. Now, we will go to Section 50; you propose that vested interests should be specially provided for; and I understand that with this view you propose that all persons who desire to claim the privilege of a lawfully existing factory or magazine, should take out a continuing certificate?—Yes, I think that certain exemptions or privileges should attach to lawfully existing factories or magazines; but I think that it should be incumbent on every person claiming those exemptions or privileges, or proposing to claim them, to establish their right to them, and for that purpose it seems to me that the most convenient way would be to require them to obtain in every case a continuing certificate, because in order to obtain a continuing certificate, it would be necessary for the applicant to establish the legality of the existence of his factory or magazine to the satisfaction of the Secretary of State.

297. This certificate you propose they should obtain from the Secretary of State, and without reference to the local authorities?—Yes; I do not think it is necessary there to go to the local authorities at all, and, in fact, it would be better not to go to the local authorities.

298. You propose that the occupier of a place, which can be shown to be lawfully existing, should be entitled to such a certificate as a matter of course?—Yes, as a matter of right, without payment.

299. You also propose that there should be an appeal from the Secretary of State in any case of dispute to a court of law?—I think that would be necessary, otherwise it would be abrogating a right which licensees at present enjoy; if we challenge the legality of any particular magazine or factory, it would at present be open to the owner of a factory to appeal to a court of law, and I merely propose to continue that right of appeal.

300. You exempt mine magazines, and magazines under a general license under the Nitro-glycerine Act from these privileges, why do you do so?—I do that for this reason, that mine magazines and magazines licensed by a general license under the Nitro-glycerine Act, are so numerous, constituting as they do the bulk of the places of storage for consumers throughout the country, that the work which would be thrown on the Secretary of State's Department, in granting continuing certificates to all of them (probably some thousands) would be excessive, and as these magazines can all obtain a common license as a matter of right, and on payment of a small nominal fee, there would really be no hardship in requiring them to conform to the general provisions of the Act.

301. But might not this in some cases press very hardly upon the occupiers; even to the extent in some cases of requiring the removal of the magazine?—No, I provide against that expressly by saying that where the occupier of

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such a magazine can show to the Home Secretary that he was unable to obtain a common license, or that it would necessitate his removing his magazine or part of it, then if the Secretary of State thought the magazine might be safely continued, I would let the Secretary of State grant a continuing certificate.

302. Why do you allow nearly expired licenses to run out?—That is chiefly in order to meet the cases of the very large number of small firework factories which exist throughout the kingdom; they generally bear on the license a limitation for one year. Most of them would probably take out common licenses.

303. Would you propose to limit the duration of the continuing certificates?—No, I do not think so, except where the license under which a factory or magazine at present exists is one of a limited duration.

304. With regard to the conditions which you propose to empower the Secretary of State to insert in the certificate; why is it necessary, in your opinion, to give such a power?—The necessity arises from the fact that I would propose, as already explained, not to assign in the Act any distances or quantities for special licenses. Each special license is to be considered on its merits and with reference to local circumstances. These continuing certificates would be, in fact, special licenses under which the factories or magazines to which they applied would continue to exist, and, therefore, if these certificates contained no conditions with regard to quantities, distances, &c., the manufacturers or occupiers of the magazines would be under no limitation whatever with regard to quantities, distances, and other matters of detail which ought to be regulated.

305. But might not this have the effect of placing every manufacturer absolutely at the mercy of the Secretary of State?—No, because I would carefully guard against this by providing that the Secretary of State may not in any case require the removal of any buildings or works to which his certificate applies which can be shown to be legally existing, or to reduce the quantities which the applicant is at present entitled to have in any of his buildings, with this exception, that those buildings which are at present unlimited as to quantities, should, in my opinion, have a limit applied to them in a manner which I hope presently to explain to the Committee.

306. I observe that you empower the Secretary of State to assign a limit to magazines which are at present unlimited?—Yes, because I think the time has quite come when the power to add to a magazine, and increase the quantity stored in one given spot indefinitely, might be fairly put an end to without any serious injustice, by fixing the limit of the quantity at the capacity of the magazine on a given date.

307. Do you give the Secretary of State a power to assign a limit in the case of any other buildings which are at present unlimited, some of which you mentioned the other day at your former examination?—Yes; such buildings in gunpowder factories as dusting houses and packing houses, or glazing houses. I think that in the case of all working buildings there should be the power to assign a limit; but in these cases the limit should be assigned, not with reference to the capacity of the building, but with reference to the requirements

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requirements of the building and of the general work of the factory; that is to say, such buildings should be limited, with regard to quantity, or amount which is necessary for the immediate supply of the work of such buildings, without specifying the quantity in each case.

308. Do I understand that you propose to allow an appeal to arbitration against any condition proposed by the Secretary of State?—In every case of a dispute arising between the applicant and the Secretary of State with regard to any technical detail; for example, in any question which might arise with regard to the amount which a manufacturer might have for the immediate supply of the works, I would say that in all such cases there should be a reference to arbitration, if desired.

309. Would existing licenses be subject to all the other provisions of the new Act?—No, not all; they would be exempt, for example, from the provision which relates to a license being in all cases of limited duration. Where they are unlimited at present they would continue so. Then, again, they would not be subject to the provision which renders them liable to the forfeiture or revocation of a license; nor would it be necessary to require them to have their factory or magazine certified by an inspector, before its use, under a continuing certificate, could be carried on.

310. Will you be kind enough now to come to Clause 51; why do you not propose to apply the new Act to Crown factories and magazines?—In this respect I am merely following the existing Gunpowder Act, and I believe all preceding Gunpowder Acts. I think that inconvenience might in some cases arise from subjecting the Crown factories, or explosives belonging to or carried for the Crown, to provisions specially framed with reference to the private trade. It may also be added that the necessity for subjecting Crown factories and magazines to compulsory enactments with regard to precautions to be taken is really unnecessary, seeing that those magazines and factories are generally conducted with an amount of care and caution far in excess of anything that could be attempted to be imposed on the private trade at large.

311. But are volunteer storehouses invariably under proper supervision and control?—No, they are not. I would only exempt such volunteer storehouses as are approved by the Secretary of State for War as fit places for such purposes, and then only provided the storehouse were managed in accordance with the War Office Regulations. In such cases only should these storehouses be deemed to be Government magazines within the meaning of the Act.

*Colonel North.*

312. With regard to that head of your suggestions which relates to carriers, do you there refer merely to carriers in large towns, or do you mean any common carrier in small towns and villages?—I refer to all carriers.

313. But I think you said that even in London, according to the law, a quantity of powder may be carried, provided it is covered with tarpaulin?—Yes.

314. As far as I understood your evidence, you do not consider that sufficient?—Certainly not, with regard to the larger quantities; and indeed with some of the small quantities some

*Colonel North*—continued.

extra statutory provision should be provided, in my opinion.

315. Do you think that country carriers, who very often go home in anything but a sober state, ought to be allowed to carry powder in that way?—It would dislocate the trade so terribly, and cause so much inconvenience, that I am afraid we must permit them to do that, provided they will do it under some restriction; for instance, if a man carries gunpowder, he should not do it in the same compartment with something that might set fire to it; matches, for instance.

316. You will often see those country carriers with lighted candles utterly unprotected in their carts, will you not?—I am afraid it is so; but I do not see how we could interfere with them in that respect.

317. I think you say you would allow only 5 lbs. of powder to be carried in omnibuses, and so on; would you restrict a carrier in the same way?—No, I think he might be allowed to carry up to a certain limit without providing a special vehicle, and beyond that limit only in a special vehicle; at present he is only required to provide a special vehicle when he carries a ton and a half. I think the line ought to be drawn as low certainly as half a ton.

318. That would be the same, I suppose, whether they were cartridges or gunpowder?—In the case of ammunition of the safety class I would not impose any limit of quantity.

319. With regard to the manufacture of fireworks, I think you said that a large quantity of fireworks were made in London, even in garrets?—Yes, a very large quantity.

320. I suppose you could not allow those people even to have common licenses?—No.

321. I suppose the places would be inspected by the inspector to see that they were proper places before the license was granted?—The license should bear on the face of it the conditions under which it was granted, then the onus would rest on the licensee of observing those conditions; and inspection would ensure that they were observed.

322. You want to put down this manufacture in those dangerous places, I suppose?—That is my object, and to afford full facilities for carrying that manufacture on with safety.

323. Now, with regard to volunteer storehouses, I know there is very great difficulty with most volunteer corps in obtaining storehouses at all; but I suppose you mean that those volunteer storehouses that are exempt as Government storehouses would be under Government supervision?—Certainly; it comes to this, that I would make the Secretary of State for War's certificate exempt a volunteer storehouse from the operation of the Act of Parliament.

324. But all others you would put under the Act, would you not?—Yes, all others I would put under the Act.

*Mr. Vivian.*

325. With regard to the classification, I see you place the safety fuze in Clause 5 in the same class as safe ammunition?—Yes.

326. You consider those goods to be safe from all danger of explosion, spontaneous ignition, and, in fact, that it is a manufacture that should be classed as almost non-dangerous?—Yes, I think that the manufactured safety fuze might practically

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cally be relieved pretty nearly from all restrictions after manufacture. The danger with regard to the safety fuze as generally made in this country occurs in the manufacture only; I believe it practically ceases there.

327. You would place them under no restriction at all with regard to storage or transit, would you?—I do not think it would be necessary to place them under any restriction at all with regard to storage or transit, except that they should be packed perhaps in a particular way, but otherwise the amount of restriction might be the minimum.

328. Do you not consider that this manufacture as carried on by the largest makers represents a minimum risk as compared with other manufactures in which explosive agents are employed?—The risk is practically concentrated in two operations, that is to say, the drying or preparing the powder before putting it in, and the process of making the fuze. There the risk is very much what it is in a cartridge factory; but in all the rest there is practically no risk at all.

329. The risk is in the smallest degree, is it not?—Yes, with ordinary care there ought to be no accident.

330. Are the precautions taken by the larger manufacturers such as you in general approve of, and have not those people been among those to whom you referred on Tuesday, as most ready to avail themselves of your advice and suggestions for adopting every additional precaution?—Yes, the trade has generally been exceedingly ready to adopt any suggestions which I made. There was a great deal which was very much wanted when I visited that part of the country in which these factories chiefly exist; but now, except in one or two cases, there is very little to complain of.

331. Then with regard to the storage of gunpowder in mine magazines, you say that they would be better off after the passing of the Act which you propose than they are now, and that they will be able to store, I think you said, two tons within 200 yards of their mines?—Yes.

332. Would you propose to place any other restriction with regard to the storage or transit of gunpowder?—I would place them under such statutory provisions, or by an Order in Council, as refer generally to the storage of explosives. If you will look at Section 32 of my Summary of Suggestions as to the amendment of the law relating to explosives, you will see it says, "General Rules for the manufacture, storage, packing, and carriage of explosives to be laid down, either by statute or by Order in Council." Those general rules, I propose, should apply to mine magazines, and to powder carried for the use of mines.

333. Under what conditions would you propose that existing mine magazines should continue as such; and first of all, with regard to gunpowder and then dynamite?—I should be very glad to preserve the distinction which is observed at present between a dynamite magazine and a gunpowder magazine, but I am inclined to think that that imposes a very great deal of inconvenience on the consumers, and it is very often not observed. I am disposed to think that I would no longer continue the distinction between small dynamite and gunpowder magazines, so that they would both come together into one, if the owner was so disposed; but I would always recommend him to keep them apart.

Mr. *Vivian*—continued.

334. But under what conditions would you permit the existing magazines to continue as such?—Wherever the existing magazine was within the quantities and distances given on the sliding scale it would have a right to its common license, and it could obtain it for a nominal fee. If it was an existing magazine which was interfered with by the new regulations, then it would be in the discretion of the Secretary of State to give it a continuing certificate, provided he thought it was safe, though it did not technically comply with every point in the Act of Parliament. I believe that under this arrangement it would be possible to do what is not possible now, namely, to legalise a far larger proportion of mine magazines.

335. That would be by special license, I suppose?—Yes, a special license obtained from the Secretary of State.

336. That is to say, after inspection of the magazine by the inspector who would be created by the Act?—Yes, or after such particulars given in reply to written questions as would give us the necessary information; but that would be only to meet exceptional cases where the mine-owner could not obtain his common license.

337. Then every occupier of every mine would have to go to the petty sessions for a common license?—He would merely write for the license, send his fee, and he would get it as a matter of course.

338. I think you stated on Tuesday that the existing mine magazines, as a rule, are in an unsatisfactory condition?—Yes, very.

339. Upon what ground have you based that opinion?—On inspections which I have made, and which have been very numerous. I think the number of mine magazines which I have visited in various parts of the country amounts at the present time to over 300. We have taken different districts; we have taken every district, I believe, in North and South Wales, Cumberland, Northumberland, Durham, Yorkshire, Staffordshire, Cornwall, and Devonshire. We have inspected none in Ireland, but in Scotland we have.

340. In what way do you generally find those magazines defective?—In many respects. First of all, the construction of the magazines is frequently exceedingly bad; in fact, they are not built as magazines at all; they are many of them common stores, in which the pickaxes and other articles required for the use of the mine are kept. In many cases, perhaps, they do not keep those articles there; but then the construction of the magazine is quite unsuitable; they are very often ordinary stone buildings, with, perhaps, a stone floor or brick floor, and an unlined stone wall, and no attention is paid to the details of the internal management; instead of keeping them clean and from grit, people walk in and out in their ordinary shoes, iron shod, and the powder is spilt about the floor, and no more attention is paid, I was going to say, in nine cases out of ten to the handling of the powder than if it was so much tea or some other inexplusive material. Major Ford reminds me of one which he visited last Thursday, which, perhaps, will give the Committee an example of what I mean. This is a copy of a letter which we have drafted to send off to the proprietors:—"I have the honour to inform you that Major Ford, R.A., who inspected the gunpowder magazine belonging to your mines, has

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has reported that it is in an unsatisfactory and dangerous state. There is a stone floor in the building, but in the portion in which the gunpowder is kept a raised floor of wood about four inches above the stone floor has been put down, but with large spaces between the planks. There was loose gunpowder lying on the planks, and a considerable quantity (admitted by the storekeeper to be at least 1½ lb.) had accumulated on the stone floor beneath, having fallen through the spaces. On these planks the storekeeper walked in his ordinary iron-nailed boots, on a mixture of gunpowder and grit. Moreover, to add, if possible, to the danger, there were 900 detonators for firing dynamite stored there, and about 75 lbs. of old gun cotton."

341. I should hope that this was an exceptional case?—I am sorry to say that it is not an exceptional case. I could instance very many such cases.

342. I gather from what you state that in most cases you would infer that the mine magazines are defective?—Yes, in the majority of cases.

343. They would have to be replaced by new ones, would they?—No, not at all; in a great many cases where the owners have adopted our suggestions, they have converted very bad magazines into very good ones. All that is needed in most cases is, first of all, to provide a proper wood floor and wood lining, and, secondly, to provide proper magazine boots, and to insist on reasonable cleanliness and care.

344. That can be done at very small cost, can it not?—Yes, that can be done at a very small cost, and has been done very often.

345. Did you ever know of a mine magazine exploding?—Yes, I knew two cases in Cornwall; one at Dolcoath, and the other, I think, at Dolcoath also. In that case the mine magazine was exploded by some children; there were holes in the door, and the children got some gunpowder, laid a train, and fired the magazine.

346. But that was not from any defect in the magazine, was it?—It was; if the magazine had been properly constructed, they would not have been able to accomplish that. Those cases were curious cases, and I have got the depositions which were made at the coroner's inquest, which I could produce if desired.

347. When was that?—I think it was in 1868 or 1867.

Chairman.

348. Will you be kind enough to hand those depositions in?—Yes, I will do so.

Mr. Vivian.

349. There was loss of life in those cases?—Yes, in both cases. There was also a bad explosion which killed six people two years ago in Denbighshire. I think that was owing mainly to the magazine being placed in a most improper position close to a line of railway; a truck got off the line, and ran into the barrels.

350. Was that explosion at Dolcoath the only one you heard of in Cornwall?—There were two in Cornwall.

Chairman.

351. Will you kindly put in an account of both of those cases?—Yes; I will do so.

Mr. Vivian.

352. Then with regard to dynamite, in what

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class would you propose to place dynamite?—In what I call class two, nitro-explosives.

353. In what class is nitro-glycerine, or is it in any class at all?—Yes, nitro-glycerine would be in that same class; but I do not propose that we should, with our present knowledge, legalise the manufacture or importation of liquid nitro-glycerine.

354. Then the substances contained in each class would not be subjected to the same restrictions?—Yes, they would in each class or sub-division of a class; for example, the packing of dynamite would be the same as for lithofracteur, or for Horsley's blasting powder, or for other substances, of which nitro-glycerine is the explosive base; but they would require of course to be differently packed to gun-cotton or sawdust powder, or gunpowder proper.

355. I observe you speak of dynamite number two: there are two kinds of dynamite, are there?—Yes, two have been licensed.

356. One contains nitrate of potash, and the other contains nitrate of soda; is that the difference?—No; dynamite containing nitrate of soda was submitted, but rejected; No. 1 contains no nitrate whatever, it consists of 75 degrees of nitro-glycerine absorbed in a certain infusorial earth called kieselguhr; there is no other substance in it at all; but No. 2 contains a less proportion of nitro-glycerine with a proportion of substances which may be considered a form of gunpowder; namely, nitrate of potash and carbon.

357. Are the two kinds of dynamite equally explosive?—I have no experience that enables me to say; one appears as safe as the other; but I believe that No. 2 is meant to be less powerful than No. 1.

358. Would you propose to place them in the same sub-division of that class?—Yes.

359. Is nitro-glycerine in chemical or mechanical combination in dynamite?—The nitro-glycerine is absorbed, but it is in mechanical combination only with the kieselguhr.

360. To come to another point, can exudation be avoided by cartridges being packed in airtight cases?—The best mode of avoiding exudation is careful manufacture; then assuming that that care has not been exercised, I do not think any method of packing would satisfactorily provide against that, for although the case may start from the manufacturer's intact, yet when it gets into the mine it is the practice of the miners, or persons using it, to open the package and break it up, and in some cases to empty the cartridge out into bags, in order to prepare charges of different quantities; you thus get the package destroyed, and then you get exudation.

361. At what temperature does it freeze?—I think that it freezes at about between 40 and 50 degrees Faht., and once frozen it will remain frozen even up to 55 and 60.

362. The process of thawing is a very dangerous one, is it not; would you propose to let that be carried on by a miner, or any unskilled hand?—I believe that it may be done without danger with a little care. It is a very dangerous process if a man does it, as many of the miners do, by putting it before the fire on a shovel; but so far as we know it, it is not dangerous to thaw it by means of warm water, or by placing it in a manure heap, which is a very common way of doing it.

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363. Do I understand you to be of opinion that where the manufacturers of dynamite pack it in air-tight packages exudation could be avoided?—Yes, exudation can be avoided so long as the package is kept intact; but, obviously, that cannot continue.

364. Then if a magazine contained several of those packages, and if any of the dynamite that was taken out were not allowed to be replaced, after the packages were once opened, would not the magazine be in as safe a condition as if it had gunpowder in it?—That is a very difficult question to answer, because it is practically a comparison of risk between gunpowder and nitro-glycerine preparations. That is a point on which it is almost impossible to give a straightforward answer; I must first assume that another very important risk has been got rid of, namely the risk of impurity. You may have got rid of exudation, but not of the risk of impurity; in that case the air-tight packet would be rather unfavourable than otherwise.

365. You would allow dynamite to be stored in mine magazines under the same conditions as gunpowder, would you not?—Rather reluctantly I would do so, for it appears to be almost necessary.

366. You know, do you not, that dynamite is becoming of great importance to mining operations?—In some districts it is becoming largely introduced, I believe.

367. You have heard, I presume, that in certain classes of ground, mining operations cannot be done without dynamite?—Yes, I believe that in very hard metalliferous mines it is very valuable.

368. And in wet ground, for instance?—Yes, it is used in wet ground with very great effect.

Mr. Whitelaw.

369. With regard to giving special licenses, in Scotland you propose that they should be given by the court of quarter sessions, or the sheriff; it is the one or the other, is it not?—Yes, it is an alternative.

370. Turning to Clause 50, does the proposed power of compulsory purchase of clearance rights apply to those who obtain continuing certificates?—Yes, I would propose that it should.

Mr. Norwood.

371. Have you any practical experience of the way in which powder is shipped for export?—I derived a good deal of information from a report which was made by the Lord Lieutenant of Ireland, with reference to the shipment of gunpowder, and which I brought under the notice of the Committee, from which it appeared that gunpowder was shipped in the same way as any other goods.

372. You are aware, are you not, that the Thames is the great shipping place for gunpowder?—Yes.

373. Therefore Ireland is not likely to give you quite as much information as you can get at home?—No.

374. I suppose you have not been on board ship and seen how it is placed on board?—No.

375. Therefore you cannot say what precautions are taken by the crew; but I suppose you are aware that all the Government powder, which is the most important part of the trade, is shipped under inspection, and into magazines which have

Mr. Norwood—continued.

to be passed by a Government inspector before the loading commences?—Yes, I know that.

376. You would not interfere with the shipment of Government stores, I suppose?—No, because I believe it is properly done.

377. Have you ever heard of a case in which a vessel has been lost by an explosion of gunpowder?—No, I have never heard of a case of that kind, except the "Lottie Sleigh"; but I think it is exceedingly probable that some vessels as to which we do not know how they are lost, have been lost in that way.

378. Before you could give a very decided opinion on that point you would have to know, to begin with, how many vessels leave port with gunpowder, would you not?—Yes.

379. But you have no special knowledge about it, have you?—I know of no case of a vessel, except the "Lottie Sleigh," and one that was blown up by the act of the captain the other day, being blown up by gunpowder.

380. I think you have suggested that no powder should be shipped in passenger ships except by special permission of the Board of Trade?—Yes.

381. You would not allow the Government to do it even?—This proposed Act would not apply to the powder carried by the Government.

382. But is not Government powder calculated to explode and destroy life and property as well as private powder?—Yes.

383. Then why should you draw that distinction between Government powder and private powder?—Because the special precautions which are taken by the War Office are, in my opinion, sufficient, whereas private powder is shipped under no supervision whatever. What I desire is, that the powder should be shipped under the supervision of the Board of Trade, or some competent officer.

384. Is there any supervision at all with regard to the handling of the powder on board ships even by the Government?—It is all done in the most careful manner, and once on board ship it is not handled until it is at the station.

385. Who does the slinging of the powder, rolling it along the deck and handing it down between decks?—According to evidence which was before me at Newhaven last year, that is done under the immediate supervision of a control officer, and under certain precautions with regard to safety.

386. You have alluded to harbour authorities, and you spoke very highly of the bye-laws at Liverpool; have you seen the statutes under which other large ports are governed, for instance, Glasgow, Bristol, and Hull?—Yes, I have seen them; I had occasion to refer to several of them at the time of my Newhaven inquiry, and I found that none of them went near meeting the case in the way that the Liverpool gunpowder regulations do.

387. Am I right in supposing that you would recommend, in the case of a general statute being passed, that the law as laid down in that statute should override local statutes?—Yes, except where the local authorities could show cause for the continuance of any provision in their statute.

388. Have you thought of the way in which lucifer matches in large quantities are kept in ships and in docks?—Yes, it is exceedingly dangerous.

389. Do

Mr. *Norwood*—continued.

389. Do you propose to inform the Committee on that point?—No, that is not a branch to which my attention has been directed.

390. But lucifer matches are explosives, are they not?—No, I think not. They are very highly inflammable, and in certain classes of matches they would go very near being explosives.

391. Would you be able to give the Committee evidence with regard to the practice in our large docks with reference to the reception and storage of explosive substances: can you tell me, for instance, what the East and West India Docks, or the London and St. Katharine Docks, do with respect to the custody of explosives?—I think they do not keep or ship them there at all.

392. Not even within their own wall?—I think not.

393. Now with regard to dynamite?—In the case of nitro-glycerine, the local authorities are empowered, by virtue of our licenses, to make such regulations as they think necessary. In the case of the Thames, the shipment of powder goes on beyond Gravesend mainly; the shipment to the barges goes on at Blackwall, but the barges go down to Gravesend, and tranship the powder into the vessels.

394. Do you know how merchants' ships are relieved from their powder when they come into dock, or are they relieved at all?—Yes, I came across that branch of the subject about two years ago. I found it was the practice of one of the Thames powder lightermen to board the various ships, and take off what were called their magazines, viz., the small tin or metal receptacles in which they kept their signal lights, cartridges, and so on.

395. Is that done before the vessel enters the dock?—That I cannot say. It certainly had been largely done, because I found some hundreds of those powder magazines in a powder magazine near Erith.

396. You would consider it right, would you not, to examine the different Merchant Shipping Acts, to see how far they deal with the subject?—I have done that; but what I would propose is, that certain clauses of the last Merchant Shipping Act should be embodied in this Act.

397. Will you kindly inform the Committee what is really the practical difference, with regard to danger, between half a ton of powder and two tons of powder carried together; would not half a ton be as destructive as the two tons?—In the immediate locality it would be quite as destructive, but not over a more extended area.

398. But in treating the subject generally, I notice that you make a sliding scale in the quantities, and my question was rather directed to the difficulty that I feel as to the exact point at which half a ton of powder ceases to be less dangerous than a ton; half a ton of powder would be quite enough to destroy a vessel, would it not?—Yes; in the case of a ship at sea there is no good in making a limit.

399. Would even a quarter of a ton of powder blow a ship up?—Certainly.

400. Then you do not see that there should be any onerous difference, do you, in the regulations with regard to the conveyance of 20 or 25 tons of powder and a quarter of a ton of powder; gunpowder should be taken very carefully in any quantity, large or small?—Yes.

401. You would not draw any nice distinctions

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Mr. *Norwood*—continued.

with regard to the quantities?—Just so; my quantities in all cases bear reference to the distance.

402. Upon land?—Yes, but that would apply to floating magazines.

403. No doubt it would, but it would not apply to a vessel when it is in the middle of the sea with no other ship near her?—I mean floating magazines such as we have in the Thames and on the Mersey.

Mr. *Knowles*.

404. Would you propose, where a mine owner provided an iron safe to put the gunpowder in, to make any difference with regard to distance?—No, because an iron safe is specially directed to save the powder from the effect of a fire in the house. I think the quantities kept by the mine owners would be in excess of what they should keep in or near a house, and therefore I think it would be a superfluous precaution to take.

405. In Clause 38 you say that in case of difference between the licensee and the inspector you would refer the matter to arbitration?—Yes.

406. Could you not think of any more simple and direct method of settling the matter, particularly in the case of small dealers?—I really cannot suggest anything which would be likely to be more satisfactory to the licensee.

407. Would you propose to suspend the license during the time of arbitration?—No, not unless it was a case of a thing to be remedied forthwith.

408. Could you not leave it to a county court judge, or a mayor, or a chairman of sessions, or other magistrate?—I should be glad of any mode which could be devised to simplify it, and at the same time to inspire confidence in the licensee; but it seems to me that arbitration is the fairest plan towards the licensee, because he is fully represented in that case.

409. But in the case of small dealers it might be better, might it not, simply to shut up their premises rather than go to arbitration?—If the premises were unsafe, I should say they had better shut them up.

410. But we are supposing a case of difference of opinion?—Then if he does not choose to avail himself of the remedy provided, I do not see what else can be done in such a case.

Mr. *Stanhope*.

411. Turning to Clause 10 of your Summary of Suggestions, you have very candidly stated that the question is whether you should have a system of registration or a system of common licenses, but in either case it would come as a matter of course unless the person or premises be disqualified?—Yes.

412. Do you not think that there would be a much better opportunity of ascertaining whether the person or the premises are disqualified if you made him go to a magistrate for a license, than if you proceeded by a simple process of registration?—No doubt it would be so, but that would be an unnecessarily elaborate arrangement; I want to make it easy to obtain a license because the object of the license is really to obtain supervision, and I would like to make it easy because otherwise many persons would not take them out.

413. You are rather in favour of a system of simple registration, are you?—No; on the whole I incline to common licenses.

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Mr. Stanhope—continued.

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414. I quite agree with you, that you would have a better opportunity in that way of determining whether the person or place was disqualified?—Yes; in the case of a common license, you could send a local inspector first to see the place, although you would not have the power of refusing the license, except the place or person should prove to be disqualified.

415. It would not be necessary to put the applicant for a license to any expense, except the mere expense of going before the magistrate, would it?—I would not even make him appear in person before the magistrate; he might simply send a written application.

416. Now with regard to the points contained in Clauses 16 to 18 of your summary. I understand you to say that the reason why you think special licenses should be granted by the local licensing authorities with the assistance of the inspector, rather than by the Home Secretary, is first, because you object to over-centralisation, and secondly, because you think the public would have the additional security of the local licensing authorities besides the inspector?—Yes.

417. I suppose you would agree with me that if any appeal whatever is to be allowed, it ought to be to an authority which is independent altogether of the tribunal which originally pronounced judgment on the application?—Yes, I feel that strongly. I really do not know what authority it ought to be.

418. Your first suggestion was, that it should be in the power of the Secretary of State to refer the matter to arbitration, was it not?—No; that it should be compulsory on the Secretary of State to refer it to arbitration.

419. And you quoted to the Committee, I believe, the analogy of the Mines Regulation Act?—Not with regard to that point, I think.

420. I mean that the system of arbitration is founded on that analogy?—Yes.

421. But you are aware, are you not, that the only questions referred to arbitration under the Mines Regulation Act are questions of technical detail; for instance, the conditions which should be attached to the working of the mines; is not that so?—Yes.

422. I suppose you would think that the system of arbitration would apply in this case to the conditions to be attached to a license for dealing with explosives?—Yes.

423. But now suppose the license is refused altogether by the licensing authority, how could you refer to arbitration a question of principle like that?—It would very much run, even there, into a question of technical detail, because it would be chiefly a question of the probable effect of granting the license.

424. Upon that point you have the judgment of the court of quarter sessions; do you know of any other instance in which an appeal is allowed from a court of record like the court of quarter sessions by way of arbitration?—No; but the circumstances are very peculiar in this case, because the point to be decided is not a point of law, but a technical point.

425. The second alternative plan proposed by you is, that the Secretary of State should refer the matter to a competent person to decide; do you know of an instance in which there is an appeal from a court of record like the court of quarter sessions to the opinion of any one individual?—No.

Mr. Stanhope—continued.

426. What sort of person would you propose?—I think you could find a large number of officers, either engineer or artillery officers, or officers of other branches of the service, or officers who have charge or who have had charge of a Government factory in which explosives are made or adapted, and they would be persons well qualified to deal with a matter of that kind.

427. You refer it to a person who is not filling the office of inspector under the Act of Parliament; is that so?—My alternative suggestion was, that the Home Secretary should be required to refer the matter to some other person than the one who made the report.

428. Would you object to make it, some other inspector?—I do not object to that.

429. Do you think it would give satisfaction to the applicant that his appeal should be from one inspector under the Home Secretary to another inspector under the Home Secretary?—No, I am quite prepared to exempt all inspectors from those appeals if it is thought desirable.

430. If you went outside the body of inspectors you think that you could find persons sufficiently acquainted with the subject to be trusted to decide such matters?—Yes, I think there would be no difficulty about it.

431. Now with regard to those who might oppose the granting of an appeal by the licensing authorities, I did not understand why you thought no appeal should be given to them?—My first object is to avoid unnecessarily multiplying appeals. Then the question is, whether it will be necessary to give an appeal. I consider that as the license can only have been granted with the concurrence of the court and the inspector, the interests of the persons around and the opponents too are sufficiently guarded in that way.

432. Would not those safeguards rather apply to the protection of the public than that of a private individual who might think that his premises were being invaded by the application?—Yes, but it would give full power to the opponent to appear and urge his reasons against the granting of the license before court, when the application was made.

Mr. Hick.

433. Referring to your evidence I will just ask you a question with regard to cartridges; am I right in understanding, that as the law stands, it is illegal to fill cartridges without a license?—That is so according to the opinion of the law officers of the Crown; and that is one of the points to which I particularly call the attention of the Committee.

434. You propose to alter that, do you not?—I propose to legalize the filling of cartridges without a license.

435. With regard to the carriage of cartridges I think I understood you to say that you would allow any quantity of sporting cartridges to be carried; that is to say safe cartridges?—Yes, breech-loading cartridges.

436. Speaking broadly, would you propose to class pin-cartridge and central-fire-cartridge in the same category?—Yes, because though the pin-cartridge is more liable to be exploded, it is not more liable to communicate the effect; the explosion of a central-fire cartridge is a matter of comparatively little importance; I have myself exploded over and over again one, two, three, four, and up to 10 cartridges inside a barrel, that  
barrel



Mr. Hicks—continued.

barrel being inside an iron case tightly screwed down, and without an explosion, and I have even exploded up to a quarter of a pound of powder under the same circumstances without mischief.

437. But there must be circumstances, must there not, under which any cartridge might do mischief; supposing a cartridge exploded in the breech, and hit against some substance which would not give way, the discharge would be like that of a gun, would it not?—No, I think not; I think I can give you a case in point which will show you that; at the Royal Laboratory, at Woolwich, after an accident which took place some years ago, it was thought desirable to cap the cartridges after they were completed; and in order to do this safely, as the putting in of the cap might sometimes cause an explosion, a machine was arranged with a wide tube and the cartridge was placed, and the plunger came and pushed in the cap, and if an explosion occurred it occurred up the tube; such explosions have occurred.

438. There was no shot in it, I suppose?—Yes, it was shotted and completed; explosions have occurred, but it is very rare for the bullet to be projected over the top of this tube, which is about three or four feet high; in some cases it drops down again.

439. Referring to Section 24 of your paper of Suggestions you say, “the destruction of a magazine by explosion to determine the license;” does not that appear to you to be rather arbitrary before the cause has been ascertained?—But then it would always be open to a man if he could show that there had been no carelessness to get another license.

440. But you have not stated that proviso, have you?—No; I have not made it clear, but that is what I intended, namely, that it was to be without prejudice to the granting of a new license, the only object being to bring all the circumstances within the observation of the licensing authority.

Mr. Bell.

441. As I understand you, your third head, namely that of the chlorates, is confined to chlorates in combination with carbon, or carbonaceous substances?—Yes.

442. Then, looking at the well-known mode of action of the chlorates, do you think it prudent to confine that head of your classification to carbonaceous substances only?—I think so; I may say that with regard to this point, which is essentially a chemical point, I have had the benefit of consulting two distinguished chemists, namely Professor Abel and Dr. Dupré, and the arrangement, with regard to those substances, has been in a great degree effected upon their recommendation.

443. Yes; but inasmuch as the chlorates act with equal violence upon sulphur, for example, phosphorous and many other substances, is it satisfactory to confine the chlorates to their combination with carbonaceous substances?—If the carbon, or carbonaceous substance is present, then the addition of sulphur would still constitute it a chlorate explosive.

444. Yes; but you might have a highly explosive substance, might you not, in which the chlorates were present, and all the carbonaceous substances absent?—Then, in that case, this would require to be revised.

Mr. Bell—continued.

445. In the fourth head of your classification you have the fulminates, and there again you confine the fulminates to compounds in which the chlorates are the essential ingredients, do you not?—No, my classification is this: I do not distinguish the fulminates chemically at all, but I simply say that when an explosive named in one of three preceding classes is by any means made sufficiently sensitive to serve as a fulminate, or a charge for a cap, then I put it into the fulminate class.

446. Then your fulminate must be a substance which includes one of the substances named in one of the three previous categories?—Yes.

447. But inasmuch as there are many fulminates which contain none of those three classes, but which contain fulminic acid, it seems to me that there again it would be better to include all fulminates; is not that your opinion?—Yes. I imagined that we had included all possible combinations, but if there are other combinations, they clearly should be included.

448. In your summary of suggestions under the fourth head, you give power “to Her Majesty in Council to extend the Act from time to time, or any part or provision thereof, to any explosive not specially named or defined in the same;” now as it is well known that almost all those new explosives have been added to the category within the last 20 years, that is to say, since the year 1850, or thereabouts, previously to which the only explosive that we knew practically in commerce was gunpowder, you would not consider it improbable that the next 20 years might produce an equal extension of the list, would you?—I think it is quite probable that it will do so.

449. You would also think that some of them might be of a sufficiently dangerous character, or their action not sufficiently well known, to prevent the precaution with regard to those that we know perfectly well, being quite applicable to the new ones?—Yes, that might be so.

450. I would just name for your consideration one or two; there are compounds of chlorine and nitrogen, and nitrogen and iodine, which are so explosive that the mere shock of a carriage along the street will be sufficient to determine their decomposition?—Yes, I believe so; but the scheme here proposed would with regard to those substances give us a complete command of the two doors by which new explosives could enter; they could only enter by importation or by manufacture, and in no case would they be allowed to be manufactured or imported if chemical explosives, without a special license. If the substance was of that highly dangerous character, the probability is that just as in the case of liquid nitro-glycerine, the license would not be granted unless it could be shown that the substance would come fairly within the control of the Act.

451. Yes, but that would impose on the Secretary of State, or the licensing body, the responsibility of determining whether or not those substances were of those qualities, would it not?—It is essential, I think, that we should have some reference on such questions.

452. You would not think it desirable to impose the same restriction with regard to the time before the substance was admitted into the category of explosives, would you; I mean the time since the time of its invention?—I have not considered that as necessary. I think that

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a careful report or a careful examination by an experienced chemist would probably meet the case.

453. In your evidence on Tuesday, you mentioned something about the extraction of saltpetre from damaged gunpowder, and some danger attending that operation, did you not?—It may be so conducted as to be dangerous; that is to say, the person doing it might accumulate for the purpose of extraction a large quantity of powder, and if it was carried on without precaution, an explosion might occur.

454. You mentioned also something with regard to hot cement can you state what that is?—I do not know what it is; I have not the least idea. The Controller in his Report said, that the powder in that particular case was laid in the vessel on a quantity of “hot cement,” placing the words in inverted commas.

Mr. *Vivian*.

455. I understand you to say with reference to dynamite, that the storage should be placed under the same condition as that of gunpowder; I suppose you would apply that to the conditions of transit in the same way?—Substantially so; there would be differences in the packing of course, in transit, but otherwise there would be practically no difference.

COLONEL CHARLES WRIGHT YOUNGHUSBAND, R.A., called in; and Examined.

*Chairman*.

Colonel  
*Younghusband*,  
R. A.

460. YOU are a Colonel of the Royal Artillery, are you not?—Yes.

461. You are, I believe, Superintendent of the Government Gunpowder Factories?—Yes.

462. Will you kindly inform the Committee, besides the general knowledge of explosives which you have gained in your profession, what special experience you have had on the subject?—For the last six years and a few months I have been superintendent of the gunpowder factories, and also during that time I have been president of a committee on explosives, and of a special committee on gun-cotton, and other explosive materials.

463. I suppose you are well acquainted with the existing Gunpowder Act?—Yes.

464. And with other Acts of Parliament connected with explosives?—Yes; I think I may say I am acquainted with all the Acts of Parliament on the subject.

465. Do you consider them sufficient, or if not, in what direction do you think they require amendment?—I consider them quite insufficient, and I think very defective in many respects, inasmuch as they are wanting in general principles; while as to matters of detail, they are regulated by stringent, hard and fast provisions without regard to contingent circumstances. I am speaking now of the Gunpowder Act.

466. First, with regard to the general provisions, what have you to say to them?—By referring to Clauses 10 and 13, it will be seen that with regard to the system of licenses, there is no provision made for requiring the justices to take advice on technical points respecting the particular factory for which licenses are required. First, in the way of designs for the selection of sites and relative position of the buildings; and secondly,

Mr. *Vivian*—continued.

456. You said also that if it was pure it would be comparatively safe. Now would there not be a power in this Act to punish adulteration?—Certainly; in No. 48 you will find that “heavy punishments are to be imposed for a substantial departure from any important condition of the license.” It would be a very substantial departure from an important condition of the license if there were any adulteration, and therefore any adulteration would be heavily punishable.

457. If there was no adulteration, if it was pure, and if there were no open packages in the magazine, I suppose you would place dynamite under no other restrictions at all with regard to transit or storage?—No restriction special to itself. I think I have stated that the regulations which would suffice for ordinary properly managed gunpowder magazines would suffice, eliminating those two risks, in the case of dynamite.

458. With regard to those two explosions which you have mentioned, that is a very small percentage, is it not, considering the number of existing mine magazines in the kingdom?—Yes, very small.

459. It is infinitesimal, is it not?—It is very small indeed.

*Chairman*—continued.

with regard to the construction and fitting up of the buildings; thirdly, the description of machinery employed, tools, implements, barrels, tubs, &c., &c. On all those points, technical knowledge is necessary.

467. Will you be kind enough to state your views to the Committee on each of the three points which you have just mentioned?—With regard to the relative positions of the buildings, the special object to be kept in view is to prevent or check the spread of fire or explosions; relative distances should therefore be regulated by the natural features of the ground, the amount of artificial protection, the nature of the operation to be carried on, and the quantity of powder in each house; this question cannot be separated from the next, that is to say, the construction of each building. Under this head must be considered the nature of the operations to be carried on, and consequently whether it is more expedient to provide against danger from within or danger from without. As a general rule, all powder-houses in which the powder is manipulated in the course of the manufacture, should be constructed of light materials, so that if an explosion should occur, fragments could only be projected to a very limited distance. On the other hand, store magazines should be strongly built; brick arched roofs offer the greatest resistance to violence from without, while at the same time this is the weakest form for resisting explosions from within, and that is the best construction. In many cases, in fact in most cases of serious explosions of which I have any knowledge, the spread of a disaster may be traced to insufficient distances between the powder houses, insufficient protection by natural or artificial obstacles, or faulty construction, or all combined. As an illustration of faulty construction, I would

*Chairman*—continued.

I would instance a serious explosion which occurred at Waltham Abbey in the year 1870; that explosion occurred in the press-house, which was built with the adjoining house in the year 1811, or rather they were reconstructed then. The explosion took place in the press-house, and the press-house being built of strong materials, with large heavy rafters, those were projected and fell into the adjoining house, which caused an explosion at once. If the press-house had been built, as it should have been built, of light materials, the probability is that the second house would not have been exploded.

468. Are there any other important omissions in the existing Acts of Parliament to which you would wish to direct the attention of the Committee?—Yes, with regard to the fitting up powder houses; this comprises the exclusion of iron nails; the lining of the walls, to prevent grit falling on the floor; the pasting over the seams between the boards with linen or paper, to keep out dust; covering the floors wholly or partially with hides, &c. By the existing Act, lightning conductors are only required for store magazines; they should also be fitted to mixing-houses, press-houses, granulating-houses, charge-houses, and so on. Then with regard to other omissions in machinery; tools, implements, barrels, and tubs, are not mentioned in the Act. Machinery, if not made by competent manufacturers, skilled in constructing for the special purpose for which it is intended to be used, may be highly dangerous, even if the materials employed are suitable. As a simple illustration, in the safe use of incorporating runners, are involved their diameter, breadth, speed, weight, and a number of other details. I think one of the honourable Members of the Committee asked a question on Tuesday last with regard to an explosion at Waltham Abbey; I rather think the honourable Member had in his mind an explosion of some steam mills in the year 1861. If the Committee wish for information about it I should be glad to give it.

*Mr. Hick.*

469. My question was, whether the cause of that explosion was ever arrived at?—I think that the cause of the explosion was accurately ascertained. With regard to the origin of the explosion, it was simply a want of care on the part of a man as to some powder underneath the runners; but the extension of the explosion was clearly traced to an imperfect arrangement in the mills, so that the fire ran along a shaft communicating to all the mills, and thus the explosion was communicated to all of them instead of being confined to one building. That explosion took place in the year 1861. Of course we have had a very great deal of experience since then.

*Chairman.*

470. You have, no doubt, carefully drawn-up rules and regulations at Waltham Abbey, which are strictly enforced?—Yes, and I have brought copies of those rules and regulations with me (*handing the same to the Committee, vide Appendix*).

471. Are there any points in those rules to which you desire to call the attention of the Committee?—Yes; I think that those rules are, perhaps, more in detail, and are more special than would be required for powder manufactories generally. The essence of these rules is, that

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*Chairman*—continued.

precautions should be taken from the first in all the operations, commencing with the different ingredients, saltpetre and sulphur, from the moment of their purification, and charcoal from the moment of its being ground. No person is allowed to go into any of the houses where any operations are being carried on without having special shoes on. In all the powder-houses every one wears special clothing; that is the essence of the rules; but the rules are stated in detail in the papers which I have handed in.

472. With regard to the existing Acts of Parliament, are you of opinion that they are in some details unnecessarily stringent, and, if so, will you kindly state to the Committee in what details?—Yes, not only so, but they contain several inconsistencies; by referring to Clause 2 of the Act, it will be seen that there is a restriction on the quantities to be milled, pressed, and granulated, dried, &c., and on the additional quantities that may be kept in those houses, but there is no restriction on the mixing, charge, or dusting houses; if the former are included so should the latter be: but a rigid restriction is in most cases useless if not mischievous. The safe milling of any charge must depend on the nature and construction of the machinery, the width, diameter, speed, &c., of the runners, and many other details; also upon the amount of moisture in the mill charge, so that it would not only be safer to work a given charge in one mill than in another, but in two equally good mills it might be safer to work a heavy charge in one mill than a light one in the other; consequently, the laying down of a fixed amount of 50 lbs. or 60 lbs., I think, is not only unnecessary, but mischievous. Again, where large amounts of powder are operated upon, as all the men in the house at the time would probably be sacrificed whether the quantity was 1,000 lbs. or 3,000 lbs., the construction of the building and its neighbourhood to other buildings is of more importance than the quantity of powder, and the machinery is the most important of all. The nature of the ground, the intervening obstacles, whether natural or artificial, are also most important considerations. Again, although the weight of the mill charge is restricted, the manufacturer may place an unlimited number of incorporating mills in the same building. The restriction as to quantity is no doubt designed to prevent the severity and spread of explosions; but if a number of mills are placed under the same roof, it is evident that where an explosion may spread from one to another the restriction as to quantity is useless. I think that the Acts are too rigid and inelastic by laying down fixed regulations with regard to distances between houses. The distances and quantities are laid down without consideration being given to the nature of the ground, and also to artificial screens, such as traverses. To sum up, I think that the law requires amendment by the introduction of broad principles, and by the exclusion of rigid and inelastic regulations in matters of detail. As safe distances depend on the configuration of the ground; as construction of buildings and quantities of material depend on relative position on the nature of the operations; as suitability of the machinery is all important, and cannot be specified in sufficient detail; the grant of a license should be governed by the consideration of the whole of the circumstances, backed by the opinion of a competent adviser.

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473. Are

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473. Are you acquainted with the Nitro-glycerine Act?—I am.

474. Do you consider that that Act requires amendment, and if so, will you kindly state to the Committee in what respects it requires to be amended?—I think that in placing all nitro-glycerine compounds in the same category with liquid nitro-glycerine, the existing Act of Parliament is unnecessarily harsh, stringent, and oppressive to the trade and mining interests. I think that just as there are modifying circumstances in the case of gunpowder works, each explosive requires special regulation, depending on the nature of the substance. I draw a wide distinction between chemical compounds such as gun-cotton, saw-dust-powder, and nitro-glycerine compounds, on the one hand, and gunpowder on the other hand, which is a mere mechanical mixture. Gun-powder, however impure and crude its materials, or even when the proportions are varied, or very carelessly and unskilfully mixed, is a stable

*Chairman—continued.*

substance. A chemical compound depends for its stability on the extent to which the purification has been carried, and also on the manufacture. It is extremely difficult for an inspector to ensure that the requisite amount of purification has been carried out, and even with the best intentions of the manufacturers, dangerous materials may get abroad. Take the case of the great explosion at Stowmarket, in the year 1871. In that case, 13 tons of gun-cotton exploded, and the whole had undoubtedly been carefully manufactured; but after its manufacture, and after it had passed all the tests for purification, some portion of it had been tampered with, and acid had been introduced, which converted a safe into an extremely dangerous material. The result was, as we all know, that active decomposition set in, induced by hot weather, and the whole 13 tons exploded. In fact, the disaster might have extended very much further had not precautions been taken when this explosion occurred.

*Tuesday, 12th May 1874.*

## MEMBERS PRESENT:

Mr. Bell.  
Sir John Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. Laird.  
Mr. M'Lagan.

Colonel North.  
Mr. Edward Stanhope.  
Mr. Vivian.  
Mr. Whitelaw.  
Mr. Whitwell.

VICE ADMIRAL THE RIGHT HON. SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Colonel CHARLES WRIGHT YOUNGHUSBAND, R.A., re-called; and further Examined.

*Chairman.*

475. ON Friday last you were proceeding to state your reasons to the Committee for thinking that gun-cotton and nitro-glycerine explosives should not be regulated by the same rules as gunpowder; will you be good enough to state your reasons?—My principal reason, which I stated, I think, on Friday last, but which I may now repeat, was, that gunpowder is a mere mechanical mixture, and however impure the materials may be, however the proportions may be varied, or however carelessly or unskilfully mixed, or however long the mixture may be kept, no change whatever takes place; it is a perfectly stable material; whereas chemical compounds depend for their stability, to a great extent, on the complete purification of the ingredients, frequently, also, on the exactness of the proportions of those ingredients; this applies to nitro-glycerine compounds as well as to gun-cotton, which I instanced as a material which, though completely purified at the time of manufacture, might be rendered impure subsequently; it was brought out in evidence before the coroner's jury at Stowmarket, that the material had been made impure, and caused a very serious explosion.

476. Which of the two classes do you consider the safer?—That is a question which cannot be answered directly; first of all, because in some respects gun-cotton is safer than the chemical compounds, while in other respects it is not so safe. Gunpowder is safer in one respect, because for stability and consequent safety, it does not require any complete purification, or care, or skill in manufacture. On the other hand, as an instance of careless manufacture rendering the material dangerous, I might instance dynamite, a quantity of which was found in store with the nitro-glycerine running out of it; that was an instance of imperfect manufacture, although the fact of the imperfection was unknown to the manufacturer; of course that was a very dangerous state of things. There is a great difficulty as regards the chemical compounds in being assured that the whole of any large quantity of them are pure; even if samples were taken by an inspector and examined, there would be no

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*Chairman—continued.*

security to him that the whole of the store was equally pure; the decomposition of one portion of the store might determine an explosion of the whole. But all those compounds I have referred to, are safer than gunpowder in this respect; if a barrel of gunpowder were opened in a mining magazine, for instance, and a spark were to accidentally fall into it, we all know that the barrel would certainly explode; on the other hand, any of those chemical compounds that are used under similar circumstances, such as nitro-glycerine compounds or gun-cotton, if such an accident were to happen, the whole would probably burn away without any explosion; we have fired magazines of gun-cotton, containing 6 cwts., without any explosion; the whole has burnt fiercely, but no accident has resulted. At Hastings, two years ago, three magazines of gun-cotton were fired, containing 6 cwts. each; in two instances the magazine burnt down without any explosion; in the third instance, where the gun-cotton was strongly confined in solidly-made boxes, an explosion resulted after a short time. At Llanberis, in Wales, I saw the firing of a magazine of dynamite containing 6 cwts., and it burnt about six minutes without any explosion, and then exploded violently. The dynamite in that instance was packed in strong boxes, to represent the boxes that had been used for gun-cotton. I think it is probable that if the boxes had been of light construction, there would have been no explosion; it is possible at all events. A similar experiment on a small scale was carried out with lithofracteur, another species of nitro-glycerine compound, and with the same result, that is to say, it burnt away without explosion. That is a very material point, as showing in this respect the greater safety of nitro-glycerine compounds over gunpowder. With regard to gun-cotton, gun-cotton may be kept wet, so far as we know, for any length of time perfectly unchanged, and in that state it is quite unflammable, and therefore perfectly safe. Whether it can be used wet for industrial purposes, is another question. For warlike purposes, I believe it is determined to

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use it wet, and also to store it wet. Thus it has this very great advantage over all other explosive materials that we know of.

477. There is some danger in drying it, is there not?—It is not necessary to dry it, but even then the danger extends only to ignition; the way in which it will probably be used, is entirely in its wet state, and it only requires a dry primer to explode it.

478. I think you gave the Committee some information with regard to Government magazine regulations, but I believe you can amplify that and also give some information to the Committee with regard to the conveyance of powder by water?—Yes; I produce a copy of the gunpowder magazine regulations, which do not form part of the rules and regulations of the Waltham Abbey Factory, which I put in the other day; at page 19 are to be found "The Regulations for the Conveyance of Ammunition and Gunpowder by Departmental Vessels." At page 32 of the small book of the regulations at Waltham Abbey, are the regulations for the conveyance of powder by the Waltham Abbey barges.

479. Have you any remarks to make to the Committee on that point?—No, I think not, only to call the attention of the Committee to the precautions taken in the Government vessels used for conveyance of gunpowder.

Mr. M'Logan.

480. I think you have stated that it was necessary to have a gunpowder factory built of light materials; would you be kind enough to specify to the Committee what you mean by light materials?—I said with regard to some buildings it was necessary; I would name incorporating mills, press-houses, granulating-houses, and dusting-houses.

481. What would you call light materials?—The press-houses and the granulating-houses I should build of light wood, framed in an iron-frame; the mills we build now as our latest construction of a frame filled up with a canvas for the back and front and roof, with side walls of brick.

482. I suppose the canvas is rendered quite unflammable?—No, it cannot be rendered unflammable; a quantity of powder-dust unavoidably adheres to it, and though it is our practice to wash down the place completely once a week, still the crevices get filled up with powder-dust.

483. Is there not a risk of explosion from the ingredients of which gunpowder is made before it is really mixed into powder?—Not that I know of.

484. Suppose the saltpetre and sulphur were brought into contact, what would be the result?—They are not brought into contact until the first operation, which is the mixing.

485. Are you aware of any accident having taken place at a gunpowder factory from those two materials being stored under the same roof?—No, I am not aware of any.

486. Do you remember the great fire which took place in Newcastle in the year 1864, which was attended by a great explosion?—No, I was not in England at that time; but I can quite understand that if a fire were to extend to a store of saltpetre, an explosion would result.

487. I believe that the explosion took place from the saltpetre being under the same roof, and the effect of the explosion was felt for 24 miles round?

Mr M'Logan—continued.

—At Waltham Abbey, I may mention, we keep our saltpetre and sulphur in separate stores; the saltpetre stores and also the sulphur stores are brick arched buildings.

488. It is not necessary to have the charcoal in order to get an explosion, is it?—No, I think not.

489. You think that it is perfectly safe to carry gun-cotton in a damp state, do you?—Perfectly.

490. Can you account for the prohibition of the carriage of that material lately by the Government?—It is not prohibited by the Government; on the contrary, the Government has been in communication with some of the railway companies, and the railway companies have agreed to carry wet gun-cotton made by the Government. I think that all the principal railway companies have agreed to it.

491. But not if made by private manufacturers?—I think not, except in the case of the Stowmarket Company, which is the only company making this kind of gun-cotton in England at present, the Great Eastern do carry it for them.

Mr. Hick.

492. I think I understood you to say that gunpowder was more dangerous, and more liable to explosion than nitro-glycerine compounds?—Yes, in some respects.

493. But nitro-glycerine compounds ignite at a much lower temperature than gunpowder, do they not?—Yes.

494. Nitro-glycerine compounds ignite at about 300 degrees, I believe?—Yes, and gunpowder ignites at between 500 and 600 degrees.

495. In the case of ignition by a blow or a fulminate, it would only ignite that in the immediate neighbourhood which was raised up to the temperature, but it would not necessarily explode the whole quantity, would it?—I may illustrate this point by the explosion of a torpedo of gun-cotton, the action of which is similar to that of dynamite. The primer, consisting of one disc of dry gun-cotton, is detonated by the fulminate. The mass of gun-cotton, that is the charge of gun-cotton in connection with it, is immediately exploded by the detonation of the primer. I have seen trains of gun-cotton, dynamite, nitro-glycerine, upwards of 40 feet long, detonated in the open by the explosion of the primer placed at the commencement of the train.

496. Dynamite consists of 75 per cent. of nitro-glycerine, and 25 per cent. of other matter?—Yes.

497. If it is not properly mixed, the nitro-glycerine in dynamite is liable to run out. Now, in the event of its running out, is it as pure as it was before it was used?—Yes, quite. I have several illustrations of the running out of nitro-glycerine, and of variations in the proportion of the ingredients making them dangerous; we had before us three varieties of lithofracteur, a preparation of nitro-glycerine, analogous to dynamite, and they all failed from some cause or other. The first stood all the tests of concussion and a variety of other tests applied to it, very well indeed, but when heated to a temperature that was not above a natural temperature in England, that is to say, from 70 degrees to 100 degrees, which it might be in a railway carriage, for instance, the nitro-glycerine exuded. That substance was replaced by a second description, which stood the heat test which the first

Mr. Hick—continued.

one failed in, but failed when it was subjected to the action of a moist atmosphere. The third description passed the moist atmosphere test, but failed in the heat test. Those were instances of attempts, by varying the proportions of the ingredients, to produce the same results.

498. You said, I think, that a large quantity of nitro-glycerine might be ignited at one point and would not explode, but would continue to burn until all was consumed?—Yes.

499. That would not be the case when treated as dynamite, would it?—Yes, certainly it would; I witnessed an experiment in Wales, when a small quantity of dynamite burnt without any explosion; there was also a magazine containing 6 cwt., which burnt for six minutes before the explosion; but the explosion even then, I think, was caused principally by its being confined in boxes.

Mr. Bell.

500. You did not give a very positive answer to a question addressed to you with regard to the power of explosion between saltpetre and nitrate of potash, and sulphur, or charcoal separately; that is to say, mixed saltpetre and sulphur, or

Mr. Bell—continued.

saltpetre and charcoal; the question put to you was whether those two substances were explosive or not?—I should say that if a store of saltpetre was on fire and allowed to burn, it might eventually cause an explosion; I am supposing the saltpetre is stored with a number of other materials which would cause a large fire.

501. You are aware that what chemists call deflagration would ensue, and not an explosion; a mixture of saltpetre with sulphur would deflagrate, and not explode?—I am aware, of course, that sulphur is not necessarily an ingredient in gunpowder.

502. But as we at present understand the word gunpowder, it is so, is it not?—Yes.

503. You have stated that guncotton when wet is not inflammable, but still it is used in artillery, and I suppose in consequence that it could be used for mines in a damp state?—I fancy the practical difficulty with regard to mines would be, that it is necessary to have a dry primer to initiate the explosion, and that the objection to that complication would make it preferable to use dry guncotton.

Doctor AUGUST DUPRÉ, called in; and Examined.

Chairman.

504. WILL you be kind enough to state what your official connection with the Government is?—I have been for the last year examining many specimens of dynamite, letho-fracteur, guncotton, and other chemical explosives for the Home Office.

505. Have you had otherwise experience with regard to explosives?—Yes; besides my general knowledge of the subject as a scientific chemist, I was one of the chemists called in by the Home Office to assist the coroner and Major Majendie during the inquiry at Stowmarket, and I there had an opportunity of inquiring into the manufacture, storage, and use of gun-cotton on a large scale; I have also attended some experiments on gun-cotton, which were made by the Gun-cotton Committee.

506. I suppose you heard Major Majendie's definition of chemical explosives as distinguished from explosives consisting of mechanical mixtures?—Yes.

507. Do you concur in that definition?—Yes.

508. And do you consider there are any good reasons for making such a distinction?—I think so; gunpowder, for example, is a mechanical mixture of comparatively simple substances, none of which are liable to explode or decompose by themselves; if they are mixed in a careless way in the manufacture or not mixed in the proper proportion, it becomes on the whole rather more safe than it would be if it were perfectly manufactured. On the other hand, chemical explosives are more or less complex compounds, which are, unless perfectly pure, liable to spontaneous decomposition, which under favourable circumstances may end in an explosion; any even slight carelessness in the manufacture, thus renders these explosives highly dangerous.

509. Can you point out to the Committee any impurity likely to be left in the manufacture of these explosives which, if so left, would make

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Chairman—continued.

such explosives dangerous?—Yes; Class 2, the nitro-explosives, are made by the action of nitric and sulphuric acids on an organic substance, and to make them safe it is absolutely necessary that all the acid should be afterwards removed; if any is left behind, the explosive is liable to spontaneous decomposition, which, of course, may produce an explosion under fitting conditions. This removal of the acid is often a very troublesome process, and is not at all unlikely to be shirked or overlooked by the manufacturer; it is, therefore, highly desirable that it should be very closely supervised.

510. Can you give the Committee any instances of such neglect that have come under your own observation?—Yes, many; during last year I examined 29 samples of certain nitro-glycerine explosives for the Home Office, and no less than eight were found to contain acids. To show the value of supervision, I might say that the chemist under whose superintendence those samples were manufactured, not only denied the existence of any acid in any of the samples, but he strongly insisted that it was quite impossible that any acid could remain behind, while ultimately they had to admit that several of their samples were acid.

511. Is there any danger besides spontaneous decomposition to which some of those explosives are liable?—Yes; all explosives containing nitro-glycerine, if they are not properly manufactured, are liable to allow some of their nitro-glycerine to exude, and the nitro-glycerine so exuded is much more dangerous than when it is absorbed by some porous material.

512. Can you give the Committee any instances of that from your own experience?—Yes, I could give the Committee a good many. Out of 32 samples of one kind of nitro-glycerine explosives examined in the first year, no less than 18 showed signs of exudation. In seven of those

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exudation was to a dangerous extent, so much so, that the nitro-glycerine actually ran out of one of the cartridges on opening it. Out of five samples of another kind of nitro-glycerine explosives, four showed signs of exudation, one of them being to a dangerous degree.

513. Why do you attach so much importance to this question of exudation?—Because the liquid nitro-glycerine is a much more dangerous substance than that which is absorbed; so much so, that I do not think liquid nitro-glycerine could be safely used on a large scale. It is more liable to explosion by concussion, and it is much more liable to explosion by spontaneous decomposition, a slight impurity which might make the liquid dangerous, so far as we know at present, would not make the dynamite dangerous; secondly, the liquid is of course more liable to be spilt about, more particularly if the persons think they are dealing with a solid, whereas they are really dealing with a thing which is partly solid and partly liquid. Any substance on which nitro-glycerine is dropped, is liable to explode by heat or by being trodden upon.

514. How does this danger of exudation arise?—It arises first of all from an overcharge of the nitro-glycerine. On the one hand the absorbing power of the various substances used varies, and on the other it is of importance for the strength of the material that it should be charged to its maximum extent; there is, therefore, a great risk for the manufacturers to overcharge it. This nitro-glycerine so added in excess, is afterwards liable to run out. Secondly, some materials which under certain conditions of the atmosphere absorb perfectly, do not do so under other circumstances. At a low temperature they absorb perfectly, but they allow the nitro-glycerine to run out at a higher temperature, which may be the difference between winter and summer; or if the atmosphere is quite dry, the absorption remains perfect, but the liquid may run out if it is exposed to a moist atmosphere. Thus a slight variation in the manufacture would make a safe explosive unsafe. For example, I have had specimens of two kinds of explosives that were to have been imported into England, which on inspection showed signs of exudation, and when analysed, they contained 10 per cent. more of nitro-glycerine than the license sanctioned, and part of it had run out. In this case it was strongly denied that any excess had been used, though it was ultimately admitted that 10 per cent. had been added in excess.

515. Do you think it practicable to place all explosives on the same footing with regard to regulations for their manufacture and storage, and so on?—I think not, unless the regulations are unduly stringent with regard to some of them. Some of those explosives are so very dangerous that they can scarcely be used at all; for example, iodide of nitrogen could not be made on a large scale; some of the fulminates, though less dangerous, yet they require the utmost precaution; compared to these, such a substance as gunpowder is almost harmless. Then again the degree and kind of danger varies considerably; for example, dynamite is more liable to explosion by concussion than gunpowder; on the other hand, if dynamite is set fire to, it may, under certain conditions, burn without exploding if it is not confined; whereas gunpowder always explodes. On

*Chairman*—continued.

the other hand, if we have a large store of dynamite, it may even when unconfined, explode, by simple ignition. Then with regard to dynamite, there is that danger of exudation; there is nothing of the kind in gunpowder or in gun-cotton, therefore I think it would be impossible to frame regulations which would be applicable to all cases without being very unduly stringent with regard to some.

516. There is one more question which I wish to ask you; do you think it practicable to fix by a hard and fast line the distance within which the explosion of a magazine would be dangerous?—I fear that I possess no special knowledge upon that point; but as far as my experience goes, I should say it is not possible, without again being unduly stringent under some circumstances. The danger area would have to be fixed too high. In the case of a magazine above ground on a level plain, the danger area would be much greater than if it was in a valley, or excavated in the side of a hill. I believe, therefore, it would be advisable to some extent to leave the fixing of the distance to the licensing authority, who would inquire into every special case.

*Mr. M'Lagan.*

517. You have stated that the great danger of nitro-glycerine compounds, such as dynamite and others, is the separation of the nitro-glycerine from the rest of the compound?—That is one of the great dangers.

518. Is that nitro-glycerine in a state of mechanical composition, or chemical composition?—Only mechanical.

519. What is the absorbing material?—It varies; in dynamite it is a siliceous or infusorial earth; in lithofracteur it is partly that, partly charcoal, and partly nitrate of barium; in fact, it varies in every case.

520. You speak of lithofracteur; I believe the transit of it has been prohibited in this country, has it not?—I believe so, but I do not know.

521. You do not know whether any lithofracteur has been manufactured in this country?—None has been manufactured in this country.

522. With regard to the experiments that you made with it at Woolwich, was it not found that it was very unsafe on account of the separation of the nitro-glycerine?—Yes.

523. In the experiments with the dynamite class the danger was also in the separation of the nitro-glycerine, was it not?—To a great extent it was.

524. Would you see any reason for forbidding the transit of lithofracteur when it was found that dynamite was just as dangerous, and that the danger arose from the same cause?—I do not think it is quite as dangerous, because the lithofracteur is a much more complex compound, and is much more liable to be affected by variations in temperature, or the moisture of the atmosphere.

525. By its composition it is a more dangerous compound than dynamite, is it?—Yes.

526. Would any decomposition take place in gunpowder, so as to make it more dangerous than it is usually?—No, I think not.

527. You say in nitro-glycerine the danger arises very much from the presence of nitric acid and sulphuric acid together?—Yes.

528. You have the elements of nitric acid, sulphuric



Mr. *McLagan*—continued.

sulphuric acid, in gunpowder; do you think there is no risk of any decomposition taking place so as to make it in any stage more dangerous?—No; because you have no free acid at all; it is the free acid that forms the danger.

529. But is there no possibility of danger from a free acid through the absorption of the oxygen or any other ingredient?—I think not.

Mr. *Bell*.

530. I think you stated that in some of those impure specimens of nitro-glycerine compounds, you had some difficulty in persuading the other chemists of the existence of any free acid?—Yes.

531. But in all inorganic substances there could have been no difficulty about that, could there; you would not have disputed with anyone to three minutes in such a case as that; take a solution of soda and sulphuric acid, you would very soon find whether there was any free acid or not, would you not?—So it would have been in this case, but the chemist was not in London; he denied it on the strength of his general experience of dynamite.

532. You found no difficulty in determining whether the free acid was present or not?—No, certainly not.

533. You and he were not examining the dynamite at the same table together, so that you could compare notes?—No, certainly not.

534. With regard to the exudation of nitro-glycerine from dynamite, you spoke as to the quantity required for saturating this infusorial earth; is there no mechanical difference in the infusorial earth itself?—Yes, no doubt.

535. Which would alter its power of absorption very considerably?—Yes.

536. It would be quite impossible to lay down any rule with regard to the quantity of nitro-glycerine which should be added to a given quantity of the earth, inasmuch as the earth itself varies in the power of absorption?—It is quite impossible.

537. I think you said that it would be quite impossible to frame regulations which would be applicable to all explosives, some being dangerous in one direction and others being dangerous in an entirely different direction; did I rightly understand you to say so?—Quite so.

538. Therefore, of course, it would be still more difficult to frame any regulations which should be applicable to any future discoveries?—Certainly; it would be impossible.

539. And probably in the event of any future discovery making known a new series of explosives, those new explosives ought themselves to be subjected to some examination before they were introduced commercially?—No doubt that should be so.

540. I think you said that you approve generally of Major Majendie's definitions of explosive substances?—Yes.

541. Would you think it desirable in speaking of the third head of his definitions to confine it to chlorates, when they were combined with carbon, or carbonaceous substances?—I think, perhaps, that is an omission.

542. You would consider that sulphur and phosphorus should be included?—Certainly.

543. And in the fulminates it would be scarcely

Mr. *Bell*—continued.

right to confine the definition to substances containing chlorate of potash as an ingredient?—Certainly not.

544. Mr. Whitwell, a Member of the Committee, has handed me a list of questions which I am requested to put to you in his absence; are not all these nitro-explosives of easy decomposition, and liable to change by keeping and exposure to light or damp?—If they are not perfectly pure it is so.

545. Is it easy to ascertain their purity, considering the great variety of materials of complex nature from which they can be made?—It requires considerable care.

546. Is not picric acid, or picric powder, produced by the action of nitric acid on one of the coal tar compound products?—Yes.

547. Are not the fulminates, as a class, produced by the action of nitric acid on alcohol, in presence of certain metals or metallic salts?—They are.

548. Cannot glycerine be made from all animal and all vegetable fats?—Yes.

549. Does the quality depend on the source from which the glycerine is obtainable?—No, I do not think it does.

550. When frozen at about 55° Fahrenheit, is nitro-glycerine, whether liquid or mechanically combined, as in dynamite or similar compositions, more or less sensitive to decomposition than it is at higher temperature?—I should say rather less.

551. With regard to communication of explosions, may they not be caused by detonation, which is defined in Watts' Dictionary of Chemistry as the noise accompanying the sudden decomposition of a compound or mixture of chemical compounds under the influence of heat or electricity?—Yes.

Mr. *Vivian*.

552. With regard to the manufacture of dynamite, is it difficult to manufacture it pure?—It requires great care, I believe.

553. If pure it is comparatively safe, is it not?—Yes, it is.

554. If cartridges were packed in skins, would there be a danger of explosion?—Yes, there would be; at least there might be, because it leaks out of the folds; it exudes through the folds of the wrappers even when closely wound up.

555. Even if they are made of skin?—Even if they are made of skins, if they are folded it leaks out through the folds.

556. After it has been once frozen, is there a danger in thawing it?—Not if it is done with ordinary care.

557. I suppose if done by ordinary workmen, there is some danger?—Yes; no doubt there is some danger, because they are extremely careless.

558. But if properly and carefully manufactured and free from adulteration, dynamite is no more dangerous than ordinary black gunpowder, is it?—In some respects it is more so, in others less.

Chairman.

559. Have you anything further to lay before the Committee upon this subject?—No, I think not.

Dr. *Dupré*.

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Professor FREDERIC AUGUSTUS ABEL, F.R.S., called in; and Examined.

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560. WHAT is the title at Woolwich by which you are known?—I am Chemist to the War Department.

561. You have given special attention to explosive substances with a view to applying appropriate legislation in connection with their manufacture, storage, transport, and use, in their several varieties?—Yes, I have given the subject careful consideration, and especially of late, having been directed by the Secretary of State for War to afford Major Majendie information and assistance in the consideration of these particular points. I will, if the Committee wish it, give the general classification which I consider might be a reasonable one to adopt in the case of those substances. In the first place, I should consider the term gunpowder not merely to include that substance as ordinarily manufactured from saltpetre, sulphur, and charcoal, in various proportions, but I should consider it to embrace every mechanical mixture in which either saltpetre or any other nitrate is mixed with a non-explosive carbonaceous substance, either with the addition of sulphur or a sulphuret, or without the addition of those substances. This embraces naturally a very large number of materials, many of them much less explosive than gunpowder, but still possessing explosive properties, which have been proposed as substitutes for that material. If, however, gunpowder be mixed with any material in however small a quantity, which is in itself explosive, or if it be mixed with chlorate of potash, or other chlorates, that particular preparation would then be excluded from the gunpowder class. In the second class, to which the name of nitro-explosive class might be properly given, I should include any chemical compound possessed of explosive properties which is produced by the action of nitric acid, or a mixture of sulphuric acid with nitric acid, or sulphuric acid with a nitrate of any kind, upon a carbonaceous substance, whether the product thus obtained be used in its pure condition, or whether it be mixed with other non-explosive substances, or other explosive substances containing a sulphuret or a nitrate. If such a nitro-preparation were mixed with a chlorate, it would then be excluded from the nitro-class as being more dangerous than a simple nitro-explosive itself. The third class, which it is a little difficult to separate from the fourth and last class, would be termed the chlorate explosive class, and this class would include any mixture of a chlorate with any form of carbon or carbonaceous substance, whether such substance be explosive or non-explosive, and such mixture might or might not contain sulphur, or a sulphuret, in addition to the carbonaceous material. If the chlorate preparation consisted of a mixture of the chlorate with phosphorus, or contain certain descriptions of phosphorus compounds, with or without the addition of carbonaceous matter; or if it consisted of sulphur, or a sulphuret, either separate or together, but without carbonaceous matter, it would be excluded from this class as being still more dangerous than an ordinary chlorate-preparation, and would come under the next, or fulminate class. In the fourth and last class, which I would term the fulminate class, I would include

*Chairman—continued.*

any chemical compound, or mechanical mixture which, from its great susceptibility to detonation, is suitable for employment in percussion caps, or other appliances for developing detonation, or which from its extreme sensibility to explosion, and from its great instability, that is to say, readiness to undergo decomposition from very slight exciting causes, is especially dangerous. It is evident that this class should contain two sub-divisions; the first sub-division would comprise such compounds as the fulminates of silver, and of mercury, and preparations of those substances such as are used in percussion caps; it would also include those chlorate-preparations which I specified just now. The second sub-division would include such substances as the chloride and the iodide of nitrogen, and certain fulminates known as fulminating gold and silver; and any substance which, in short, possesses at the present time, or is believed to possess, very great instability of character, and is as yet, for that reason, inapplicable to practical purposes.

562. Would you consider the gunpowder class of explosives safer as a class than the nitro-glycerine preparations, first, with regard to their manufacture; secondly, as regards their transport; thirdly, with reference to their storage; and lastly, with regard to their employment?—With regard to their manufacture, something is to be said on both sides. Gunpowder is dangerous from the very first moment when the manufacture has actually commenced; that is to say, from the very period when you begin to mix the ingredients it is an explosive substance, and can only be dealt with properly under special precautions. In the case of dynamite and other nitro-glycerine preparations, the manufacture of the nitro-glycerine is a dangerous operation, and requires very special precautions; and it is in connection with the manufacture of the nitro-glycerine that by far the larger number of accidents which have occurred at dynamite works have arisen; but when once the nitro-glycerine has been prepared and purified, the further operations attending the production of dynamite are, I should say, safer than those attending the concluding operations in the case of gunpowder; the mixing of the liquid, which bears moderately rough handling with safety, with an inert solid substance, and the gradual compression of the mixture into cartridges by very simple mechanical means, are really safe operations in themselves. Then with regard to transport, I should consider that, in small quantities, dynamite would be decidedly safer to transport than gunpowder, unless strict precautions are adopted with the latter. The non-liability to escape from its packages, of dynamite as now made into cartridges, in which condition I distinguish it decidedly from the earlier form of dynamite known a few years ago, constitutes an element of safety. Moreover, the plastic condition of dynamite is also an element of safety. But, in saying that it is safer in small quantities to transport than gunpowder, I must distinctly point out that I mean to imply by this only dynamite perfectly manufactured; that is to say, dynamite resembling in its properties the particular dynamite known as Nobel's No. 1 dynamite,

*Chairman*—continued.

namite, which consists simply of kieselguhr, and such a proportion of nitro-glycerine as has been proved by careful experiments to possess, under ordinary conditions, no liability to exudation. The moment there is a tendency to exudation of nitro-glycerine from the preparation, I should consider it very much more dangerous to transport than gunpowder; in fact, I should consider it almost as dangerous to transport as liquid nitro-glycerine itself. With regard to storage, we have at present but small experience as to the stability of nitro-glycerine-preparations, as compared with our experience of the stability of gunpowder, and, therefore, it is difficult to give a decided opinion with reference to storage as an abstract matter; but, with regard to the possibility of accident, either by fire or carelessness in storage, I should say that a small quantity, say from one to three cwt. of dynamite, would be safer than a small store of gunpowder, because dynamite, being supplied in cartridges is not readily spilt or dusted about a room; it is less readily ignited by sparks, and if ignited in small quantities it burns gradually and does not develop explosions; but, if the store consists of five cwt. or six cwt., then there is very considerable danger of the development of an explosion; that is to say, if the fire reaches the packages of dynamite. That has been proved by actual experience.

563. Do you draw the safety line at two cwt. ?—I do not know that I do, I say a few cwt. In the case referred to by Colonel Younghusband, the explosion was developed by the burning of a magazine containing six cwt.; a considerable portion had already been burnt, when the heat and the pressure of gas, acting together, developed a very violent explosion. If the fire had been limited to two or three boxes of cartridges, these would have simply burnt away without exploding. With regard to its use in ordinary mining operations, dynamite is safer than gunpowder; there is less liability to spilling about and less liability to its being ignited by a spark, and though it is more liable under certain conditions to ignite by concussion than gunpowder, still it will stand safely a very considerable amount of rough usage. There are, however, certain elements of danger in connection with its use, or in connection with its being in the hands of the miners, which do not exist in connection with gunpowder, arising chiefly out of the tendency of nitro-glycerine-preparations to freeze. I formerly believed, with others, because several accidents had occurred especially with frozen nitro-glycerine, that the material in this condition was more sensitive to detonation than when in a liquid state. That was an error, but nevertheless when the material is frozen, it is much more liable to lead to accident for two reasons, first, because the men get a false idea into their heads of the security of the thing, finding that it is less readily exploded, and secondly, because they have to thaw it for use, and in thawing it they are very liable to follow their own notions, which are generally of the crudest description; but even when special precautions with regard to thawing it are taken, accidents occasionally occur, and those may occur especially from any tendency, however slight, to exudation of the nitro-glycerine, which becomes increased if the cartridges have been frozen. In the case of an explosion which recently occurred near Clifton, there was a special apparatus em-

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*Chairman*—continued.

ployed for thawing the nitro-glycerine, which had been arranged, and which was heated, according to directions furnished by those specially conversant with the subject. The cartridges were placed in a metal box which was heated by steam, and it is stated positively that the steam could not raise the contents of the box to a temperature of even 200 degrees, and nevertheless on one occasion a very serious explosion occurred, and this could not be accounted for in any other way, than by the circumstance that some of the nitro-glycerine must have exuded (a very small quantity probably) from the cartridges, and this, by contact with the metal had gradually undergone a chemical change, and developed heat, which change, nursed by the heat, aided by that externally applied, eventually resulted in an explosion. So it is in the freezing of nitro-glycerine preparations that special danger arises, but in other respects I should say that the preparation is comparatively safe in the hands of the miner.

564. Do you consider that a simple system of inspection and testing would be applicable as a safeguard, or to secure the provision of nitro-glycerine preparations possessing the attainable elements of safety?—I think so, and that it would tend very greatly in that direction; it is, in fact, indispensable. The fact that all nitro-glycerine preparations are really indefinite materials, being mixtures of nitro-glycerine in various proportions with the various media used for the purpose of absorbing it, makes them very liable to great variations in composition, and a very slight want of ordinary care in the regulation of the mixture and production of the cartridges may give rise to danger from greater exudation in one case or another; therefore a simple system of test and inspection of cartridges from time to time would be of very great use. Then with regard to the purity of nitro-glycerine, which is vital to the permanence and the safety of those preparations, that can also by the application of a careful test, be ascertained satisfactorily, and a system of inspection in that direction would be a very great safeguard.

565. With regard to gun-cotton and preparations of that substance, how do you consider them to rank in respect to safety as compared with the gunpowder class?—Much that I have said with regard to nitro-glycerine preparations applies here. With regard to the manufacture, if a particular system be followed, that is to say, carrying out the operations in a wet state throughout, the manufacture of gun-cotton is indisputably more safe than that of gunpowder; but if gun-cotton is dealt with in a dry condition, if it is attempted to press it, when dry, into discs, or other shapes, or to deal similarly with preparations of it containing other materials, such as nitrate or chlorate of potash, when in a dry condition, there is much more danger than in the manufacture of gunpowder. In such cases, the period of danger is in the concluding processes, the operations connected with the production and purification of gun-cotton being safe. With regard to transport and storage, much also applies to gun-cotton of what I have said as to nitro-glycerine. The transport in small quantities, I should say, is safer than the transport of powder, because of the comparatively small liability to dust (I now speak of it in the dry condition exclusively,) and because if ignition occurs when there is only a small quantity (two or three

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cwt.) no explosion is developed; but just as in the case of nitro-glycerine, if the quantity exceeds a certain comparatively small limit, ignition must result in detonation. When the quantities are large in a dry state it is more liable to give rise to dangerous accidents than gunpowder. Then with regard to the use of gun-cotton, here again, under certain conditions, gun-cotton is safer than gunpowder, and under other conditions it is more dangerous than gunpowder; it is not like the nitro-glycerine preparations little susceptible to ignition by sparks; it is readily ignited by sparks, but if accidentally ignited in the open air, as would be generally the case in mining, it burns away without developing a violent explosion; it is therefore safer in the hands of a miner than gunpowder. It is more liable to ignition by concussion or friction than powder, and therefore it is more dangerous in that direction. Of course, if gun-cotton be employed in a wet condition, and if it is stored in a wet condition, we have as perfect a degree of safety as can be obtained at present with regard to any explosive agent, inasmuch as there is only one particular inciting cause which can develop a violent explosion of gun-cotton when in this condition. I should state, however, with regard to gun-cotton and nitro-glycerine preparations, and generally, with regard to nitro-preparations of most kinds that they present one element of danger from within which renders their introduction into a particular class, and their treatment with special precautions, necessary. If gunpowder is manufactured imperfectly, the result is merely the production of an indifferent gunpowder; the ingredients are as nearly and absolutely permanent as any similar substance with which we are acquainted; they have no chemical action on each other at ordinary temperatures, and the sulphur in gunpowder, which is the most oxidizable component, undergoes so very slight an oxidation by length of time, as it exists in gunpowder, that the result amounts practically to nothing. Now, in the case of any nitro-preparation, or almost any such preparation, unless the material be purified after preparation with the greatest care, an element of danger may always exist, in the presence of minute quantities of free acid. The existence of traces of the acid used in the preparation of the material, however minute they may be, would always constitute an element of danger; and the exposure of such preparations to heat and to light, if not in a perfectly purified condition, may give rise to charges more or less serious. Therefore, while in the case of a gunpowder manufactory, a man can afford to be comparatively careless in carrying the processes to completion, in the manufacture of nitro-glycerine or gun-cotton he must exercise most absolute care with regard to the complete purification of that which he manufactures.

566. Do you consider the chlorate preparations as a class to be more or less dangerous than the nitro-explosives, that is to say, nitro-glycerine and gun-cotton preparations?—I should consider them more dangerous decidedly as a class; chlorate of potash is a material which in itself is a very violent oxidizing agent; as such, it is more liable than any nitrate to act violently on any substance under a slight incentive, and, therefore, an explosion between the chlorate and the substance with which it is mixed is much more likely to be brought about by friction, percussion, or by heat.

*Chairman*—continued.

567. With regard to explosions at manufactories or stores, do you consider they would be reduced in number or seriousness by proper attention to precautions or regulations of the kind adopted at Government establishments?—Yes; undoubtedly the careful exclusion of dust, and the enforcement of regulations with regard to change of clothing by the workmen, to the wearing of special shoes, at all events, in all cases where dangerous operations are conducted, and the exclusion of iron tools and other implements of any kind, all such precautions must contribute to the diminution of liability to accidents. Those precautions are not merely directly important, but their enforcement is important, morally, as having a great influence on the men, by keeping them constantly alive to the dangerous nature of their employment. No doubt it is difficult in any private works to enforce many of the regulations which are carried out by the Government with the desirable amount of strictness; still, the regulations, amended as far as absolutely necessary, should be adopted at all such works.

568. You consider, therefore, that an efficient system of inspection of factories, and magazines for powder and other explosives, must afford the public great protection?—Certainly. It would, when combined with a system of testing, give important protection, with regard to one particular large class of explosive substances; and, generally, the inspection of magazines, works, and stores of explosives, of any description, must lead to the exercise of care on the part of those who are subject to this inspection. Though such inspection is not likely to prevent many of the small and very lamentable accidents which occur with the miners and others using explosives, still the fact that they will themselves see, when going to the stores, whence the explosive is furnished to them, that special precautions are rigidly adopted, must influence them beneficially.

569. Can you give any definite statement as to safe distance, at which buildings containing particular quantities of gunpowder or other explosives should be placed from each other?—I cannot; it would indeed be inadvisable to lay down any hard and fast rules for the government of such matters. The communication of an explosion from one building to another is due to several causes, or at least may be due to several causes; it may be due to the direct action of flame and heat; it may be due to the projection of ignited substances to an adjacent building, and it may also be due to the communication of the explosion by the direct action of concussion; but in all cases it must greatly depend on local circumstances; it must be regulated by the construction of the buildings, by the existence of impediments such as trees and plantations between the buildings, and also by the configuration of the ground. It would in all cases be necessary in laying out a factory or in determining the distance at which such buildings should exist, to leave great discretionary power to the inspecting officer, who would naturally guide the manufacturer in the arrangement of his works.

*Colonel North.*

570. I will just ask you whether you could lay down a minimum distance?—There is no doubt that certain minimum distances could be fixed, which could be best done by an officer, such as the inspecting officer of the Home Department,

who

Colonel North—continued.

who has great experience in inspecting; but after all, the fixing of such distances would be more or less a rule of thumb matter, and the difficulty would be to fix on a distance which might involve unnecessarily great restrictions in some instances, or insufficient ones in other cases.

571. Would you propose to give power to the inspector, if he thought that one building was too near another, to order it to be pulled down?—I certainly would.

Mr. Vivian.

572. In your first class you put gunpowder, and any nitrate mixed with non-explosive carbonates?—Yes.

573. And in your second class you put nitrates?—Yes.

574. May I suppose from that, that dynamite would be in your second class?—Yes.

575. Would you propose that each class should have its special rules with regard to the manufacture, storage, and transit?—There would be certain general regulations common to the different classes, or at all events to those two classes; but there would also be special regulations necessary with regard to the quantities stored in different buildings, probably with regard to the distance, and probably with regard to construction.

576. The first and second class, I suppose, would be ruled by the same general regulations with reference to storage, transit, and so on?—Yes.

577. You have stated that the ignition of any large quantity of dynamite or guncotton must result in an explosion?—Yes.

578. Would it be so if there was no detonator present of any kind?—Yes, it might be so if there was no detonator present of any kind, and the reason is this: if the mass catches fire, the outer portions in the first instance burn, or the exterior portions of the individual masses; the inner portions of the masses are raised to a very high temperature, and the same kind of action may then be brought about by this heating to a very high temperature, which is brought about suddenly by the action of a detonator.

579. That would not be the case if there were a safe quantity, say five or six cwt., would it?—I should say it ought to be a less quantity than that; but at all events, a small quantity that would be stored in what I should call the expense magazine where the wants of the day must be provided for, would I should say, be a perfectly safe quantity.

580. Would you propose that every magazine, however small, throughout the kingdom should be inspected?—Yes.

581. That is to say, by an inspector under the Home Office appointed for that particular duty?—Yes.

582. Take the case of a mine magazine, could not that be inspected by the inspectors of mines?—That is a matter of detail which I would rather not venture to give an opinion upon; I have no doubt that the inspectors of mines are very intelligent men, and that they could be easily educated to do a certain portion of the inspecting of the works, but I think that the inspectors, generally, should be under the supervision of a highly qualified inspector, who had special education and experience in connection with such explosives.

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Mr. Vivian—continued.

583. But that special knowledge which is required for inspecting a magazine could be easily obtained, could it not?—It could be readily acquired.

584. Would you think it necessary that those magazines which contain, say two tons of gunpowder, should be made of any particular design or construction?—I should think it wrong to tie down the proprietor or constructor to any special design, but I think that certain general features could usefully be laid down with regard to the construction of such buildings, and it would be very desirable that they should be followed as much as possible, such, for example, as an arrangement for either allowing the building to be blown away as easily as possible, or for giving that direction to the force of the explosion, when it occurred, in which the least mischief is likely to result.

585. You gave it as your opinion that No. 1 dynamite, that is to say, pure dynamite, composed of simple kieselgur and a certain quantity of nitro-glycerine, is generally as safe a substance as gunpowder?—Yes.

Mr. Whitelaw.

586. You have mentioned that No. 1 dynamite was not liable to exudation?—No; that is speaking generally; I have seen a considerable quantity of No. 1 dynamite, and I never saw any liability to exudation; of course this depends on the strict carrying out of the patentee's directions in the manufacture of the material.

587. When you spoke of exudation, was it after the thawing that you mean?—Not merely that; I was speaking of nitro-glycerine preparations generally, which vary considerably in composition, and, therefore, in their liability to exude.

588. Do you consider the liability to exude to be greater after it has been thawed?—Yes, it is more liable to exude when thawed after being frozen, especially when repeatedly frozen.

589. Would you suggest that there should be rules to be observed by the miners with regard to the thawing of dynamite?—Undoubtedly there should be very stringent rules, and special means should be provided to be used exclusively for thawing this material.

590. Would you propose that there should be an inspection on that point?—Yes.

591. Have you formed any opinion as to the frequency with which inspections ought to be made?—No.

592. Or of the number of inspectors that would be necessary?—No.

Mr. McLagan.

593. Have you ever known nitro-glycerine to exude from cartridges during its transit from the manufacturer to the consumer?—Personally I have not.

594. Have you ever heard of it?—I do not know that I have.

595. Under what circumstances has it ever been known to exude?—When the cartridges have been exposed to the sun, or when the boxes have been exposed to the heat of the sun, in a warm magazine or near the windows.

596. Do you think it possible for it to exude under the usual circumstances and mode of packing adopted by the manufacturers of dynamite?—I cannot say positively, but I consider that it is very improbable. I am now limiting these opinions to the dynamite known as No. 1, manu-

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factured under the patent of Mr. Nobel. I have not seen any other dynamite yet which has the same freedom from liability to exude.

597. With regard to that particular kind of manufacture, is it manufactured under a patent?—I believe that it is manufactured in Scotland by a company near Glasgow; it is manufactured very largely abroad.

598. Is it under a patent?—Yes, under a patent.

599. Do you think it is possible to prevent that exudation of nitro-glycerine from all the other varieties of dynamites?—It is quite possible, I think; it is a mere question of attention to the proportions of nitro-glycerine used, with regard to the absorbent materials employed. In some cases certain other absorbent materials, or other solid materials, are used in addition to the kieselguhr; they are not absorbents; they are added for other purposes, and of course they diminish the tendency of the total weight of solid matter to retain a given quantity of nitro-glycerine.

600. The great objection to the transit of dynamite is the risk of the nitro-glycerine exuding?—Quite so.

601. Could that objection be overcome by any inspection of the material before it leaves the manufactory?—Yes, I think that might be overcome to a very considerable extent. The manufacturers themselves would naturally adopt such tests as the inspector found efficient for detecting this liability, which would be at once checked thereby, or at all events, would be diminished.

602. You would leave it to the manufacturer, would you?—That is a matter of detail; it is possible to submit the material to inspection on the spot, but whether it is possible to carry out that arrangement officially or not I cannot say.

603. Do not a great part of the accidents occur more from carelessness of the men than from the materials themselves, either in gunpowder or nitro-glycerine or dynamite?—There is no doubt that the far larger number of accidents occur from that cause.

604. Then you think that inspection would be of very little use in cases of that kind, I suppose?—Directly, I think so; in the case of the miners themselves you cannot introduce a system of inspection which would abolish accidents, but indirectly the inspection would have a beneficial influence on them.

605. The truth is that the advantage would lie more in the masters taking more precautions with their servants, is it not?—As far as those accidents go, certainly it would.

606. With regard to inspecting mine magazines, one of the honourable Members asked you how often you would have these inspections, and you said that you could not say; but cannot you give the Committee some idea?—That is a question for the House of Commons to determine; it would be so much a matter of detail that I do not like to give a decided opinion, but I should say that once a quarter, at uncertain dates, would be quite sufficient.

607. Then for a whole quarter the manufactory or the neighbourhood of the mines or the district, they would be liable to a blow up at any time?—I have stated that the inspection, though made once a quarter would be at uncertain periods; one might possibly follow the other immediately.

Mr. *M'Lagan*—continued.

608. If there was a general inspection of all those magazines, manufactories, and so on, would not that entail on the country the expense of a very large number of inspectors?—If it involved the inspection of every small mine magazine no doubt it would, but I should say that a very efficient system of inspection might be organised without a very large and expensive staff.

609. Could you sketch out a plan of such an inspection, and hand it in to the Committee?—No, it is not within my special professional experience.

Mr. *Knowles*.

610. Would you propose to lay down any special rules for the storage of gunpowder for dealers and mine owners?—Yes; I think there are simple general regulations which it would not be difficult to lay down, such as, I believe, are already laid down and followed without any difficulty by the trade in many instances.

611. Are you not aware that in the case of mere dealers they have not magazines at all, but that they stow it in their cottage wherever they can?—I am quite aware that this unfortunately is the case; I think even with regard to small retail dealers there should be certain specific regulations with regard to the storage of gunpowder and other explosives; it would not be difficult for them to provide special small sheds, or even closets specially constructed, in which the materials might be with comparative safety warehoused.

612. Would you insist on having licenses or a registration?—That is a question which I have not considered.

613. Would not it be obviously desirable that all dealers in gunpowder should be registered?—Yes, I think so.

614. If they were registered would you expect any difficulty in the inspection?—No, certainly not.

615. You were asked whether you thought it probable that the mine inspectors could not do the work of inspecting the gunpowder; do not you suppose that those are two distinct occupations?—I am not acquainted with the precise duties of a mine inspector, but I should fancy that his hands are full, and that an inspector of powder magazines would also find plenty of work to do in mines.

616. Now with regard to the times at which the inspection should take place; do you not suppose it would be better to have full and free access at any time to the mines when the inspectors thought proper to go?—Yes, certainly; in saying that the inspection should take place quarterly, I mean that he should also have the power to inspect at any time in addition to that, if he thought it advisable to do so.

Mr. *Hick*.

617. Chlorate of potash is a highly explosive material, is it not?—It is not actually itself explosive, but it is a material that is very easily decomposed, and it explodes readily when associated with oxidisable substances.

618. It is used extensively in making oxygen gas in combination with manganese, is it not?—Yes.

619. In the process of mixing, is it liable to explosion?—No.

620. Suppose

Mr. Hick—continued.

620. Suppose by accident it got mixed with charcoal?—Yes, under that condition it would be altogether dangerous. Manganese is not chemically acted upon by chlorate of potash under ordinary conditions, but charcoal would be readily acted upon, and then you would have at once an explosive mixture.

621. Mixing it with charcoal, for example, it is liable to explosion, is it not?—A mixture of chlorate of potash and charcoal can be ignited by friction, but it is not very readily ignited by friction.

622. In gas so manufactured may not an accident take place from the incautious use of charcoal, and ought not this to have supervision in the same manner as gunpowder?—If you mean in the manufacture of oxygen, it is difficult to say that you might not indirectly trace an explosion to such a cause as you refer to in that manufacture, but the chances would be distant and very rare.

623. Can you tell me at what temperature chlorate of potash ignites or explodes by itself?—By itself it does not ignite at all; it must be in connection with some substance which is greedy of the oxygen which it contains.

624. It would ignite at a much lower temperature, would it not, when mixed?—Yes; it becomes a dangerous substance when mixed with combustible materials.

Mr. Bell.

625. I think you said that nitro-glycerine, when frozen, is, according to the generally received opinion, less explosive than when it is in a liquid state?—Yes.

626. But still the conditions of handling it, and so on, being very different from what they are when it is in a liquid state, you encounter a further cause of danger, do you not?—Yes.

627. For example, I dare say you remember that the Newcastle explosion took place in consequence of the person in charge of the works not being able to get the liquid nitro-glycerine out of a case?—Yes; I remember that distinctly.

628. Not being able to get the liquid glycerine out of the case, the gentleman in question took a spade in order to knock the top of the vessel off, and while doing that, the nitro-glycerine exploded?—Yes.

629. Although nitro-glycerine, when frozen, may be less liable to explode than when it is in the liquid state, it may be under certain circumstances very much more dangerous, is not that so?—Yes, decidedly. The great danger in handling nitro-glycerine preparations in using them, indeed, commences when the material is in a frozen condition, though nitro-glycerine itself is really less liable to ignition by concussion than when it is in its liquid state.

630. When by chance a quantity of liquid nitro-glycerine had dropped out of a bottle on to a bundle of sticks and frozen, it would be in a very dangerous condition to remove, would it not; in fact, you would be afraid to remove the sticks, lest an explosion should ensue from the mechanical disturbance of the mass?—Yes.

631. You have stated that gun-cotton when in a wet state is not dangerous; it would then be very suitable for mining purposes, would it not?—Yes, but there is a practical difficulty in employing gun-cotton in a wet state for mining

Mr. Bell—continued.

purposes, for this reason; when you have gun cotton sufficiently saturated with water to be quite non-inflammable, you require a comparatively large amount of dry gun-cotton, or a larger amount of fulminate of mercury, corresponding to it in power, to develop an explosion, and as the blasting charges are generally small in amount, you would be using a very large proportion of your charge of dry gun-cotton for the purpose of setting fire to a very small quantity of wet.

632. Do you know the relative effect on the health of the inhabitants using gunpowder or gun-cotton, or nitro-glycerine, in mining operations?—I know it from hearsay only; with regard to the gun-cotton used in mines, if there is any possibility of an imperfect explosion, the vapours are undoubtedly more deleterious than those produced by the action of gunpowder; and the same would be the case with regard to nitro-glycerine preparations. Then, in addition to that, some people suffer from the handling of nitro-glycerine, though I believe, and from personal experience consider, that the human system gets used more or less rapidly to the handling of nitro-glycerine, so that after a time it does not produce those bad effects which are at first experienced in some instances. I am always a sufferer the moment I handle nitro-glycerine, but possibly if I daily worked in it I should get accustomed to it.

633. You have mentioned nitro-glycerine as being more dangerous than gunpowder, but I suppose you mean only when exudation takes place?—Yes; I said that in some respects it is decidedly safer.

634. But if exudation were entirely prevented, it would be almost in every respect less dangerous than gunpowder, would it not?—I think so in a very large number of respects, but I must limit that by the questions of quality and quantity. I consider that as soon as nitro-glycerine preparations of any kind, as also gun-cotton preparations, are stored in very large quantities, they are undoubtedly more dangerous than gunpowder.

635. Because more violently explosive, I suppose?—But in addition to that cause of danger, there is the danger which must arise from the possibility of a small quantity of impurity in the material, which it is extremely difficult absolutely to eliminate, even by the most perfect system of manufacture.

636. But, practically, nitro-glycerine, even when impure, and nitro-glycerine as it exists in dynamite, is, for practical purposes, a solid, is it not?—Yes.

637. Then the difference between the liability to danger as between gunpowder and nitro-glycerine consists essentially in the fact that you have elements in the gunpowder which are solid and less exposed, therefore, to motion *inter se*, while in nitro-glycerine you have them in a liquid state, and, therefore, much more liable to spontaneous decomposition?—I should say that it did not depend entirely on the material being in a liquid state, because the question of danger applies equally to gun-cotton, which is solid. The Committee know that nitro-glycerine and gun-cotton, however carefully purified, at best, are liable to contain minute quantities of foreign matters, and some of those are less permanent in character than the explosive itself, and it is owing to the existence of minute quantities of such

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such impurities that the changes that occasionally occur in those explosives are due; it is difficult to remove those minute quantities of foreign matter from nitro-glycerine or gun-cotton preparations generally, and that is the reason why I consider that, as a class, they are in the abstract more dangerous than gunpowder.

638. Therefore, if exudation were entirely suspended, you think that from dynamite you would still be liable to a greater amount of danger than from gunpowder, would you not?—Yes, under the conditions which I have mentioned.

639. Do you consider your definition in No. 4, with regard to fulminates, sufficiently comprehensive so as to take within its bounds any new compound which chemical knowledge may supply us with hereafter?—Yes, I think the last paragraph is as comprehensive as it can well be made. I say there, "The term 'fulminate explosive' to apply to any chemical compound or mechanical mixture, which, from its great susceptibility of detonation, is suitable for employment in percussion caps or other appliances for producing detonation, or which, from its extreme instability, or susceptibility of violent decomposition by concussion or heat, is of specially dangerous character." Without defining in any way the nature of the substance, at the same time I would state that, though it is necessary to have special restrictions and regulations applying to the whole class, it is necessary not to exclude or shut them out from all possible use, because we cannot tell what may occur to render their application practicable.

640. I thought that you do not think that we could make that Section more comprehensive?—

Mr. CHARLES WILLIAM CURTIS, called in; and Examined.

Chairman.

Mr.  
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—

646. You are a partner in the firm of Curtis & Harvey, who are large manufacturers of gunpowder, are they not?—Yes; we are large manufacturers.

647. How long have you been in business?—I have been in business 32 years. My firm were 50 years.

648. Has the necessity for legislation about explosive substances been a subject of consideration with you for some time?—It has.

649. Have you also had before you the recent Government inquiries?—We have.

650. And you have considered this matter, I suppose?—We have.

651. Will you be kind enough to state to the Committee your opinion with regard to the line which you think might be drawn between gunpowder proper and all the other numerous explosives which have of late years been brought before the public?—I would state my opinion, and I believe the same opinion is held by the manufacturers of gunpowder proper, or perhaps, to distinguish it, I would call it black powder (I believe none of the chemical explosives are black). We are of opinion that the manufacture of black powder is so totally different from that of any other explosive referred to that it ought to be carried on under a different law. The first Act of Parliament relating to gunpowder that I am aware of was passed in the reign of George the Third in the year 1772, and it was repealed

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I think that it includes everything which could possibly be included as an explosive.

641. There was a question put by an honourable Member with regard to the storing of saltpetre in large quantities, and in that question reference was made to the dangerous explosion at Newcastle, was it not so?—Yes.

642. Have you any explanation to offer to the Committee with reference to the cause of that explosion?—That explosion, and other explosions of that class, for there was a similar one at Tooley-street, may have been due to several causes. In the first place, the melted saltpetre would come into contact with a large quantity of carbonaceous matter raised to a high temperature, and you then have the inevitable explosive action which must result from such contact; you bring about at a very high temperature, conditions similar to those attending the ignition of gunpowder. Then, again, the oxygen developed by the heating of the saltpetre may give rise to an explosive result on account of its action again on any highly heated oxidisable substance it might meet with.

643. Would you think that the water from the fire engine would in any way help the action on the saltpetre?—No, that would be quite apart, I think.

644. You do not remember, I suppose, the experiments made at the time to show that that possibly was the cause of the explosion?—I did not hear of that.

Chairman.

645. Have you any further observation to address to the Committee?—No, I think not.

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in the year 1860, not so much on account of the gunpowder factories as of a very serious explosion in an ammunition factory at Birmingham in the year 1859. The law of 1860 was arranged with the concurrence of the then superintendent of Waltham Abbey, Colonel Askwith, with whom the manufacturers were in frequent communication, and at that time it was supposed that the requirements with regard to the manufacture, of powder (I am speaking more especially with regard to the manufacture of powder than the storage of it) were sufficient.

652. I gather from what you say that you are of opinion that more or less stringent provisions may be necessary with regard to the manufacture, storage and conveyance of other explosives, but that the same stringency is not necessary in the case of gunpowder proper?—Yes, I do think that.

653. By what definition do you separate gunpowder from those other explosives?—The one I consider a mechanical compound, and the other explosives, so far as I am acquainted with them (but I have not much knowledge of them), are chemical compounds.

654. Your experience is really more with regard to the safety of gunpowder than any special knowledge with reference to any legislation that may be necessary with chemical explosives?—Yes, I have to some extent investigated the chemical compounds; in fact, several



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several of them have been offered to the firm to which I belong, but the investigations which were made did not induce us to take up the manufacture. We have five distinct factories, and these are all exclusively employed in the manufacture of black powder.

655. You do not think that those other explosives should be manufactured in gunpowder factories?—Certainly not.

656. What is your opinion of the present law with regard to gunpowder proper?—My opinion with regard to the present law with reference to gunpowder proper, so far as the manufacture is concerned, is that it seems to meet the necessary requirements.

657. Do you speak of the Gunpowder Act of 1860?—Yes, I speak of the Gunpowder Act of 1860. There are some defects in it doubtless, and some inconsistencies; but I think, with the power under the clause which enables the Government to appoint an inspector, that the manufacture of gunpowder can be safely carried on under the conditions of that law.

658. You are of opinion, I believe, that the old Act of Parliament which was repealed in 1860, and which was in force for 88 years, was never shown to be insufficient?—I have never heard that it was. Of course, I had personally little to do with it, but I have never heard of any special question being raised with regard to the old Act; it was in force, as you have stated, for 88 years.

659. At all events, it was repealed in the year 1860?—Yes.

660. Will you now be kind enough to state to the Committee what, in your opinion, led to the change of the law then?—I believe it was principally in consequence of a very serious accident in an ammunition factory in the year 1859. There were, no doubt, other causes which led to it, but that I believe was the principal cause.

661. Are you opposed to any change whatever in the present Gunpowder Act?—No, not entirely. There are doubtless some changes necessary with regard to the arrangements of storing and keeping gunpowder outside the factories, and there may be some few improvements made in the law with regard to the working of the factories; but my feeling is, and I believe that I express the feeling of the trade generally, that the present law is sufficient, armed as it is by the inspection clause.

662. With regard to what you have stated as representing the trade generally, may the Committee assume that you express the opinions of others as well as yourself in this matter?—Yes; the gunpowder manufacturers knowing that there was a change of the law in contemplation, met together and consulted on this question; and I believe all the manufacturers in the country with whom I have been in communication, share my opinions generally.

663. Then the Committee may look upon you as in some sort the representative of the trade?—Yes; I am.

664. It seems to you that what is required, as an improvement of the present law, would be the appointment of a Government officer, acting under such powers of inspection as the Act of 1860 puts in his hands, to suggest improvements in the manufacture, but you would not desire that officer to be armed with any compulsory power, I suppose?—That is our opinion; we feel that since the inspections of the gunpowder fac-

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ories have taken place many improvements have followed. I may mention that I have no recollection of any inspections taking place under the Act of 1860, until the year 1871, ten or eleven years afterwards; but many improvements have taken place consequent on the law being enforced, and suggestions from the inspectors being adopted. I have had frequent communications with the inspectors, and have (and I believe other members of the trade can say the same) gathered much useful information from their inspections.

665. The manufacturers have frankly adopted the suggestions of the inspectors, have they?—I think so, without hesitation; I admit that there is no power given to enforce their suggestions, but the trade generally have been glad to relieve themselves of responsibility, for their own sakes, and they have generally, if not always, adopted the suggestions of the inspectors.

666. You speak now of the manufacture, and not of the storage?—Yes; I now confine myself to the manufacture of gunpowder.

667. What is your objection to compulsory powers to be exercised by the officers of the Government appointed for the purposes of inspection?—My objection is, that in the first place it would transfer the responsibility from the manufacturers, and the managers of the factories, to the inspectors; one of the great objections to compulsory powers is, that there are so many matters of detail in connection with the manufacture of gunpowder, that to have an arbitrary power given would be very inconvenient and uncalled for. I am not speaking against the present inspectors, but merely against compulsion in the abstract; it is an arbitrary power, and it seems to the trade to be one which would be very much to the disadvantage of the manufacturer without securing greater safety to the public. There are many details in connection with the manufacture which I could scarcely explain to the Committee, although I am most ready to answer all questions; but I think the only way to understand the working of a gunpowder factory is to spend some time in one.

668. You seem to suggest that any additional regulations that may appear to be unmistakably necessary should be made by the statute obligatory, and that it should then be left to the Government inspector to see that the statutory injunctions should be carried out; will you then state what regulations should, in your opinion, be made statutory?—I have not gone into that question deeply, but I am merely showing the Committee that the trade are quite willing to adopt any reasonable regulations that might be made.

669. Do the Committee understand you to say, that the trade think that any statutory regulations should be established which may be unmistakably necessary, and that the Government is to see that they are enforced, and if so would not that be arming the inspectors with compulsory powers?—It would to a certain extent, but the principal objections to compulsory powers being put into the hands of a Government inspector is to prevent interference with the working arrangements of the factories; for instance, the mode of operations, how gunpowder shall be manufactured, how it shall be separated, how sized and glazed; those are points which the trade are anxious should be guarded against undue interference.

670. Have you any general knowledge of other  
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gunpowder factories beside your own in England?—I have seen some of them.

671. Is it your opinion that both the large and small factories are conducted with due regard to safety?—I am of that opinion, and I am confirmed in that opinion by the statement of Major Majendie one day last week, when he was asked, if the suggestions made to the trade had been generally complied with, to which he replied that he had but little to complain of.

672. Do you know the Government works at Waltham Abbey?—I do.

673. Do you think that the general arrangements in private manufactories are as conducive to the public safety as those which are carried out by the Government?—I think that they are. Doubtless there are many different arrangements at Waltham Abbey from those of private factories; but taking them as a whole, I think there is great unity of arrangement.

674. Do you believe that all the manufacturers of gunpowder in these three countries have as perfect arrangements as those at Waltham Abbey?—I think that would be too strong an opinion to give.

675. If Waltham Abbey is superior to many of the factories, would not the greater safety resulting from the arrangements there be something to aim at in any legislation on the subject for other manufactories?—It would to some extent, but in the manufacture of gunpowder by the Government, the cost of re-erection or putting up machinery is not a consideration, but I do not quite go that length with reference to private factories.

676. What incentive is there to the manufacturer to adopt all the necessary precautions for safety?—Their own sense of what the results will be if they do not do so, that an explosion may occur, and when an explosion takes place the loss falls on the manufacturer; this is usually very serious; and it would appear to me (and it is the feeling of the trade) that the more we can prevent accidents the better we shall succeed in our business.

677. Is there any process of insurance applicable to gunpowder factories?—No.

678. Then I gather from what you say, that though some improvements are now, in your opinion, necessary, they are not numerous, and you would rather that any power given to the inspectors should be by way of suggestion than by way of statute?—Yes; I may state that the manufacturers generally have adopted the suggestions made by the inspectors, and I feel sure that they will continue to do so.

679. With regard to the suggestions which have been made, as to the quantities permitted to be present in some of the powder buildings, have you any opinion to express to the Committee on that point?—Yes; in the existing Act of 1860, certain precise quantities are alluded to, and those quantities were arranged with the full concurrence of Colonel Askwith, but there are buildings on gunpowder factories in which it appears to the trade difficult to say exactly what quantity would be a suitable quantity, and a question has arisen between the inspector and the trade upon those points, as to whether in those particular buildings, which are alluded to in Major Majendie's Report, there should not be a limitation of quantity, and the trade still hold to the opinion that, assuming a limitation of quantity was agreed upon, it

is not likely that that limitation would ensure greater safety. The processes which are more particularly referred to in that report are those carried on in the glazing houses and the dusting houses, and there are many circumstances in connection with the glazing and dusting of gunpowder, which at times, but not always, necessitate larger quantities of gunpowder being required in those buildings than might perhaps be considered desirable. I may mention that it is not generally considered that, in the glazing-house or in the dusting-house, there is any extraordinary danger; and the record of accidents will, I think, bear out that conclusion.

680. With regard to the retention of considerable quantities of powder during the process of manufacture, you are of opinion that there is no need for further legislation, are you?—I think not; and certainly not in the departments which I have mentioned.

681. Will you be kind enough to state to the Committee in which departments you think legislation might be advisable?—I cannot suggest any; I think much must be left to the discretion of the manufacturer.

682. With regard to tools, machinery, and implements, what is your opinion with reference to the general condition of the gunpowder manufactories of the country in that respect?—My opinion is, that at one time before inspections took place there were unsuitable tools, and possibly unsuitable machinery; but the inspections during the last three years have materially altered the state of some of the factories; I am of opinion that the factories at the present time are well conducted, and that the tools, implements, and machinery are good and well adapted for the purposes of the trade.

683. You speak generally of the trade, I suppose?—Yes, I have made special inquiry with regard to these points; but, of course, there may be some exceptions.

684. Now with reference to the number of workpeople to be employed in the different factories, and the different portions of the factories, have you any remarks to make to the Committee upon that point?—Questions have arisen between the inspectors and the manufacturers with reference to the number of hands employed in particular buildings, and it was stated on the 8th of May that a limitation of the number of workmen employed in the different buildings would be desirable, and there was mention made by Major Majendie of the number of women employed in certain buildings. Now there is no doubt that at times, in the packing department, there are, possibly 20 to 40 women employed in packing gunpowder; but notwithstanding the number working under one roof, I consider that the precautions adopted in those buildings reduce the risk to a minimum, and that even assuming it was desirable to reduce the number of women to one-half, the fact of doing so would necessitate the re-erection of other buildings, and we are of opinion that the fewer buildings there are on gunpowder factories the better.

685. Is it for the purpose of economy, or for the purpose of safety that you aim at the diminution of the number of buildings?—I cannot say that it is for economy. If any manufacturer thought that by dividing his packing house into two he would create greater safety, I have no doubt it would

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would be done, but I do not myself think that it would create greater safety.

686. You do not think that it would be desirable to limit by law the number of hands to be employed in any given building at any given time?—I do not.

687. When trade is active and there is a large quantity of powder demanded, is the number of hands considerably increased in those buildings?—It is increased to some extent.

688. Are those hands trained and experienced hands, or are they raw hands?—Experience is hardly necessary; carefulness is insisted on; weighing and filling into canisters small quantities of gunpowder does not require great experience, and the other operations of labelling and putting up in paper still less.

689. Now, with regard to the clothing of the workpeople in gunpowder factories, will you be kind enough to state to the Committee what is the ordinary practice in the trade with reference to that point, and also whether you concur in the suggestions which have been made as to the proper inspection of clothing?—I quite concur in the suggestions which have been made with reference to the inspection of clothing, but I think it would be undesirable to lay down a hard-and-fast line by statute. In the factories, certainly, since inspections have taken place, the workpeople now invariably, I believe, change their clothing, and they have proper places assigned for that purpose. The clothing they wear differs according to the weather; in the winter, in some powder buildings which are extremely cold, the men wear thick cloth jackets, generally very old, without buttons or pockets; but in summer, particularly in very hot weather, in powder buildings where there is a great deal of dust, the workpeople are generally almost without clothing. I may say, that on some occasions they work almost naked.

690. I need hardly ask whether there is a separation of the sexes on those occasions?—Yes; I speak now of the granulating houses and stores, in which women do not work.

691. With regard to the employment of children, at what age are children employed in gunpowder factories?—I think the youngest boy we have got on our premises is 16 years old.

692. Is that generally the case in the trade, do you think?—I believe so.

693. So that no very young children are employed?—No.

694. Do the Factory Acts apply to gunpowder factories?—Yes, where there are more than 50 persons employed, and we are under that jurisdiction at four of our factories. The employment of young persons is generally done as a kind of privilege to the workpeople. Many of our hands have been with us for a great number of years. An application is often made by them to us to take their children into our employ, and, if the parents have been respectable and steady, we give their children a chance, and in time they grow up and become workmen themselves.

695. But it is always after they are 16 years of age that you extend to them that privilege?—Yes, they are always over 16.

696. Now, with regard to the rule and regulations of the gunpowder factories, are there, in your opinion, satisfactory and proper means taken to make them known to all the people in the factory, and to enforce their observance?—I

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consider that the rules in all well-conducted factories are well attended to; these are distributed periodically to the workpeople, and they are made acquainted with them. Those in force on our works have been communicated to the inspector, and he approves of them. I have brought up some of the rules which are observed in our establishments (*handing in Papers, vide Appendix*).

697. You made use of the expression just now, "In all well-conducted manufactories," which would lead one to believe that, in your opinion, there are some that are not well conducted?—I beg pardon if I conveyed any such impression, because I have reason to believe that all the manufactories are well conducted at the present moment; I have also brought the rules, showing the arrangements with reference to the press-houses, corning houses, mixing houses on our factories; and there are forms of various kinds which are daily filled up and delivered to the managers of our different factories, to some of which I would also call the special attention of the Committee.

698. With regard to the inspection of the workpeople as they enter the works, what precautions do you take at your factory, and what is the ordinary course of precaution taken in the trade?—A searching takes place in our factory daily; I think it is not carried out daily in every factory, but it is always frequently carried out; and the searching takes place on irregular days, not always on the same day. In our factory, we have searchers at the entrance gate, and the men are carefully examined in every way to see that they have nothing about them which is prohibited; but there are other searchings; one takes place by a female, in the packing houses, when the women come in, and they are always searched again after they return from their meals, because they have their meals in a separate building. The foremen of the different departments also examine the men after they have put on their working clothes, which become very much saturated with the powder dust, to see that they have nothing about them to cause the slightest danger. I understand that the same rule is carried out in other factories.

699. You have not mentioned shoes, have you?—Their shoes are also changed. The manufacturers supply leather shoes to the men, which are made without iron nails, for out-door and in-door use.

700. No iron or steel is admitted, and no knife or needle?—Just so.

701. And, of course, no smoking is allowed?—Smoking is strictly prohibited within our factory. Factories are of large extent; one of ours stands on nearly 200 acres of ground, and smoking within the premises is strictly prohibited.

702. What penalty would be inflicted on a workman bringing in lucifer matches or any other dangerous substance to the factory?—We have the power summarily to take him before the magistrate, but the usual penalty is dismissal.

703. Which is enforced, is it?—Which of course is enforced.

704. I believe you are of opinion that it would be undesirable that in the existing factories there should be any legislative interference with the distribution of the buildings, and the arrangement of the works; but with reference to new

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factories, what do you think would be advisable?—With regard to new buildings in existing factories, there is a difference of opinion between the inspector and ourselves as to the power which ought to be possessed by the inspector with reference to the arrangement of new buildings, or the alteration of old buildings, or in fact the carrying out of any new arrangement in the factory. We think that the public safety is well provided for by leaving the power in the hands of the manufacturer to re-arrange his factory, provided he does so consistently with safety; and the manufacturer ought to be at all times quite ready to receive the suggestions of the inspector as to those changes or alterations. With reference to new factories, the law doubtless could be amended as to the arrangement of buildings. But what I would suggest is, that it should be a matter of suggestion with the inspector; so much depends on local circumstances. In one of our factories, in South Wales, which is situated in a valley, we can arrange the buildings comparatively close to each other, and yet out of sight of each other. On flat ground there are greater difficulties; I object therefore to any hard-and-fast rule with regard to how factories should be laid out, because so much depends on circumstances under which the factory is to be erected.

705. You would also deprecate any interference with the arrangement of the works, I suppose?—Yes, I do, but without any disrespect to the present inspector; but I assume that this new law will be in force for some years, and changes and improvements may suggest themselves; it is therefore desirable to guard against the inspector interfering in the arrangement of the works, with reference to how the different processes should be carried on.

706. Can you give the Committee any information, say over the last 30 or 40 years, with regard to explosions in powder works, and the loss of life occasioned thereby?—I am unable to give the number of accidents which have occurred within the last 40 years, but I am sorry to say that they have been numerous; but, at the same time, there is one fact which I believe I can state without fear of contradiction, which is, that though explosions have taken place inside powder works, persons have never to my knowledge within the last 40 years been injured outside by those explosions.

707. You mean that no persons other than the workpeople have been injured?—Just so; no other person has been injured, I believe.

708. Now, how do you think it would be possible to define the different modes of manufacture by legislation?—I think it would not be practicable at all, there are so many variations depending on the different trades that are carried on. Some factories are almost exclusively occupied in making mining powders, of which there are many kinds, and in those the process is more simple; but when the trade of the factory is general it includes mining powder, export powder, sporting powder, Government powder, and other different kinds of powder; there are upwards of 100 qualities, so that it would be to my mind quite impossible to define any particular way in which this work should be carried on; freedom of action in the management appears to be necessary; the difficulties arising in the manufacture of some powders are very great; pebble powder, for instance, we have had considerable experience in the manufacture of this description

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during the last three or four years, sometimes with success, but I am sorry to say that often we have not been successful; the requirements of the service for large guns are such that pebble powder must be manufactured even in character, even in density, and even in velocity. I may mention that a very large quantity of powder that was contracted for by my firm, was returned upon our hands to be remixed, or re-arranged in some way or other, in order to meet the tests to which it was put by the proof officers. A fixed velocity per second was laid down by the specification; there were occasions when this powder did not attain that velocity by, perhaps, two or three feet per second out of 1,420 feet. It was the same with regard to the pressure of the powder. There are great variations in powder, and in order to reduce the pressure in the breech of the large guns, certain densities must be arrived at. The knowledge of making pebble powder is improving, but there are yet many difficulties to be overcome. I particularly allude to pebble powder, because it is the best means of showing the difficulty of fixing limits in the manufacturing buildings. In mixing pebble powder, and it is the feeling of the trade that it cannot be mixed and arranged without having considerable quantities lying about at the same time. I believe the same difficulties are well known at Waltham Abbey. As to other powders, sporting powder, for instance, the sizes are very much considered in the present day; some sportsmen prefer large-grained powder, and others prefer it finer. There are many circumstances with regard to sporting powder which necessitate a large quantity of powder lying about the factories. I question whether any limitation would secure greater safety, although this part of the trade would be seriously interfered with.

709. Would you be kind enough to state the difficulties which exist in the manufacture of gunpowder, and which you think would be increased by legislative interference?—It is hard to define the difficulties. There are many difficulties which are really only known to a practical powder maker. I am not myself a practical powder maker, although I am constantly at our factories. But I would suggest that the Committee should call up the manager of one of the gunpowder works to give evidence upon that subject. He would explain better than I can the many troubles that he has to contend with.

710. Will you be good enough to state what difficulties, in your opinion, arise from changes of weather, which would be increased by legislative interference?—I will instance two of the processes in the manufacture of gunpowder, one the milling, or the incorporating of the powder. The changes of the weather have considerable effect on the milling of the incorporated charges. For instance, if the weather is very damp and moist, it is quite possible that there may be a good deal of discretion necessary to decide whether the milling shall take a longer time or a shorter time than usual. Also, as to the requirements to which the powder may be put after it is granulated, for some purposes the powder has to be milled rather wet or rather heavy; under other circumstances, it has to be rather light or dry. Then with regard to glazing; I particularly specify glazing, because the glazing-house has been a subject of discussion with the inspector; the inspector is of opinion that the quantities of powder in the glazing-houses should be limited.

I admit

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I admit that it is very desirable to limit, if it can be done; but, unfortunately, there are accumulations arising from time to time in the glazing-house which are very often consequent on changes of the weather. There is a certain quality of blasting gunpowder made of a particular polish to use in damp places, and that particular powder, unless it is properly glazed, will not meet the requirements of the trade. It has possibly to be re-glazed, and it is allowed to remain in the glazing-house, and not removed, merely for convenience, and also, as we maintain, for safety; for that powder if it was taken away and stored in an expense magazine (which are used in gunpowder factories very generally), there would be an additional handling, and we maintain that the less we handle powder the less the risk; that is our opinion as powder makers of long practical experience.

711. Do you think that greater safety would not be obtained by legislative enactments as to control and management?—I think not; I think that the manufacturers are sufficiently alive to their own interests to appoint only good managers. I am aware that there is an instance mentioned in the inspector's report of a factory being carried on under bad management, but I say that must be an exception; the manufacturers are perfectly aware that unless they have good management they cannot carry on their business properly; therefore, I say that the selection of managers should be left entirely in the hands of the manufacturer, and not interfered with by legislative enactments.

712. Are you prepared to state to the Committee that so far as you know there has been one bad management?—I do not know whether I dare make a statement of that kind.

713. But if it were possible that there were more bad managers than one, might not safety be ensured, and perhaps the profit of the manufacturer be ensured also, by some judicious inspection?—It might be so; but no manufacturer would dare to continue employing a bad manager, if the inspector told him that he might be amenable for the consequences.

714. Now with regard to the packing of gunpowder, do you believe that some greater safety might be obtained by a stricter inspection of the process of packing?—Yes, I do.

715. How far would you desire that the law should interfere in that respect?—I think that the law may interfere there very usefully. We have already had a communication with the inspector on this subject, and the trade generally are quite willing to adopt a pattern package such as would be approved by the inspector. There is no doubt that many accidents have taken place from defective packages, and I am sure that the manufacturers generally see the desirability of securing a good and safe package, and that would do away with many other difficulties in connection with the existing law.

716. Does that apply to barrels, boxes, and canisters?—Yes.

717. And every description of package?—And every description of package.

718. Would you think it desirable that all those articles should be approved by a Government officer, or that they should be identical with a pattern to be approved of by the Secretary of State?—Yes.

719. Now, with regard to the mode in which

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*Chairman*—continued.

workpeople take their meals at gunpowder factories, the Committee have heard some evidence that that is an occasion of danger; will you be kind enough to explain to the Committee what is the practice in the trade generally; and also state whether you have any suggestions to make with regard to the enforcement of proper rules and regulations to meet that?—The case which was mentioned by the inspector, I believe, was not one that took place in a gunpowder factory; I believe it was in a cartridge factory. With regard to gunpowder factories, all manufacturers, I think, have proper places called watch-houses, where the men go during the interval of attending to their work, or for their meals. Those places are situated conveniently for the purpose, and are provided with proper protections to the fires, and so on. With regard to the packing women, they also have separate places where they have their meals, and there are persons appointed to attend upon them, so that they need not approach the fire to get their meals cooked. I may state without hesitation, that the trade would willingly see adopted any arrangement by statutory regulation, that such places should be properly constructed, and so on.

720. Do the workpeople ever take their meals in the working portion of the buildings?—Not to my knowledge; certainly not in places where the powder is manufactured or packed, and I have no knowledge of such practices taking place anywhere.

721. Practically, the meals are brought in cooked, I suppose, are they?—No, I think not in all cases; sometimes there are fires and un-cooled ovens in the watch-houses for the men to warm their tea or coffee; it is all done under proper supervision.

722. Are there knives allowed?—There are knives in the watch-houses.

723. The knives never leave those watch-houses, do they?—The knives never leave the watch-houses.

724. Are they the property of the manufacturer, or the property of the workpeople?—In some cases the property of the workpeople, and in others of the manufacturer.

725. But at all events, the knives and forks are retained in the watch-houses by regulations which are enforced?—Yes, certainly, they are retained in the watch-houses by regulations which are enforced.

726. Now with regard to limited, or unlimited buildings, or magazines; have you any observations to make to the Committee on that subject?—Yes, the manufacturers hold rather a strong opinion on that point, because they have expended large sums of money, both in factories and magazines. Having no limit put on the operations in some, it might be considered desirable to limit them, but at the same time it would be doing away with vested rights that exist in factories, and also in magazines; however, I would not offer any decided opinion on that point; I think it is a matter for the consideration of the Committee; there are unlimited magazines at Purfleet, Marchwood, and other Government establishments, containing, of course, very much larger quantities of powder than the private manufacturers' magazines; but, as I have already stated, I am not prepared to offer any very strong opinion upon the subject, except as to interference with our vested rights.

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727. With regard to Purfleet and Marchwood, you would probably say that every precaution is taken that was possible, with regard to the Government magazines?—I believe so; and I may also state that that is so with regard to private magazines, although the quantities are less.

728. Now, with reference to the proposal to make the licenses personal, have you any remarks to offer to the Committee?—That is a new proposal; I think it would be attended with difficulty. Hitherto it has been the practice to license places for gunpowder making and for magazines. A personal license would in a great measure do away with the power that exists in the hands of the manufacturers, with reference to the management and control of existing factories and existing magazines; but if it is considered desirable to make a change, it is a matter which I think might be arranged, but on the face of it we object.

729. You are of opinion, I understand, that the position and structure of the existing works and magazines must be taken as sanctioned by experience and use; but is it so without any limitation; is it your opinion that all the existing works and magazines are so arranged that there might be no necessity for the public safety, or the safety of the workpeople to have some re-arrangement under legislative enactments?—I will not say all; but many of them are sufficiently well arranged to secure the workpeople and the public safety also.

730. But you think there are some that might be improved, and which it is necessary to improve for the public safety, I suppose?—I have not knowledge sufficient to say that I think it is necessary.

731. With regard to new works, how far do you consider that their construction and distribution should be interfered with before giving them licenses; first of all, with reference to the extension of existing works, and, secondly, with regard to the creation of new works?—With reference to existing works, it would be difficult to give a general opinion without seeing all the works. So far as our own works are concerned, I see no necessity to make any change, but at the same time I should not like to be deterred from making a change if hereafter I found a change was desirable.

732. I understand you to say, that with regard to the works, it is necessary that they should be seen, and in that case it is necessary that they should be inspected, is it not?—Yes.

733. Then would you, by enactment, confer on the inspector the power of seeing that the arrangements for the distribution of new works in existing factories were so made as to provide for the public safety and the safety of the workpeople?—I would scarcely propose to give full power to the Government inspector. I think a suggestion and not a positive instruction would be desirable.

734. Do you think it would be desirable that the Government inspector should inspect and suggest in those cases?—Yes.

735. You have stated that in your own case that suggestion would have great influence?—I am sure of it.

736. Do you think it would be so with all the trade?—Yes, with the majority at all events.

737. But with regard to the minority, would it not be desirable that there should be some

power in the hands of the inspector?—I cannot quite speak to that.

738. With regard to the construction and distribution of buildings in entirely new works before granting the new license, do you think that where the safety of the public might be fairly provided for from the beginning, it would be desirable that the inspector should have legislative power to enforce proper arrangements?—I think that would naturally follow if the clause in the existing Act with reference to new magazines were enforced. For new magazines the magistrates grant licenses conditionally, namely,—that there are certain arrangements, not with regard to the quantity so much, as to the position or structural arrangement. I assume that a similar power would be in the hands of the Secretary of State or the justices with respect to new works.

739. With reference to reconstruction in old works, what power would you propose to give to the Government official there?—I should hesitate to give the power which is asked; that is to say, positive prohibition against re-erection. Explosions arise from such extraordinary causes, that the Government official might possibly say, “I think this building should not be re-erected.” Take, for example, the accident at our factory in the year 1869, which was rather a serious explosion. The explosion passed by a building containing powder and did not fire it. There appears to be no rule how accidents will take place, or what the results will be when they do take place. I think the discretion of the manufacturer ought to be taken with regard to the re-erections.

740. You speak of that case rather with reference to the area at the disposal of the manufacturer, I suppose?—This was within a short distance of where the explosion took place. The area is extremely difficult to define; so much depends on whether there are trees, or mounds, or other interruptions.

741. In all cases would you think it best that the reconstruction should take place on the old plan?—Yes; but I would willingly listen to the suggestions of the inspector.

742. Are the old plans of erection in some cases of long existing factories never faulty?—They are sometimes, no doubt.

743. Would it, do you think, be desirable that the manufacturers should submit to the opinion of the inspector for a totally new re-arrangement?—The trade hold a strong opinion to the contrary; but perhaps they might be induced to think otherwise if by suggestion.

744. Would such a re-arrangement and reconstruction frequently damage the property of the manufacturer?—In small factories, I understand that where buildings have been close to each other, and both have exploded, if one was to be taken away, or not allowed to be re-erected, the factory would be useless; but this might also be the case even in larger factories, with a large area at command.

745. Taking the case of such factories as that, would you consider that the public safety, or that of the workpeople might not require some interference?—With reference to the safety of the public, I would assume the danger area outside is a sufficient protection, but as to workpeople, competent management secures their protection without the inspector's interference.

746. But still, even there, you adhere to “suggestion”

*Chairman*—continued.

gestion" rather than compulsion in those cases?—I do.

747. Your opinion in this matter is formed rather with regard to the protection of vested rights than the safety of the workpeople, is it not?—No, I think not, because I stated just now if the inspector pointed out the danger it was corrected, as a rule.

748. By "suggestion," you mean?—Yes.

749. You adhere to the desire that the inspector should have no arbitrary powers, do you?—Yes; he might have increased powers, but arbitrary powers are not desirable.

750. Nor would you, I suppose, give arbitrary powers to the Secretary of State on reference to the inspector?—The Secretary of State, I presume, would be, in practice, the inspector himself.

751. What powers would the trade think a Government inspector should have with regard to searching factories, and making reports upon them, both as to time and place?—With regard to the inspector, or inspectors. I would not limit their powers at all as to searching the factories; I think that clauses 37 to 41 bear on the power of inspection; as to the powers beginning at clause 37, to interfere in the factories, I have already expressed my opinion; but there is a suggestion as to interfering forthwith; of course our opinion is that peremptory interference forthwith is a much greater power than an inspector ought to hold, particularly as in connection with it there is the power of searching under warrant; I would object to that interference more on principle, and not against the present inspector, because I think the present inspector would act as might be wished; but it would be a very serious power to give another man who might not be as competent as Major Majendie.

752. You are aware that clause 40 of the Suggestions runs this: "Licensing authorities to be empowered to appoint searchers to ascertain if the provisions of the Act are duly observed in any premises licensed under a common license within the jurisdiction of such authority; and in the case of harbours, to search ships and barges (as provided in present Gunpowder Act in the case of the Thames)"?—That is with reference to common licenses on which I offer no opinion; but it is with respect to special licenses for searching within the factories which I object to.

753. "Where a matter is urgent, and fraught apparently with serious public danger, an inspector or a 'specially authorised' constable or searcher may make the necessary inquiry or inspection, and take such steps in the way of the seizure of the explosives or otherwise (to be defined by the Act) as may be necessary to remove the risk or source of danger"; you object to that, do you?—We think the power is far greater than it ought to be; it would appear under that power that the head constable at Hounslow might issue a warrant and send one of his constables into our factory, a man perhaps totally unacquainted with gunpowder, to make a search, and possibly create great danger. It would be very difficult to carry out that suggestion, in a gunpowder factory. I believe there were several matters in the evidence of Major Majendie to which I wished to refer, but which I am afraid I am not acquainted with at present, as I was not furnished with either a copy of his report or his suggestion.

*Chairman*—continued.

754. Now with regard to reporting all accidents, in order to provide for the safety of the workpeople, what is your opinion with reference to that provision?—The definition of all accidents is that which we cannot quite see our way to; there is no doubt that under the present law we are not bound to communicate to the inspecting officer the accidents which occur in our factory. We do so if they are serious; but "all accidents" would imply the communication of every accident. We have in our establishments upwards of 600 workpeople, and at the different factories scarcely a day passes without some little accident occurring. A man may cut his finger, or pinch it, or pour hot wax over it, or something of that kind; so that if such a clause was introduced, it would be necessary to define what accidents should be reported. I assume that it is not intended to report all trivial accidents; and as to reporting what might cause an accident, it is difficult to define.

755. Will you be kind enough to give the Committee your opinion with reference to the necessity, or otherwise, for an alteration of the law with respect to trade magazines?—With reference to trade magazines, the present law seems to meet all requirements; they are now inspected, and, I believe, as a rule, that they are well managed. The inspectors, from time to time, have communicated with us, and with other manufacturers. In some cases the magazines have been defective, and in other cases they have been reported upon as satisfactory, but I have reason to think, at the present time, all the trade magazines are in a fair state, and conducted with every care for safety.

756. Can you state, with reference to other countries, what kind of restrictions and supervision are enforced by law; I believe that you have some knowledge of the subject in France and America?—I have been endeavouring to ascertain what the law is in France and America with respect to the manufacture of powder; I was informed that in America, if there is any law at all upon the subject, it is very lax. With regard to the Continent the law there with reference to the manufacture of powder is very different to what it is here; I am not prepared to state what it is at present, but I will endeavour to obtain that information, and if the Committee wish it I will lay it before them on another occasion.

757. Now, with reference to Clause No. 3 in the suggestions of Major Majendie, I believe that you have some observations to offer to the Committee on that Section 3, which runs as follows: "A new Act to be framed to regulate the manufacture, keeping, selling, carrying, and importing of gunpowder, nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances to be named in the Act;" what suggestion have you to make to the Committee on that clause?—I have already stated that the manufacture of black gunpowder ought, in our opinion, to be provided for simply and distinctly from the other explosives which were mentioned by Major Majendie.

758. Would that objection apply to all the provisions being within one Act for all purposes, so long as the sections were arranged to meet different requirements?—If the existing Act was embodied in the new Act of Parliament it would meet the requirements of the trade.

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759. Will you be kind enough to go to the next number in the suggestions of Major Majendie, on which you have any desire to make remarks?—With regard to the personal licenses under Clause 9, I have already expressed my opinion; but with regard to special licenses which, I think, come under the same head, I understood Major Majendie to say that there would be facilities for transfer with consent. I presume it is considered necessary that there should be consent to transfer a gunpowder factory, for instance, under that regulation, but it will affect vested rights.

760. Have you any objection to such a regulation?—Yes, I think we should object to it. On the question of common license, I have nothing to remark, nor on the arrangement for dealing with gunpowder outside the factories.

761. Nor with regard to the licensing authorities, I suppose?—I think not. There was some question raised with regard to arbitration, but I think that the trade are quite willing to leave that in the hands of Parliament.

762. Now turning to point 18 in the summary of suggestions as to the amendment of the law relating to explosives, have you anything to say on that subject?—We are willing, I think, to leave the question of appeal to the Home Secretary as it stands.

763. Then No. 48 suggests, "Heavy punishments to be imposed for a substantial departure from any important condition of license, or for making, or storing, or importing an explosive without a license (where license required), or otherwise than in accordance with the terms of such license, or for wilful neglect or wilful act, tending to endanger life or limb, with power, if the case is tried on indictment, for the court to forfeit a license, except in the case of magazines and factories lawfully existing at the time of the passing of the Act." What have you to say to that?—I think with regard to punishments for offences that cause danger to the public, or for wilful violation of the Act, or for making or storing gunpowder or explosives in unlicensed places, I would not say a word; but these ought to be guarded, because it might be difficult to define what was dangerous to the public, or what was a wilful violation of the Act. I have no immediate suggestion to make however.

764. You think that that section is rather too general?—Just so.

765. But you do not object to the principle, do you?—Not at all; and possibly there ought to be heavier or more suitable penalties than those under the existing Act.

766. Is there any other point on which you would desire to express an opinion?—No, not at present.

*Colonel North*.

767. Did I understand you to say that you considered that there was no necessity for an amendment of this Act of Parliament?—So far as the gunpowder manufacture and trade magazines are concerned, I do not think that there is any general necessity for an amendment of the Act; I admit that there are some defects in the Act, but that a general amendment of the Act to regulate the working of factories and trade magazines would be sufficient.

768. Major Majendie, in his statement, made the greatest possible difference as to some of the manufactories; no doubt many of them, and one

*Colonel North*—continued.

of those is your own, are in a most satisfactory condition, but he gave us some fearful instances to the contrary; for instance, the case of those mad volunteers using the door of a powder magazine as a target, the owner allowing it; and many others. Do you not think cases of that description require some one to look after them?—I quite hold with inspection under such unusual circumstances, but I wish to confine what I say to gunpowder factories; but with reference to the storage of powder outside factories, I quite agree that with regard to such places the inspector ought to have proper power.

769. But Major Majendie spoke not of one or two, but of a number of bad cases; he followed one man into a magazine with a lighted candle, and the men were walking about with iron-nailed shoes on. Then in his report of the last inspection of store magazines, he says here, "nine were considered so bad as to require almost entire re-modelling; only one of those magazines could be considered in a thoroughly satisfactory state, and there the foreman had been employed in the Royal Laboratory, at Devouport; and there are other very bad cases. Then there is the question of the use of improper tools and implements, and the employment of young children. Now, those who conduct their works properly need have no fear of the law, but do you not think that a very much more minute inspection is required than that which exists under the present law?—Store magazines are generally regulated under particular arrangements, but there are thousands of other magazines in the country in connection with mines. I have not had time to acquaint myself with the particulars of Major Majendie's Report, but I believe that since his inspection commenced some three years ago, there is a great difference in their management; the law was not enforced until 1870 or 1871; immediately on Major Majendie's appointment a great improvement took place in all the factories and magazines under his existing powers.

770. Is not that a reason for employing a good many more inspectors; have you not heard in your establishment of cases where the powder was loose on the floor, and the men walking about shod with iron shoes, and so on; do you not remember that in Major Majendie's evidence?—I am afraid that is so in some places, but certainly not in our establishments; but I wish particularly to confine my remarks to manufactories.

*Mr. Vivian*.

771. You say that in your opinion the difference between black powder and other explosives is so great that they ought not to be placed under the same restriction in an Act of Parliament?—Just so.

772. You take one to be a mechanical compound, the other a chemical compound?—Yes.

773. Have there been many accidents with other explosive substances besides black powder?—I have no record of any; but there have been explosions on the Continent, and there was one very serious explosion of gun cotton years ago. With regard to dynamite and lithofracteur, I know but little about them; I have never manufactured them, though the patents have been offered to me. With regard to Schultze's powder, I have very little to say on the subject. There are two other descriptions that I know something about; there is Punshon's patent gunpowder; whether



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whether that is being manufactured now, or not, I cannot say, but I believe there have been attempts to manufacture, and explosions in connection with those attempts.

774. But you think there have been no serious explosions except the one you have named?—Just so.

775. There have been frequent explosions at gunpowder manufactories during that time, have there not?—Yes, there have.

776. Practically the proof of danger in the manufacture would be the number of explosions that took place, having due regard to the quantity manufactured, I suppose?—Possibly, but with due regard to the quantity manufactured, and the number of factories, would be the proper way of arriving at conclusions as to whether there are more accidents in gun cotton, or dynamite, or gunpowder factories; but if the quantities were compared, I am of opinion that there would be a very large balance in favour of black powder.

777. Take the substance known as dynamite, is it not the fact that very large quantities have been manufactured in the United Kingdom of late years?—It is very difficult to ascertain what quantities of dynamite have been manufactured. There is a manufactory in Scotland where, I have heard, there is occasionally large quantities being manufactured, but I do not know of large quantities being consumed.

778. But there have been no explosions, to your knowledge, in the manufacture of dynamite, have there?—There was an explosion at a dynamite factory some time ago, but whether it was in the manufacture of the dynamite, or any other process, I cannot tell you.

779. Was the opinion which you expressed, that gunpowder, and the other explosives, should not be placed under the same restrictions, based on what you have read in the newspaper, or something of that kind?—It is an opinion which we have formed, partly on information obtained with reference to dynamite, which contains a very large quantity of nitro-glycerine. I confess that with regard to anything that is manufactured with a large quantity of nitro-glycerine, I fear it. The exudation that may take place, and the changes that may take place, make it, in my humble opinion, not a safe article to manufacture.

780. Have you anything to do yourself with the manufacture of dynamite, or any other nitro-glycerine substances?—No, no attempt has been made to carry on that trade by me.

781. You would not propose to arm the inspector with any power, however moderate and guarded, in the event of any manufacturer who, unlike yourself, would not take any suggestions which might contribute to the safety of the manufacture of gunpowder?—Just so. I think the first person who suffers is the manufacturer, if an accident occurs, and with the assistance of the inspector and his suggestions, the number of accidents might be materially reduced, and the manufacturer would thereby be benefitted.

782. What harm could result to people like yourself, who are willing to adopt the inspector's suggestions, supposing he had power to enforce them?—At present I see no immediate harm, but my general opinion remains the same, as I shall be placed under stringent regulations and inspections without necessity.

Mr. Vivian—continued.

783. In your opinion, would not the power of appeal, or arbitration, as in the case of the coal mines inspection, be a sufficient safeguard to the manufacturer?—I think that the analogy of the coal mines is scarcely applicable; but it appears to me, that in the event of questions arising between the inspector and the manufacturer, it would be very difficult to appeal to the Secretary of State. Take the question arising with regard to our factory, as to how our working buildings shall be placed, it is not likely that the Secretary of State could come down and arbitrate upon any question in dispute; he would refer the case to his inspector.

784. But if you had powers of arbitration, such as are proposed by Major Majendie, one person being appointed on each side, would not that be a sufficient safeguard to the manufacturer?—I do not quite recollect the suggestion of Major Majendie.

785. He says, at section 38, "If a licensee objects to the inspector's requisition he may (except where the matter is required to be remedied forthwith) object in writing within a certain time, and in that case the matter is to be referred to and decided by arbitration (in manner to be provided by the Act):" and then at clause 44 he says: "Arbitration under the Act to be as in Mines Act, namely, one arbitrator to be appointed by the appellant, the other by the respondent, and the arbitrators to appoint an umpire"?—I assume that that would be only applicable in the event of the inspectors having arbitrary powers to enforce a particular arrangement in the factory; I have already expressed an opinion adverse to arbitrary powers.

786. You are against the inspector having arbitrary powers altogether?—I am against his having those extreme powers. Let him come and inspect the works, but not arbitrarily. The present Act gives him this power.

787. His duties would be confined to suggestions according to your view?—Yes, that is my opinion.

788. Now with regard to the question of clothing. I suppose the real good or chief advantage would be to the survivors in case of their being clothed in a proper way; they would not suffer so much if clothed in flannel as if they were clothed in linen, would they?—We unfortunately at times have men burnt about the arms, and generally speaking, we find that men who wear flannel clothing are only burnt where the skin is exposed; but if with linen clothing, the chances are that they would be burnt more seriously.

789. Would not it be an advantage, do you think, to have your rules and bye-laws sanctioned by the Home Office, for the purpose of securing a conviction before a magistrate in the event of any infringement of them?—I have not considered that point.

790. You are aware that that is the case in our coal mines, are you not?—Yes, personally, I would have no objection (I am not speaking for the trade) to our rules being sanctioned, but not made statutory, because if they were merely sanctioned they could from time to time be revised and improved.

791. Is that the case now?—It is next to that; I put my rules into the hands of the inspectors, but as I desire to have good rules I am quite willing to amend them if necessary, and I think that all manufacturers would be the same.

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792. You spoke of the different kinds of mining powder; is there any difference in their composition and power?—The basis of the composition is the same; they are all made of charcoal, brimstone, and saltpetre; the composition is varied according to circumstances; sometimes a strong blasting powder is required, and the composition is altered accordingly; then with regard to the size of the grain, sometimes it is even larger than a pea or bean, and at other times it is much smaller, but there are a great number of varieties of powder suited to different districts. I may state with regard to mining powders, that miners are extremely prejudiced in favour of a particular powder as to appearance, perhaps, more than strength. A man who has been in the habit of using powder that is coated with black lead would not think of using any other, or *vice versa*; but with regard to the basis on which the powders are made, it is all the same.

793. I meant more especially having regard to the explosive nature of the substances, and the storage of them; are they all equally explosive?—If you refer to black powder, it will not explode unless fire touches it.

794. Do you think that the trade generally would adopt any suggestions from the inspector in the matter of packing?—Yes, I think they would.

795. Would you not give power to the Legislature to enforce good regulations for packing on any one who did not attend to any practical suggestion?—Yes, certainly; I believe that more safety would be secured by good packing than almost anything else.

796. You would give the inspector power in that case, would you?—I think that there might be a statutory power to that effect.

Mr. *Whitelaw*.

797. I daresay you have observed in Major Majendie's evidence that he proposed the limit of the duration of the licenses should be 30 years, or so long as the danger area was not encroached upon; what is your opinion of the danger area?—The danger area is very difficult to define; in fact, I think impossible.

798. But how do you regard that question, speaking as a manufacturer?—With regard to the danger area, so much depends on the locality. A magazine may be in a hollow perfectly safe, with another one close by it, but if it were in an open plain there must be much more distance between the buildings.

799. Would you consider it an advantage to have the right of compulsory purchase of the ground covered by the danger area, as suggested by Major Majendie?—I think I should; I do not ask for it, but I think it would be an advantage to the manufacturer.

800. I understand you to object to the establishment of general rules which would be liable from time to time to be altered by an Order in Council?—I object to that; but as to rules for working the factories, the trade generally would approve of rules sanctioned by the Secretary of State, which would be tantamount to statutory rules.

801. There were special rules proposed by Major Majendie which were to be adopted by each manufacturer, while the Secretary of State should have the power to add to or disallow them; what do you say to that?—I understand the proposal to be, that there should be statutory rules,

Mr. *Whitelaw*—continued.

and also special rules made by the manufacturers, to be approved by the Secretary of State, and, in my opinion, one set of rules would suffice. As a rule, the working men in powder factories are not very good scholars, and the less they have to read the better.

802. I understood you to say, that your firm have a searcher at the entry of the workpeople, and other factories also; if that is so, on what ground do you object to regulations, under an Act of Parliament, to search those people?—I am not aware whether the question applies to a public searcher, or to a private searcher. If the latter, it be made statutory; I think I could state on behalf of my own firm, and I believe on behalf of the trade generally, that there would be no objection raised with regard to that provision.

Mr. *Knowles*.

803. In case of difference of opinion between the inspector and the manufacturer after an explosion, the manufacturer wishing to reconstruct his works, I understood you to say that it might be vital to the manufacturer if he could not reconstruct on the old site, in the event of not being able to obtain another site; and on the other hand, that it might lead to serious consequences if the inspector said it would be unsafe to the public; now, how would you deal with that, except by arbitration?—With regard to the public, I assume that factories generally are placed away from the public, and therefore the public are not as a rule endangered by gunpowder factories.

804. But in some cases the public have come to the factories, have they not; take, for instance, railways, and so on?—Yes; I do not think that the trade ought to object to any reasonable arrangement in such matters.

805. Would the trade object to arbitration if one of the arbitrators was appointed by the trade and one by the inspector, the umpire to be a practical man?—I have not consulted the trade on that point, but on the face of it I see no objection for those particular purposes, namely, whether the works to be reconstructed are dangerous to the public or not.

806. That question would not arise unless the inspection objected, would it?—No, perhaps not.

807. With regard to the trade generally, you speak for yourself, but not for all the members of the trade, do you?—We are in a measure associated together.

808. But it is an exceptional trade, is it not?—There is no doubt it is so.

809. No doubt it is true economy, and all large old established manufacturers know it, to have everything on the safest and best principle; but if the case should arise, as it does in most trades, for the want of capital or from any other cause, the works should not be sufficiently safe, has the inspector sufficient power now, in your opinion, to compel the manufacturer to make the works safe, under the Act of 1860?—I believe that the powers are not quite as wide as the inspector thinks he ought to have; but there were factories, when he commenced his inspections, which were not satisfactory, and which I believe are now satisfactory in their internal arrangements consequent on the pressure put upon them by the inspector under the present law.

810. Are there not some factories which are even not quite satisfactory?—I will not commit myself to that decidedly.

811. Would

Mr. Knowles—continued.

811. Would you say that they are all in a satisfactory state?—I cannot commit myself to that, but I believe that they all are in a satisfactory state.

812. With regard to glazing, I understood you to say you agree with the inspector, that it is better to have a small quantity of powder in the glazing-house, but that that cannot be always practically carried out?—I think I mentioned that, with reference to the glazing-house, it would be very difficult to limit the quantity at the glazing-house for the reasons already given.

813. But could you not limit the quantity, by having an increased number of glazing-houses?—We think that it would increase the risk very greatly. Glazing is not considered a dangerous process.

Mr. Stanhope.

814. Are there many small manufacturers of gunpowder?—I cannot quite say, but there are several. Within the last two or three months, one factory in Scotland has been closed. It was on an estate which is now put up for sale, and the owner thought that the property would sell better without a powder factory on it. There is another factory within a short distance of London which is tantamount to being shut, but there are still several small factories.

815. Are all the small factories in the habit of making rules for their servants and workpeople in order to prevent accidents?—I believe so.

816. You do not know it personally?—Major Majendie has visited all the factories in England, Scotland, and Ireland, not only once, but two or three times, and he is acquainted with all the arrangements that the leading manufacturers have adopted with regard to rules; and where rules had not been established, I believe he has recommended the manufacturers to introduce them.

817. Major Majendie informed the Committee that in many cases they were absurdly inadequate; is that your opinion?—They may not be sufficient for the purpose for which they were intended. I cannot give an opinion upon that; but I think, generally, that the manufacturers themselves are found to have made sufficient rules to meet the requirements of their business.

818. It has been suggested to the Committee as a reason why all manufacturers of gunpowder should be put under the same regulations, that it would be an advantage to all well-conducted works, since now those that do not carry out strict regulations have an unfair advantage in competing with well-conducted houses like your own; do you agree with that opinion?—Yes, it is a proper suggestion, but I personally could not call on the Legislature to make enactments to protect me in that way.

819. You do not attach any importance to that, do you?—No, I think not; those kind of things often cure themselves.

820. You object to limit the quantity of gunpowder in a magazine, because you think it would be an injury to vested interests; was your attention called to the Suggestions made by Major Majendie under head 50. "All occupiers of factories and magazines lawfully existing at the time of the passing of the Act (except as hereinafter named) to be entitled to obtain from the Secretary of State, and without reference to the local authorities, a 'continuing certificate' of

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Mr. Stanhope—continued.

unlimited duration (except to such extent as the duration may be actually limited by any existing license affecting the factory or magazine);" and then again, "The Secretary of State to be empowered to impose conditions in the 'continuing certificate,' and to fix quantities (as the licensing authorities may do in the case of new licenses) except that he may not impose any conditions which would have the effect of requiring the removal of any legally existing work or building, or to diminish the quantities below what the license is at present entitled to have, except that in the case of store magazines for unlimited quantities he may assign as a limit the quantity which the magazine would contain on a given date?—I think I recollect some part of that, but not having the document in my possession I cannot say.

821. Would not that meet the difficulty to some extent?—I understood him to suggest that all buildings now unlimited should by the new law be limited. I assume that means that all buildings on existing factories should be limited.

822. Did you pay any special attention to his suggestions for the protection of vested interests; and do you, in fact, think them adequate?—With regard to the factories, some of the factories have no licenses; for instance, we have factories at Hounslow, one in the parish of Twickenham, and another at Bedfont. In one case the factory is more than 100 years old, and in the other case, namely, Bedfont, the factory was in existence 200 years ago, both before the passing of the Act in 1772. Those factories belonged, until two or three years ago, to the Duke of Northumberland, of whom we bought the freehold; they were in the Northumberland family for over 300 years. We consider that we have vested rights in those factories, and it was to prevent interference with those vested rights that I raised the question with reference to limiting the quantity.

823. You have not paid so much attention to Major Majendie's suggestions as to vested rights, as to be able to say whether they would protect your vested rights or not?—No; they do not.

824. You object to the provision for reporting all accidents to the Secretary of State; would it not be possible to enable the Secretary of State to declare definitely what accidents should be reported to him, and what accidents should not be reported to him?—In that case I see no difficulty, provided they are not trivial accidents, which are occurring day after day.

Mr. Bell.

825. In your mind you have drawn some comparison between the relative danger of carrying on the manufacture of gunpowder and that of nitro-glycerine?—Yes.

826. I think the result of that comparison is that you consider the manufacture of nitro-glycerine a great deal more dangerous than that of gunpowder?—Yes.

827. Was that the reason which influenced you in declining that manufacture at all?—The manufacture of nitro-glycerine was never recommended to us.

828. But you mentioned, I think, that a patent had been offered to you for dynamite?—Yes.

829. Did your belief in the superiority of the danger of the manufacture of dynamite, influence you in the decision that you came to?—Yes, it did very materially.

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830. Perhaps

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Mr. Bell—continued.

830. Perhaps being a gunpowder manufacturer, and being well acquainted with the precautions to be observed in the manufacture of gunpowder, you have no fear?—I will not say that I have no fear, but it is limited fear.

831. Perhaps your unlimited fear, which prevented your undertaking the manufacture of dynamite, might have been unlimited merely for want of the information which you possess with regard to the manufacture of gunpowder?—It might have been prejudice, and I think it was very much so, because nitro-glycerine explosions some years ago were so serious and so frequent, that the impression formed by myself, and my firm, and those whom I consulted, was that no compound in which so large a proportion of nitro-glycerine existed, as existed in dynamite, could be safe.

832. Should you be surprised if a dynamite manufacturer, being as perfectly conversant with that special manufacture as you are with gunpowder, were to tell you that in his opinion the manufacture of gunpowder was much more dangerous than the manufacture of dynamite?—I should not be surprised to hear it; but I decline to give an opinion on the chemical qualities of dynamite.

833. Now, about Legislative interference with packing, would what you said merely refer to the packages themselves, or to the mode of introducing the gunpowder into the factories?—Not to the packing in the factory, but to the packages to be used to prevent the spilling of the gunpowder. Serious accidents have taken place both on board ships, barges, and so on, from the powder being scattered. I think if the packages

Mr. Bell—continued.

were made as perfect as they might be made, many accidents from gunpowder would be prevented.

834. You would not apprehend any great danger from the Legislature interfering so far in a matter of that kind as to diminish the amount of responsibility that manufacturers now conceive rests on their shoulders?—I see no difficulty; manufacturers are desirous of carrying on their trade safely.

Chairman.

835. In a former question which was asked of you as to the application of the Factory Acts to gunpowder factories, you stated that they did apply; but are there not factories in which the limit of 50 workpeople does not obtain, and which, therefore, do not come under the Factory Acts at all?—I think we have one which does not come under the Factory Act.

836. Then there is no inspection in these cases, except the inspection under the Gunpowder Act, is there; I mean no such inspection as the large factories have?—I think that is so.

837. Would not it modify your opinion, and induce you to admit that there are at least some factories which, owing to their small size, do require some more special supervision?—I hesitate to speak for others on such points.

838. Apart from the employment of children of very young ages, and the other abuses which are guarded against by the Factories Act, is it not desirable that there should be some means of specially regulating these small factories?—Of course, I cannot raise any objection to applying the restrictions of the Factories Acts to those small factories.

Friday, 15th May 1874.

## MEMBERS PRESENT :

Mr. Bell.  
Mr. Dillwyn.  
Sir John Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. M'Lagan.  
Colonel North.

Mr. Norwood.  
Sir H. J. Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Vivian.  
Mr. Whitelaw.  
Mr. Whitwell.

VICE ADMIRAL THE RIGHT HONOURABLE SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Mr. CHARLES WILLIAM CURTIS re-called; and further Examined.

Mr. Curtis.

Sir H. J. Selwin-Ibbetson.

839. IN answer to some questions in your examination in chief, you stated that you considered that no change is required in the law, so far as the manufacture of gunpowder is concerned?—I think I stated that there was no serious change required, in my opinion. There are some trifling defects in the law no doubt with regard to the manufacture of gunpowder, but taking it as a whole, I consider it sufficient for the public and the workpeople.

840. In your own words, "it meets the necessary requirements"?—Yes, with some few trifling alterations.

841. But you thought that even those trifling deficiencies could be met by the appointment of inspectors carrying on the present system?—Quite so. I would remark that the present powers of the inspectors appear to me, so far as the manufacturers are concerned, to give sufficient protection to the public and the workpeople.

842. Would you propose now that new factories should be placed under the same conditions, or in the case of new factories, do you think that the system mentioned by Major Majendie should be adopted?—With regard to new factories, I think I might refer to a clause in the existing Act of Parliament, Clause 13, which seems to meet the case. That requires that the licensing authorities should grant licenses provisionally: "The justices licensing the erecting or having of any new mills and other places to be used for or in making gunpowder, or any magazine near thereto, or any magazine for keeping unlimited quantities of gunpowder; and the justices or council licensing any place for the making of loaded percussion caps, or for the making or keeping of ammunition, fireworks, fulminating mercury, or any other explosive preparation or composition, may, if they see fit, grant their license conditionally, upon such precautionary measures being taken and maintained with regard to the structural arrangements of every such mill, magazine, or place, the erection of mounds or screens to separate the same from any inhabited house, and otherwise, as they may deem proper

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Sir H. J. Selwin-Ibbetson—continued.

for diminishing the risk of danger to life by explosions."

843. That would apply to the present issue of licenses, would it not?—Yes.

844. Are you of opinion that the present statutory limits with regard to quantities should be retained?—I think it would be desirable.

845. That is to say, you would propose to continue the limit with regard to working charges of 60 lbs.?—Yes, I think so.

846. The object of the limitation is to prevent accidents, or to limit the effects of accidents, is it not?—I should scarcely say that.

847. Then what do you think is the object of limiting the charges?—That was taken from the original Act of George 3, which allowed 40 lbs., but that quantity was rather small. There were no doubt, in early days, many accidents in mills, arising, perhaps, from the thinness of the material between the runner and the bed not sufficiently keeping them apart. With reference to the danger or safety of larger charges, I would say, without hesitation, that a larger charge even than 60 lbs. would, perhaps, make no difference; it depends very much on the size and construction of the mill and the particular kind of powder that is being made.

848. I think you referred in one of your answers at the last sitting of the Committee to your own factory in South Wales, and you said that owing to the character of the ground you could place the buildings more closely together than if the ground had been perfectly level?—Yes, that is so.

849. From that I may infer that you consider that the situation of the buildings should always have some reference to the local circumstances?—Yes.

850. Is the object of isolating the buildings to prevent the risk of communicating an explosion from one building to another?—Yes.

851. The Committee may assume, I suppose, that the increase of quantity in any building would amount, practically, to very much the same thing as a reduction in the distance?—

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Sir H. J. Selwin-Ibbetson—continued.

Under some circumstances it would, but not under all circumstances.

852. What are the circumstances under which it would not amount, practically, to very much the same thing?—With reference to the area of danger, I do not think that I could give definite information, because so much depends on many circumstances in connection with the explosion. My own feeling is that an explosion may often happen with 50 barrels of gunpowder, and produce quite as serious an effect as if there were 100 barrels. It depends on the building, the state of the wind, and various other circumstances.

853. But do you not think that the quantities assigned to particular buildings ought to bear some reference to the distance of those buildings apart?—No, I do not.

854. Nor any reference to the local circumstances?—There are local circumstances which might justify a limitation; but the effects of accidents are so various, that I am unable to give any opinion as to what might be the effect of so small a quantity as 10 barrels exploding.

855. In the case of the mill charges, the object of limiting the quantity is to prevent communicated explosion; why, then, should the limit be fixed immutably; ought it not to have reference to the distance of the mills from each other?—I do not think it was so. With regard to mill charges, there are various circumstances to be considered; for instance, in the mill charges of sporting powder a great deal of dust is generated in the course of the incorporating process, and the buildings, more or less, become impregnated with it; this dust, in the event of an explosion, might communicate possibly with the adjoining mill; but there are precautionary arrangements adopted by some of the manufacturers. Over the mill runners is placed what is called in our factory a tipping-pan; this pan is connected by either a small shaft or a wire with the adjoining mill. In the event of an explosion in one mill, the tipping-pans in the adjoining mills are released, and the charge which is being incorporated is submerged in water and made harmless. We have tipping-pans in most of our mills, and we find them very effective.

856. Are the Committee to understand that in your evidence you express the unanimous opinion of the trade in desiring to see the present statutory limit for mill charges retained?—I believe that I am expressing the general feeling of the trade, but I cannot commit myself so far as to say that I express the unanimous feeling of the trade. I would respectfully submit to the Committee that other members of the trade should be examined on these questions; I am not prepared to state it more than generally.

857. But are you not aware that some of the makers have strongly expressed an opinion with reference to the desirability of extending the limits?—I am aware that that is so with reference to mill charges in a few instances.

858. There has been considerable difference of opinion in the trade on this point, has there not?—I would not say that there has been considerable difference of opinion, but there has been a slight difference.

859. Has it not been very often held by the makers that with certain construction of mills the present limits are absolutely less safe than larger charges would be?—Yes.

Sir H. J. Selwin-Ibbetson—continued.

860. Is it within your knowledge that in some cases makers have had actually to replace their mills with others of smaller dimensions, or to alter their runners because their existing mills or runners would not safely work the comparatively small charges allowed by the Act?—That is perfectly correct; but I may mention that those manufacturers who have expressed those opinions have had mills constructed specially to work very large charges.

861. But has not the effect been to diminish the production of those factories, or to entail upon the owners an extra cost for building increased mill power?—There is one factory in Scotland where the mills originally put up were very large; and I believe it was necessary, in order to work them safely, that the quantity allowed by the Act should be exceeded. But I am informed that in that factory large mills have been abandoned, and that smaller mills, capable of working the charges prescribed by the Act of Parliament, have been put up.

862. Compared with such factories as your own, where I presume the mills are adapted for working small charges, does not that place those other factories in a less advantageous position than they were in before?—Possibly that may be.

863. You think that those manufacturers acquiesce in your views with regard to the propriety of maintaining the present limit to you?—I believe they do so generally.

864. But I presume that you cannot speak for the whole of the trade on that point, and we may infer that perhaps some of them do not quite agree with you?—That is possible; but I perhaps should say that when the new legislation was thought about in the first instance, the manufacturers associated themselves together, and formed a committee in London to communicate with Major Majendie, and many communications have taken place relative to the new law, and the manufacturers who were not present in London, I think I may say without hesitation, were all agreed that whatever was arranged by that committee with Major Majendie would meet with their sanction.

865. Do you consider that the statutory limits assigned for the press and corning houses are satisfactory in all cases?—Yes, I consider that it is quite satisfactory in all cases. In fact, it is not altogether necessary that the quantities therein named should be taken as the necessary quantities; but in some factories those quantities are desirable, in others less quantities are desirable.

866. Do you not consider that the limits should vary according to the local circumstances in those cases?—I see no objection to that.

867. There are some of the trade, I fancy, who are anxious to have the press-house limit extended, is not that so?—I believe that one or two are.

868. Would you propose to assign the present limits to all new factories, however situated or circumstanced?—I think so; because if the law prescribe particular quantities, I believe the new factories would arrange their machinery accordingly.

869. Can you give any reason to the Committee why the limit fixed for stoves for drying powder should be 50 cwt., whereas while the powder is cooling an extra 50 cwt. may be present?

Sir H. J. Selwin-Ibbetson—continued.

present?—That question was very much discussed in 1860. In one or two factories stoves were standing close to each other, and heated by the same steam apparatus. It was considered at the time that if 50 barrels were allowed to be stoved, and 50 barrels allowed to be cooled, there would be no special danger. With regard to the difference between drying and cooling, I think it is rather an absurdity, if I may say so; because if there is a danger at all, it would be just the same when cooling as when drying.

870. As to the increase of risk, if the whole quantity of 100 cwt. were either all drying or all cooling, would the risk be appreciably increased?—I think not. I think the effect of an explosion, whether it was cooling or drying, would be the same.

871. Then surely, in your opinion, this distinction is not based on any sound reason?—I think not.

872. Would you propose to impose this unreasonable regulation on all new factories?—That is a point in the law which I think might be altered so as to be more consistent. We have had conversations with the inspector, and his opinion was that whether the whole quantity was cooling or drying, it would not materially affect the danger.

873. What is the value of a limit of quantity, if any, where there is no corresponding limit of distance imposed?—I do not see the value either way.

874. Then would the danger be less if three stoves, each containing 50 cwt., were placed together, than if three quantities of 50 cwt. each were all in one stove; would not the explosion of the whole occur in either case?—I should say that if three stoves were placed near to each other heated by the same steam power, if one exploded the whole would explode; that is to say, if they were near to each other.

875. Then is not the limitation of quantities in such cases really worthless?—I think in many buildings the limitation of quantity is not of much value with regard to the safety of the public or the workmen.

876. Yet you would apply those conditions which you consider worthless to the new factories; is that so?—No. I think I admitted that there were some inconsistencies in the Act.

877. This is one of them, and you propose to remedy it, do you?—Yes.

878. With reference to those buildings where the quantities are allowed to be unlimited, such as the glazing and packing houses, I think you say the trade object to any limit being imposed on those buildings?—I do. I think it would be undesirable; there are occasions when it would be very difficult to keep to the particular quantities which might be specified by law. With reference to quantities, I have had some correspondence with Major Majendie on the subject as to our own factories, and if I might be allowed, I should like to read what Major Majendie says, first of all with respect to our factory, and then with regard to the particular points which you have just laid before me; I am now simply referring to the factories which we have at Hounslow and Bedfont, which were inspected by Major Majendie and Captain Smith early in January 1872. The second inspection took place on the 18th of July 1873, the report on

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Sir H. J. Selwin-Ibbetson—continued.

which embodied some suggestions as to the limitation of the quantities in those particular buildings. As the two reports bear on each other, I may perhaps be allowed to read the first. The first letter is written on the 13th of January 1872, and signed by Major Majendie and Captain Smith (who is now dead). These visits were paid to our factories without notice being given. The letter is as follows: "Gentlemen, having completed our inspection of your factories at Hounslow and Bedfont, we think it only right to express our great satisfaction with the arrangements of those establishments, and with the numerous and elaborate precautions adopted for the prevention of accidents, and for the localizing, by means of mounds and isolation of buildings, of the effects of a possible explosion. It is due to you that we should recognise officially the excellence of the system by which the exclusion from the powder and composition buildings of grit, iron, and foreign bodies, which might cause accidents, is secured; and that we should state that we observed no relaxation of these precautions in any part of your extensive factories. We ventured to call your manager's attention to two small points which struck us as admitting of improvements. In one or two of the Bedfont powder buildings we observed that your weighing scales had iron beams and hooks. It would be advisable either to substitute copper for iron in these cases, or to cover the iron-work with leather. The door of one of the charge-houses in the same factory faces a group of mills; it is true that the distance from the mills is considerable, and that the projection of burning fragments to this distance is unlikely; but it would be as well, we think, if you were to place a screen in front of the door of this charge-house to get rid of even the possibility of danger from communicated explosion. Our attention was called to the fact that the store magazines at both factories are within the statutory distance of 140 yards (namely, from 14 to 20 yards short); but we understand that you hold a continuing license for these magazines, granted by the Secretary of State under the 3rd section of the 23 & 24 Vict. c. 139. We have had an opportunity of consulting the report of Colonel Askwith (dated 19th July 1861), on which these certificates were granted, and we concur in the opinion expressed in that Report, that the precautions adopted by you of erecting large substantial mounds of earth afford 'greater security than if the magazines had been simply situated 140 yards from the nearest buildings.' We should feel obliged if you would furnish us with the dates of the licenses. In conclusion, we must not omit to acknowledge the attention and facilities which we received from Mr. Brown, your manager, and from the foremen of the two factories, in carrying out our inspection.—We have the honour to be, gentlemen, your obedient servants, V. D. Majendie, Captain R.A., F. M. Smith, Captain R.A. That was the first Report which we received from Major Majendie. I may mention to the Committee, that the two suggestions, which were contained in this letter were at once attended to. The second letter is dated 18th July 1873, and is as follows: "Home Office, Whitehall, S.W., 18th July 1873. Gentlemen, it will be satisfactory to you to know that the result of my inspection of your gunpowder factories at Hounslow and Bedfont on the 26th and 30th ultimo was confirmatory of the

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the very favourable opinions which the late Captain Smith and I formed on the occasion of our first inspection in 1872. The careful attention to the elimination of known risks, the application of special precautions, the cleanliness of the buildings, and the excellent order which appeared generally to prevail on that occasion, were no less noticeable in the course of the present inspection; while some important improvements have been effected, such as the adoption of a new form of morning report, specially designed to secure a more strict enforcement of the regulations as to no pockets, and the exclusion of dangerous articles, the reduction of the quantities to a low working limit in most of the buildings, and the improved arrangements of the new mixing-house. The one or two minor points which were noticed by Captain Smith and me in our former Report have been attended to, and I understand from Mr. Brown that you have under consideration the question of discontinuing the practice of allowing the semi-worked powder to fall on to the floor in the press and corning houses. I ventured to suggest to Mr. Brown that it would be desirable to place a wire covering over the windows in *the roof* of the mixing house; and, if I am not mistaken, I observed two of the bridges under which powder boats pass, which were unprovided with ledges. These small matters I noticed to Mr. Brown at the time, and they have doubtless been already attended to. There are two other matters of more importance, to which I take this opportunity of calling your attention, because they are points which, although more or less common to the trade at large, attain perhaps more prominence at your extensive works at Hounslow and Bedfont than elsewhere. These points are, first, the serious character of the risk involved in having so large a number of people in one building as exist in your canister packing-room; second, the importance of reducing, as far as practicable, the quantities of powder in those houses, such as dusting and glazing houses, which are not directly regulated by statute: 1. I found in your canister packing-room about 40 women and half a dozen men, with an amount of powder more than sufficient, in the event of an accident, to ensure the destruction of every person in the building. It is right that I should state that the room is exceedingly well conducted, and all risks which can be foreseen are, as far as I can judge, carefully excluded, though in my opinion it would be desirable to require all sweepings of powder from the floor to be at once drowned in water, to avoid the possible (however remote) chance of an accident from the presence of a gritty particle. I have thought that it might be convenient to you if I were to express my opinions on the subject in a separate memo., as it is one of a more or less abstract character, and which affects not merely the factories under consideration in this Report, but, more or less, all those in which the gunpowder is packed in canisters; at the same time the subject is one which demands separate consideration in relation to the circumstances of each particular factory, and on this account it appears to me that it may be more convenient to you to have it treated separate, and then if you assent to the propositions laid down in my memo., that you should consider whether, or to what extent, these principles can be acted upon and applied to particular factories. 2. For

Sir H. J. Selwin-Ibbetson—continued.

a similar reason, I have thrown my remarks on the accumulation of large quantities of powder in glazing and dusting houses into a separate memo., merely observing here that I found in some of those buildings at Hounslow and Bedfont excessively large quantities, *e. g.*, from eight to 12 tons. I do not of course expect that you will be able to come to an immediate decision on these two important points, but I trust that they will appear to you as they do to me, of sufficient importance to merit your prompt and careful consideration. —I have the honour to be, gentlemen, your obedient servant, V. D. Majendie, Major R.A., H.M.'s Inspector of Gunpowder Works." The memoranda attached to this letter are as follows: "Memorandum on the Canister-packing Room of Gunpowder Factories: It would, no doubt, be impossible for a powder manufacturer to carry on the trade of filling, closing, labelling, and packing his canisters with so small a quantity of powder in the building as would afford any reasonable prospect of escape to any of the persons in it; and, therefore, on this point, *viz.*, the limitation of the total quantity of powder, it is unnecessary to say more than that the quantity should be regulated with reference to the prevention of communicated explosion; and with this view should be kept at the lowest limit consistent with the economical and efficient working of the factory. But if it be impossible to work with such reduced quantities of powder as would leave hopes of escape for at least some of the persons engaged in the building, it is the more necessary to take all practicable steps, (*a.*) To diminish the chance of an accident occurring; (*b.*) To expose as few persons as possible to the risk of injury by any given accident. With regard to the former of these points, no pains should be spared to reduce to a minimum the chance of the occurrence of an accident in canister-packing rooms; and with this view, in addition to the more obvious precaution for the exclusion of iron, grit, fire, and dangerous articles, it would be very desirable, if practicable, that all operations which include the handling of loose powder, *i.e.*, the filling of the canisters, should be carried on in a building apart, and by as few women as may be absolutely necessary. But when all has been done that experience and prudence can suggest, and when all known or suspected risks have been carefully guarded against, some risk must still remain; such risks as may arise from the violation or accidental neglect of some of the established precautions; risks from the possible presence of foreign and dangerous substances in the powder itself; and risks to the building from without. A well-conducted well-isolated packing-room is doubtless a building in which the risk of accident may be classed as very low indeed; but it cannot be said that the possibility of such accidents does not exist, and it may be worth while to recall the fact that they are not altogether unknown in the trade, and that on more than one occasion packing rooms have been exposed to no small risk from adjacent explosions and projected burning fragments. (*b.*) If this view be correct, that the risk of an accident in a canister packing room, however carefully minimised, can never be wholly and entirely removed, and if the other view above expressed, that the result of an accident would almost inevitably be fatal to every person in the building



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building be also correct, it follows that it must be of very great importance to reduce the number of persons exposed to the consequences of any single accident to the lowest practicable limit. It must, however, be admitted that the large number of workpeople generally collected in the canister packing room of powder factories, is such as to justify very great anxiety on the subject. The number of workpeople present in a single packing room, and therefore within a single risk, is, in some cases, as many as from 40 to 60. There is really no risk in a gunpowder factory, as far as the consequences of a possible accident go, at all comparable with this. All other powder buildings are worked by at most from five to six persons, often by only three or four, and hence even the most serious and extensive explosions in English gunpowder factories, those in which two or three buildings are involved, have been attended with comparatively slight loss of life; and to this cause is due the fact that accidents in cartridge factories, when they do occur, are frequently far more serious than those in gunpowder factories. But were an accident to occur in one of the large canister-packing rooms, the loss of life would probably, in some cases, be without a parallel in the history of explosions in this country, and this circumstance makes it most important that the arrangement and distribution of every one of these buildings should be carefully considered, and, as far as practicable, modified, on the basis of reducing to the lowest limit the number of workpeople that would be involved in any single accident. The only way in which this can be done is by breaking up single large rooms into two or more smaller ones, sufficiently isolated by distance or mounds from each other to prevent the probability of communicated explosion. Whether the operations be carried on successively in the different rooms, or whether each room comprise a complete and independent packing establishment is a matter of detail, and of comparative importance, except in so far as the separation of the filling (which involves the presence of loose powder) from the other operations is concerned. This, as already explained, should, where practicable, be done; the least possible number of workpeople being employed in filling, as that operation involves the greatest risk. But the broad principle of including as few people as possible in any given risk remains unaffected by such considerations as are involved in its application. One plan may suit one factory, which might be wholly unapplicable to another; but the broad governing principle should, as far as possible, be adopted universally, of superadding to the precautions to prevent accidents, and to prevent the extension of an explosion from one building to another, the further and very important precaution of having as few workpeople as possible within any one given risk, however remote the chance of an accident may appear." The other memorandum is:—  
 "Memorandum on the Accumulation of Powder in Dusting and Glazing Houses: The practice of accumulating, practically, unlimited quantities of powder in the dusting and glazing houses of powder factories, is one which is so entirely at variance with the principle which is generally observed throughout the other parts of the factory, of keeping the quantities down to a definite moderate limit, that it is worth while to consider the argu-

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ments by which it is generally defended. It may be admitted at the outset, that even if practicable, it would not be desirable to lay down one universal line or limit for these houses, for the obvious reason that this quantity should always bear a relation to the position of the houses, and the resulting danger of communicated explosion. It is no question of keeping down the quantity to such a limit as would give any hope of escape to any person within the buildings, for that is impossible; but simply of keeping down the quantity to a limit which would render communicated explosion improbable. The limit must therefore vary for each factory. A quantity which would be prudent and safe in one place, or under one set of local circumstances, would be imprudent and unsafe in another. But if this consideration be admitted, it is clear that it only establishes more forcibly the importance of each manufacturer considering the case on its merits, with reference to the special circumstances of his particular factory, and not merely contenting himself with following the practice of other factories in this matter. The question to be considered, therefore, appears to be whether it is practicable or desirable that each manufacturer should assign for each of his, at present, unlimited buildings, a working limit, based upon the average requirements of the factory, and that this limit should be posted up in the buildings concerned, and only exceeded on the express order, or with the knowledge and express sanction, of the responsible manager, to meet some exceptional case or emergency. It is obvious that if a limit were assigned which would cover all possible emergencies, no inconvenience to the manufacturer could result; and even if a limit to meet the average requirements of the factory were assigned, there would still be no inconvenience if it were distinctly understood that the managers were free on every necessary occasion to increase this limit; and such a system would unquestionably be better than leaving the quantity to the discretion of the workmen, who clearly can have no direct personal interest in keeping down the quantities, since any such limitation of quantities in no way affects their personal safety. But it seems desirable that the system should be pushed further than this, and that a real attempt should be made to reduce the quantities, which now sometimes rise to 10 or 12 tons, within moderate limits. This can probably only be done by adopting one or both of the following expedients, according to circumstances, viz., removing the operation of heading up, or any other operations which may be performed in these houses to separate buildings, and establishing expense magazines in convenient connection with the unregulated houses. Against this suggestion it is sometimes urged that the risk would be really increased instead of diminished by (a) the reduction of distances which the establishment of fresh houses would entail; (b) the more frequent moving of powder. With regard to point (a), it may be conceded that in certain cases this argument would have weight, though in very few cases could it weigh against the establishment of expense magazines, made, as they easily might be made, absolutely secure against explosion from without, even at a moderately short distance, and in which, if properly conducted, the risk from within would be sensibly less than the risk in a working building. However, this is just one of those points

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which if it cannot be replied to on abstract grounds, cannot be fairly put forward on such grounds. In other words, the point is essentially one which would have to be considered separately with reference to the local conditions of each factory. With regard to point (b.), although the truth of the axiom that the less you move powder the better may be conceded, the argument which it is sometimes sought to deduce from this axiom, cannot prevail against the proposed system, unless it can be shown that the risk of the extra removal which that system would involve, would be greater than the working risks to which the powder in question is at present exposed. Now it is worthy of notice in connection with this point, that the governing principle in the other parts of the factory is to diminish the quantity of powder within any given working risk at the expense of more constant removal. The limitation of quantities in the press and corning houses, for example, is based, in fact, upon the principle that there is less risk in frequently removing the powder to and from those houses than in allowing it to accumulate within them. It is fair then to ask why this principle should cease to apply in the case of dusting and glazing houses. The only answer which could probably be given, would be that working risks in dusting and glazing houses are less than those in the press and corning houses, a point which may be admitted, but to which two rejoinders suggest themselves, viz., first, that the operations of glazing and dusting are certainly by no means free from risk, as is clear from the fact that at least four accidents, involving the loss of 15 lives, are recorded by the late Captain Smith, as having occurred in these houses; secondly, that if the point is to be solved by a balance of risks, it will hardly be disputed that the removal of powder from one working building to another, or into a secure expense magazine, entails a less risk than that which necessarily attaches to the working or handling of that powder, whatever the operation may be, less even than that which attaches to the packing of the powder. The Magazine Committee, of which the late Sir John Burgoyne was President, in tabulating the various risks in their order of importance, reported, as follows: 'The greatest danger lies in the manufacture of the powder; the next in the examination, packings, and other dealings with it in the grain; thirdly, in its removal and transport; and the least risk is while it is in deposit in a good magazine.' (First Report of Magazine Committee, p. 4.) If this opinion be correct, and it has the sanction of several officers of great experience in this matter, including the late superintendents of the Royal Gunpowder Factory and Royal Laboratory, it follows that it must be sound in principle, and, except under very special circumstances, safe in practice to expose as little powder as practicable to any given working risks, and by preference to sub-divide the working risks, to keep so much of the powder as may not actually be undergoing dusting, glazing, packing, or other operation of handling, in safe deposit in an expense magazine. The present practice too often amounts to the use of the dusting or glazing-houses themselves as expense magazines, to say nothing of the fact that the packing of the powder is, in the majority of cases, carried on in the dusting-houses. The result is the accumulation within these houses

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of an immense quantity of powder, such as is not to be found and would not be permitted in any other part of the factory except in the magazines; a quantity which is too often only limited by the capacity of the house or by the discretion or convenience of workmen, who have no direct interest in observing a low limit. The whole of this powder is, during working hours, within the risks, such as they are, which attach to the operations that are performed in these houses, and as there is no obligation imposed upon the manufacturer to keep these houses at a safe and sufficient distance from the other working buildings, the result in too many instances is that the risk from these unregulated buildings compromises in a greater or less degree the safety of the rest of the factory, or of a great part of it. The object of this Memorandum is to recommend the adoption of a safer system, viz., first, the assignment of manufacturing limits of quantity to be posted up in the buildings concerned; second, the sub-division of the working risks; and, third, the establishment of safe places of deposit for such of the powder as is not actually in process of manufacture. In other words, a more strict and faithful compliance with the spirit and letter of the Act, which limits the quantity of powder in such buildings to what is necessary for the immediate supply and work of such house."

879. In the second Memorandum it was brought to your notice by the inspector that larger quantities of powder than he thought, from his knowledge of the subject, were safe to be kept in places of this kind, were so stored. Has any notice been taken of that recommendation, and has any reduction taken place of those amounts in the glazing and packing houses?—I quite admit that the remarks which are made in this paper, and also the conversations which I have had with Major Majendie, have led to a diminution of the quantity; but at times there are larger quantities in those buildings than at others. In my last examination I gave one or two reasons why accumulations take place in those houses, and it is on that account that I would still urge, having due regard to the removal of the powder as quickly as possible, that in those buildings the quantity should not be defined.

880. Do you think that you speak the opinion of the trade with regard to that point?—I may say on behalf of the trade that we have most carefully discussed the question of limitation in those buildings, and we agree that limiting the quantity appears to us next to impossible.

881. Yet you admit in the first instance that the inspector is right in stating that the increase of quantities tends very much to increase the danger?—I scarcely admit that, because it bears more on the question of what the explosion might do in other buildings than in the building itself, because the men, as Major Majendie says, have no chance of escape.

882. I understood you to say that the size of the buildings and the number of the people employed were two elements of danger?—I do not know whether you allude to the packing house, or whether you allude to the glazing or dusting houses.

883. I have been examining you on the glazing and packing houses, and my questions still refer to those houses; what do you say with respect to both?—With regard to the glazing house, it is a building

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building where the workpeople are few, one or two at most; the process is simple; a quantity of powder which has to be glazed is taken into the house by one or two men; it is placed in barrels; those barrels are driven sometimes by water and sometimes by steam power, and will continue to revolve for 12, 14, 18, or 20 hours, and require but little attention. With reference to the dusting-house, there are more persons employed in dusting, separating, and heading up the powder. It has certainly been a question between the inspector and myself as to whether the dusting and heading-up ought to take place in the same building. With reference to some places these processes can be separated, but there are factories where I think the separation would perhaps lead to greater danger than if it was all done under one roof.

884. But I believe the inspector has represented to the trade his objection to this state of things?—Yes.

885. Has the trade generally yielded to those representations on the part of the inspector?—I believe that the trade hold very much the same opinion as I do as to those particular buildings.

886. The trade are themselves in each particular case the arbiters of what conditions they will apply, are they not?—With respect to quantities they are.

887. And with reference to the safety that is to be the result of those quantities?—I think if explosions occur the manufacturer is the unfortunate sufferer in the first instance.

888. But surely if the inspector had the power suggested by Major Majendie, and the subject was referred to arbitration afterwards, the result of the arbitration would be more likely to be favourable to the trade than otherwise, would it not?—There is a difficulty in arbitrating on the manufacture of gunpowder, because there are so many circumstances in connection with the manufacture which must cause varied and great difficulties in enabling the arbitrator to come to a decision.

889. But when we are dealing with the safety of the public, an independent arbitrator is perhaps as fair an interpretation of what is safe for the public as the manufacturer himself?—With reference to the safety of the public, I would assume that the manufactories are placed in such a position that they are not dangerous to the public. I stated in my previous examination that there is no known loss of life from an explosion inside a factory to anyone outside a factory within the last 40 years, as far as I have been able to gather.

890. But surely some gunpowder factories are not in a condition that would render it impossible that the public outside should be injured by an explosion taking place inside the factory; are they?—I have heard that some factories are not well situated in that respect.

891. Now, there is a factory in Scotland that you know very well, is there not?—I know our own factory there.

892. Are you not aware that there is there a close proximity of the magazine to other buildings and to the working men's houses?—Yes; I have before me a report by Major Majendie, which, if the Committee think fit, I will read or put in. The factory is situated in an outlying valley in the Highlands of Scotland.

893. Is there not one place in which that

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Scotch factory abuts almost on the highway?—There is a public road passing it, but very little used by the public.

894. Was not there one instance with reference to that very factory which might have been injurious to the public, of an open space leading into the factory in a wall that nearly abutted on that road?—I believe the case that was mentioned is this: we have a magazine, described as an expense magazine; that magazine was within two or three yards of the road; the back of it close to the road, has a window, and that window had no protection over it; Major Majendie brought the matter under our attention, and he suggested certain alterations which have been made. I believe that this expense magazine could not be fired by anyone outside.

895. My object was not to reflect at all upon your manufactory, or to suggest that you would not have done what you did, but might it not be a valuable thing for the safety of the public that the inspector should have power to enforce needful changes, supposing the manufacturer did not attend to the inspector's instructions?—I cannot say a word against powers of that kind, if the public are likely to be endangered.

896. In cases of that kind, or in many others that one might name, the power to inspect which is sought by Major Majendie would be a very valuable protection to the public, would it not?—There is power to some extent now.

897. The inspector has only a power of recommendation, and the public are at the mercy of an individual manufacturer to adopt or refuse to adopt it, is not that so?—I think that the manufacturers, as far as I have heard, have adopted the inspector's suggestions.

898. Very probably; but is it not desirable to give greater power to the inspector in that respect?—I think that guarded power might doubtless be given to the inspector.

899. I think, on Tuesday, you stated in answer to Questions 696 and 697, that you believed all well-conducted gunpowder factories are now properly conducted and provided with sufficient rules?—Yes, I stated that.

900. Would you be kind enough to state to the Committee how many factories, apart from your own, you are personally acquainted with?—I have only been over two factories; one is Messrs. Halls, at Faversham, and the other is one that has lately been closed, at Melford, in Argyleshire.

901. Did you visit the factory which has not been closed, since the improvement of which you spoke?—It is many years since I visited Messrs. Halls' factory.

902. With regard to those factories which you have not visited yourself, how do you know that they are in a satisfactory condition with respect to those rules, and with reference to other matters, indeed?—I believe that what I state is quite true. In conversations which I have had with Major Majendie, he has generally stated to me that the result of his investigations has brought about a very different state of things from what formerly existed in some places.

903. At all events, it is matter of inference on your part, and not of experience, is it not?—Yes, it is a matter of inference.

904. With reference to the state of things which you say exists in your own factory, and the completeness of your rules, do you consider

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that a fair specimen of the condition of things throughout the trade generally?—I think it is, from what I hear from the manufacturers, particularly those whom I am in the habit of seeing; as we interchange ideas as to arrangements, possibly one manufacturer may have one mode of carrying on a process more safely than another.

905. Is it not a notorious fact, that some of the factories, as compared with others, are very badly conducted?—Some time ago perhaps that was so, but that is not the case at present.

906. You think that the inspector during the last three years has brought these badly-conducted factories up to the level of such factories as that at Hounslow?—I will not go that length, but the inspectors have done very great good.

907. Are the buildings in all the factories which you referred to, distributed with due regard to isolation?—So far as my own factories are concerned, I think they are.

908. But I ask you with respect to the whole of the trade, which you say you think is conducted properly. My question is whether in your answers you implied that those other factories have their buildings distributed with due regard to isolation?—With respect to the distribution of buildings in other factories, I know there are one or two that are not considered safe and desirable; but I have not seen those factories and therefore I cannot speak from my own experience.

909. Therefore your evidence with regard to those factories was only what you supposed?—It was my belief.

910. You would not consider it safe, would you, for a dusting-house and a stove to be within 33 yards of one another?—It would depend very much upon the locality; I was going to say, with reference to our factory in South Wales, that our dusting-house and stove-house are about that distance apart, but notwithstanding that, I consider they are quite safe.

911. Would you consider such a case as this satisfactory; say that there are three stoves containing 20 tons of powder or over, placed closed to one another, within 70 or 80 yards of other working buildings containing a large number of people?—I see no special risk in that case; the stove is generally considered a very safe building. The stoves now are very different from the stoves which existed 30 or 40 years ago; in early times the drying of powder was carried on by what was called the Gloom stove, but now it is universal to use steam.

912. Would you be satisfied with a factory where the stove and dusting-house were almost in contact with one another, the stove being merely a wooden building?—No.

913. In such an occupation as that of gunpowder making, in the event of an explosion, such a thing would probably lead to the destruction of half the factory, would it not?—If the other buildings were as close as those two.

914. Supposing these things to be facts, would you modify the opinions which you have expressed in previous answers?—In questions of that kind there should be power to alter them, certainly.

915. With regard to the rules that are given to the workpeople for their conduct in factories, can you state that in that respect rules are in all other factories given to the workpeople as they are in yours?—I cannot state that as a fact.

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916. You give those rules annually to each person, I believe?—The practice in our factory is this: when a new hand comes in (I speak of the powder men in particular) a copy of the rules is always given to him, besides other instructions; and it is annually the practice about the 1st of January to give every man working on the premises, whether in the powder-buildings, or cooperage, or tinshops, a copy of the rules of our establishment.

917. You cannot state to the Committee, I suppose, that you know from your own knowledge that that practice is followed in other factories?—I cannot state that it is so in all, but it is so in many cases.

918. In that case your statement is only made from hearsay, I suppose?—Yes, hearsay; I have had conversations with other manufacturers on the subject. I was only talking to one of the manufacturers a day or two ago, and he said, "We have partly adopted your own rules."

919. But you cannot positively say that there are no factories where the workpeople never receive any rules at all?—No, I cannot say that.

920. With respect to the erection of new buildings, or the re-erection of exploded buildings, would you think it advisable to allow the erection of additional buildings on an overcrowded site?—In my own case, I certainly should not allow it.

921. Then would you propose to prevent that by giving power to prohibit the erection of such additional buildings?—It is a difficult question to offer an opinion about; I think much might be left to the discretion of the manufacturer in connection with any suggestions received from the inspector.

922. But suppose a case in which a man had already overcrowded his buildings, do you suppose that the man would be a proper judge in the matter, and would be likely to listen to the inspector, or that he would not be more likely to follow out his own original idea?—I think he would probably follow out his own original idea.

923. Consequently the evil would be repeated if there was merely a suggestive power on the part of the inspector, would it not?—That does not follow.

924. You are aware that that has been done in some instances, are you not?—I hear that it has.

925. Now if it could be shown with reference to those buildings destroyed by an explosion, that they could not be re-erected without danger to the workpeople or the public, would you not give the power to forbid such a re-erection?—I hesitate to say that I think the inspector ought to have so much power given to him to interfere in the arrangement of factories; and that is one of the questions upon which I expressed a strong opinion on Tuesday last.

926. In fact, you would leave it to the effect produced by the inspector's remonstrance merely, instead of giving him statutory powers in the matter?—I think the reason why I would do so is this, that the Act of George the 3rd and the existing Act have been in force over 100 years; and it is quite exceptional for a manufacturer to place a building in a dangerous position, although it may have been done in one or two cases.

927. But you know, do you not, that it has been done, and that the inspector has strongly remonstrated with regard to the dangerous proximity

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mity of the buildings, and that his recommendations have been attended with no effect whatever?—I am not aware of that.

928. With regard to the question of lightning conductors, Major Majendie, in his evidence, stated that he had remonstrated with the trade for not providing them for all powder buildings; can you tell the Committee whether this recommendation of Major Majendie has been attended with any effect generally?—I do not think that powder buildings have generally had lightning conductors attached to them.

929. You have not acted upon that recommendation of Major Majendie, have you?—Yes, we have, in several instances; but our buildings are generally placed among trees, and we have a very strong opinion that the best lightning conductor is a tree.

930. Are you not aware that many people differ with you with respect to that proposition?—Yes.

931. Probably the public would hardly accept your interpretation of trees being the best lightning conductors?—That is my opinion, but I am quite willing to bow to any scientific decision with reference to that. It is a small matter, and if it was considered desirable that lightning conductors should be put up on the buildings, I believe the manufacturers would do it at once.

932. You are aware, are you not, that at Government works all powder buildings are provided with lightning conductors?—I know that there are a great number of lightning conductors in Government works.

933. Do you not know that they are all provided with lightning conductors?—No, I do not know that.

934. Do I understand you to say you think that the isolation of all gunpowder manufactories is so satisfactory, that if one of their magazines, containing 100 tons or 200 tons of powder, were to blow up there would be no injury to person or property outside the factory?—I really could not offer an opinion on that point.

935. I think you said that you did not believe that the injury would be outside, but that it would be confined to the people within the works?—I said that there had been no instances where explosions had taken place which had injured people outside the manufactories; I did not offer an opinion what would be the result if a store magazine exploded.

936. There are, besides your own case, many instances within your knowledge, I dare say, where a highway runs very close to a gunpowder factory?—There may be several such cases, no doubt.

937. Then it is hardly fair to assume that all gunpowder factories are so situated that the effect of an explosion would not injure the people outside, is it?—No, I could not state that; but I can state that where explosions have occurred, there has been no harm done to persons outside.

938. You do not object to powers being given to the inspector with reference to other places than gunpowder factories; to mine magazines, for instance, do you?—The evidence which I have given has been almost entirely confined to gunpowder factories, specially so.

939. Do you object to inspection in case of store magazines belonging to gunpowder makers?—In the early part of my evidence, on Tuesday,

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I made some remarks about store magazines belonging to gunpowder manufacturers; I am quite willing that every power should be given to the inspector to make such regulations as would make those store magazines safe to the public.

940. Do you think that although previously some of them were in an unsatisfactory condition, they are all of them now in a satisfactory condition?—I think that most of them have been very greatly improved.

941. Have you had your attention directed to the return of Major Majendie between the 1st of April 1873 and the 31st March 1874 with reference to the inspection of store magazines. Turning to the first page, do you not notice that out of 51 store magazines inspected there for the first time, nine were considered so bad as to require almost entire remodelling, while there are other figures which are nearly as striking. Does that represent to your mind a satisfactory condition of things?—I assume that to be a return of what was found to be the case before inspections took place. There is no doubt that, up to the time of the inspections commencing, which was in the year 1871, there was great laxity; and I believe that many men who had charge of magazines did not do their duty.

942. Then your objection to give the inspector any compulsory power of interference is, that it is unnecessary, and that the trade would at once listen to his remonstrances?—Yes, with respect to powder factories; but I offer no opinion as to store magazines, or magazines away from powder factories.

943. But you said just now that, looking at that return, it was a return applicable to the state of things before the inspections began?—Yes.

944. Will you be kind enough to look at that Return a little lower down, where it says that there were 34 magazines inspected for the second time, out of which five were reported to be in an entirely unsatisfactory condition; three of them had seven defects still, five of them had six defects still, and eight of them five defects still; does that confirm you in the opinion that the remonstrances of the inspector have always, or nearly always, been successful?—Scarcely.

945. Now will you look at the Return of the magazines inspected for the third time; do you not think it is necessary to modify your opinion with regard to a power of compulsory inspection in this matter not being needed?—With regard to the magazines outside of factories, I express no opinion; I limit myself to factories.

946. You admit that there is need of improvement, do you not?—Yes, outside of the manufactories.

947. Then let us take the gunpowder factories themselves; is it not the fact that the remonstrances of the inspector are ineffectual there also?—I think it is not generally so; and if the Committee will be kind enough to take the evidence of other manufacturers, they will find that it is not so.

948. With reference to crowding too many people in one building, do you think that no remonstrances have been made by the inspector which have not been attended to?—The memorandum I read to the Committee just now applies to that subject.

949. In that memorandum on the subject, the view the inspector very strongly took was that

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the buildings are of such a size, and that so large a number of workpeople were employed in them, that if an explosion took place the sacrifice of life would be very severe; was not that so?—Yes.

950. That being one of the cases in which remonstrance has been made to many of the people in the trade, have they in every instance, or in many instances, attended to those remonstrances?—I would speak more particularly with regard to our own factories.

951. I have not the least wish to cross-examine you with regard to your own factories, or to infer that you have not always done the best in your power to meet the inspector's views, but I am examining you on the statement which you made that you knew the conditions of the trade generally, and that those conditions were nearly as satisfactory as your own; then I ask you whether your statement is founded on experience or merely on speculation?—Certainly, with respect to other factories, I hear a good deal, and my impression has been that if Major Majendie has pointed out to any manufacturer that he had more persons in a particular building than was thought desirable, the manufacturer has, if he saw no real ground to the contrary, and no real necessity, reduced the number of hands if possible.

952. That is to say, it has been done in every instance in which you yourself have had your attention called to it; is that so?—I cannot say that we have reduced the number in our own packing-house to the extent which Major Majendie would think sufficient.

953. Now, with regard to another proposition which seems to me to be one of value, and which is adopted in all gunpowder factories, and one which some people may think of greater value than you do, namely, as to the lightning conductors, the remonstrances of the inspector have not been attended to in other factories besides your own, have they?—I do not know.

954. Now take the inspector's remonstrances on other points; have they secured the adoption of such simple precautions as magazine shoes, proper clothing, proper rules, and proper cleanliness, in other factories?—I believe that they have.

955. But that belief, I presume, is founded on the same amount of knowledge with respect to other manufactories as your previous evidence?—Yes, it may be imaginary, but it is my belief.

956. Now, if it is really the case that not only in a few cases, but in many cases, the inspector's remonstrances had not resulted in anything being done, would you not be disposed to modify your opinion as to the absence of any necessity for vesting compulsory powers in him; would you not rather think that the public interest would require that the inspector should be entrusted with more power than he possesses?—I will assume, for the sake of argument, that one factory objects to carry out the inspector's suggestions, and that all the other factories are willing to adopt them; it seems hard that compulsory power should be laid down for those who are willing, not only to comply with the law, but to go beyond it, because one individual manufacturer requires compulsory powers.

957. But allow me to put the converse; suppose one manufacturer, like yourself, was thoroughly alive to the danger of these things, and willing to adopt the suggestions, if the whole of

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the rest of the trade refused to adopt the suggestions of the inspector, and treated them as waste paper, would not that tend to modify the opinion which you have expressed on the basis of the converse supposition?—But it is giving the rest of the trade a very bad character.

958. But you have already stated that you admit your evidence is merely supposition, as far as your own personal knowledge of other manufactories is concerned?—Yes; but I would rather refer the Committee to the manufacturers to speak for themselves. I think the case which you put to me is giving all the manufacturers, except myself, a very bad character.

959. Let me refer you once more to that report which I put into your hand, where you see the defects pointed out still continue on the second inspection, and even on the third inspection, and in large numbers, showing the utter disregard paid by the trade generally to those suggestions; is not that the fact?—That is, with reference to magazines; my remarks apply to the manufactories.

960. But if the necessity is so clearly established with reference to some greater powers being given to the inspector in some cases, may it not also be assumed that the compulsory powers should be extended even to that sacred body, the manufacturers?—I cannot quite admit that.

961. Have you observed in Major Majendie's suggestions, that the interference was limited to cases where unnecessary danger, and defective material existed; is not Suggestion 37 in the summary, that the inspector should have power in the case of observing anything unnecessarily dangerous and defective, to give notice to the licensee, and to require the same to be remedied?—Sections 38 and 39 deal with the same subject; but who is to be the judge of what is "unnecessarily dangerous and defective."

962. Would not the question of arbitration come in there, and would not the arbitrator or county court, guard those powers and save you from any capricious, or unjust interference?—If the Committee would allow me, I would make a statement with reference to Section 37, and include in that Sections 38 and 39, which bear on the same question. I have considered this matter very carefully, and my opinion is that no case has been made out for the degree of interference contemplated, and I believe that more mischief than good would result from its exercise.

963. But that refers to the power of the inspector considered as unchecked, does it not?—It refers to the power of the inspector, as he proposes to take it.

964. That is to say, the power with reference to arbitration in case of difference of opinion?—Entering the factory, and requiring something or other to be done forthwith.

965. That is to say, where the case, in the opinion of the inspector, is urgent?—That might be his opinion, but his opinion might be wrong.

966. But does not the power given you in Section 39, if you feel aggrieved with the inspector, to go to the county court and ask for damages against him, protect you?—I think not.

967. I suppose then you will have no reliance on any county court judge's decision as to urgent danger?—Any question, such as might arise between an inspector and a manufacturer, could

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could scarcely be settled by a county court judge; he might never have been in a gunpowder factory.

968. That would be a case of evidence before the county court judge, would it not?—I have heard of no case of any county court judge having to decide between a gunpowder manufacturer and an inspector; there is no precedent.

969. The law does not give the inspector any such power, and therefore a case has never occurred; is not that so?—Just so; I should doubt the efficacy of the plan very much. I know of no mischief having happened in the manufacture of gunpowder which this kind of interference would have prevented. I think the exercise of such wide discretionary powers might possibly do great harm. I do not, of course, speak with regard to an able and experienced gentleman like Major Majendie; but an inexperienced man would be worse than useless. At all events, this kind of supervision and dictation, as it appears to me, should only be allowed where the Secretary of State has, on a report to him about anything wrong, authorised it. If in any powder works there is persistent carelessness, or breach of duty, the remedy would lie in withholding or withdrawing the license, and not putting the whole of the trade under, what I would venture to call, an obnoxious interference.

970. Would you approve of an inspection of the trade, with an appeal to the Home Secretary, and with power in the Home Secretary to destroy your license, supposing you did not comply with the regulations supposed to be necessary?—Yes, where persistent carelessness was proved.

971. Do you refer to cases where explosions have taken place, in which carelessness could be proved?—I say persistent carelessness.

972. When the inspector reported that a factory was not carried on properly in certain points, then if it was not altered according to his suggestions, would you approve of the case going before the Secretary of State for his decision with reference to your license continuing?—Yes, in case of persistent carelessness.

973. That is to say, refusing to comply with what was supposed by the inspector to be for the public safety?—Yes.

974. You think that an appeal to the Home Secretary would be safer than an appeal to the county court judge, who would hear evidence, do you?—I say that this kind of supervision and dictation should only be allowed where the Secretary of State has authorised it on a report being made to him.

975. From the inspector?—I assume that he would report, and if in any case there was persistent carelessness or breach of duty, the remedy would seem to lie in withdrawing or withholding the license, and not in putting the whole of the trade under a system of obnoxious interference.

976. But let us trace it out; the inspector notices what he considers to be defects in the administration of a given manufactory; he reports that case to the owner of the factory, and points out to him that it is injurious to the public safety; the owner of the factory, as the Home Secretary is informed, does not regard the admonitions of the inspector, and neglect to comply with them; the same conditions of things remain until the next year, and the inspector again reports

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and takes the case before the Home Secretary, who, on this report of continued neglect, takes away the license; now do you think that that would be a greater protection to the trade than having an immediate appeal to the county court on a point on which evidence can be brought forward, and the judge can decide whether you have done anything against the public safety, or not?—I think that the course which I have suggested would be much more satisfactory to the trade.

977. But hardly so to the Home Secretary, I suppose?—I have no doubt that the Home Secretary would feel the difficulties.

978. With regard to store magazines, have you had a large experience of store magazines besides your own?—I have visited a great number of magazines.

979. Your knowledge of the condition of those magazines is formed, therefore, from personal examination, is it?—That is so with regard to the magazines which belong to my own firm.

980. Not generally throughout the trade?—No.

981. You are aware, with reference to the storing of large quantities of gunpowder in gunpowder magazines, that it was strongly condemned; that was done, was it not, in the Report of the Committee in 1865?—I believe it was.

982. Are you aware that the compulsory powers that are suggested to be given to the inspector, guarded by this power of appeal, are already, in principle, adopted in the Mines Act?—I am aware that there are appeal clauses and arbitration clauses in the Mines Act.

983. And there are inspection clauses also, are there not?—Yes; but the inspection of a mine is very different from the inspection of a gunpowder factory. I am not prepared to point out the differences, but gunpowder factories are so peculiar, that what would appear a desirable inspection in a mine might not appear at all a desirable inspection in a powder factory.

984. Is that your reason for thinking that those same principles should not be applicable to gunpowder manufactories?—I have before me the powers of the inspectors in the Mines Act.

985. What I wish to ask you is this: can you give me any real reason why the principle adopted in the Mines Act, namely, that of inspection with an appeal, should not be applied to the gunpowder factories?—I am scarcely prepared to give an answer on that point.

986. Do you not imagine that, as they are both of them dangerous, the inspection that is considered necessary in the cases of mines, might by the public generally be thought equally necessary in gunpowder manufactories?—It might be thought so by the public, but it would not necessarily follow that it was so in gunpowder manufactories.

987. May it not be possible that the gentlemen connected with the mines of the country may have a strong opinion also that they are carrying on a business which is not dangerous to the public?—I have not consulted them.

988. Have not the public felt that a trade in which explosions took place, and where life is constantly lost from such explosions, is a trade which may be fairly put under inspection and surveillance with reference to the regulation of its conduct?—In the case of gunpowder factories, the public might possibly, under one or two cir-

cumstances,

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cumstances, suffer by the explosion of a building, say near a high road; but in the case of the Mines Act, it appears to me that the public are not in danger; it is the workmen who are in danger.

989. But I gather from your evidence that the danger in your case is limited almost entirely to the workmen?—Yes.

990. Now you say that in the case of mines the danger is not to the public, but to the workmen, and I ask you this, the public having thought it necessary for the protection of those workmen to bring the mines under inspection, might not the public go on to say, as gunpowder factories are dangerous (we will say for the sake of argument dangerous only) to the workmen, therefore they have a right to ask for the same inspection with reference to gunpowder factories that they have asked for and obtained with respect to mines?—But the present law gives power for the inspection of gunpowder factories.

991. Yes, the present law gives power with regard to inspection, but as you have stated, very often that inspection is practically waste paper in the case of a man who refuses to take a remonstrance into favourable consideration; is not that so?—That is an exceptional case.

992. Then with regard to that exceptional case, you have stated in answer to a previous question, that you are not aware of the real conditions of the other cases in the trade, except from hearsay, therefore is it not only your imagination that they would carry on their trade as you carry it on yourself?—I think the answers which I gave with reference to Suggestions 37, 38, and 39, apply in this instance, if in any works there is persistent carelessness, or breach of duty the remedy should be by withholding or withdrawing the license of that particular work.

993. I quite admit that that answer applies; but do you think that the trade are unanimous in saying that they would like their licenses to be taken from them in case the inspector reported continuous neglect, and the Secretary of State decided that they should no longer continue in existence, though their capital was largely invested in such works?—I am not authorised to make that statement for the rest of the trade; but my belief is (and I believe that the trade will take the same view) that they would be willing, under such circumstances, to have their licenses withdrawn.

994. You know, do you not, the system of general and special rules suggested by Major Majendie?—Yes.

995. And you know that they are at present embodied in the Mines Act also?—Yes, I have heard so.

996. I think you stated in the early part of your evidence, that some of the chemical explosive substances were offered to you and rejected. Now I should like to know whether your works would have been suitable for making dynamite?—Certainly not.

997. I presume that that consideration weighed with you in deciding not to undertake the manufacture of dynamite?—No, that was not so; but perhaps I might here be allowed to refer to the question of rules. In my former evidence I said I thought that rules made by the manufacturers, and

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approved by the Secretary of State, would be preferable to having statutory rules. When I made that statement I had not before me Major Majendie's suggestions, and I had not had time thoroughly to consider them; I have, since giving my evidence on the last occasion, gone into the question, and my opinion would now be stated in different terms; Suggestion 32 bears upon this question, "General rules for the manufacture, storage, packing, and carriage of explosives to be laid down either by statute, or by Order in Council, subject to veto of Parliament, and to be observed by persons manufacturing, storing, and carrying explosives. These rules to be variable only by Order in Council, subject to the like veto."

998. Has your attention been again called to Question 790, and your answer to that question with regard to the rules, and would you like to make any correction in that answer?—I said that I thought those general rules should, so far as necessary, be made by Statute. It may be objected that there would be a difficulty in laying down such rules in sufficient detail, but what could not be so done must be left to the suggestion of the inspector, and not to Orders in Council. Suggestions, when reasonable, will always be obeyed, but a power to make general rules in the way which is contemplated here, the trade would consider mischievous, because unduly interfering with their proper responsibility. I now withdraw my previous remarks about the rules not being statutory, admitting that it would be advisable that they should be statutory up to a certain point.

999. With power to add to them?—With power to add to them being given to the inspector or to the Secretary of State.

1000. Could you tell the Committee in what way you consider gunpowder so much safer to make and carry than dynamite?—I would not offer to give any scientific opinion upon the subject, but I think that a general knowledge with respect to black powder is quite sufficient to show that if black powder is kept in a proper place, free from contact with fire, there is not the least chance of its decomposition or spontaneous combustion; there is no instance that I am aware of where an explosion has taken place with black powder by spontaneous combustion.

1001. But you conceive that in other chemical preparations there is such danger, do you?—I think so, and what I heard on Tuesday last entirely confirmed my own conviction with reference to that.

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1002. One of the honourable Members wishes me to ask you whether you referred to the carriage as well as to the storing and keeping of dynamite, gun-cotton, and gunpowder in making these comparisons?—With regard to the carriage of gunpowder, I consider that if gunpowder is placed in a safe and secure package, the risk of explosion is reduced to a minimum; and with reference to the other explosives, I would not make anything approaching such a statement.



Mr. FREDERICK ALEXANDER PRESTON PIGOU, called in; and Examined.

*Chairman.*

1003. You are, I believe, a partner in the firm of Pigon & Company, gunpowder manufacturers?—I am now manager of the firm of Pigou & Company, Limited; I did carry on the firm up to the year before last.

1004. How long have you been in the business?—I have been in business since the year 1862.

1005. Have you had your attention directed to a certain summary of suggestions as to the amendment of the law relating to explosives?—Yes.

1006. Will you be good enough to state to the Committee your opinion relating to the various clauses of that summary upon which you have an opinion to offer. I believe that the first opinion that you desire to express is with reference to the third suggestion, which is as follows: "A new Act to be framed to regulate the manufacture, keeping, selling, carrying, and importing of gunpowder, nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances to be named in the Act." Will you be good enough to state your view to the Committee, and first inform them whether you now speak for yourself alone, or whether you in any sense represent the trade?—I believe that I represent the trade in the same sense as Mr. Curtis did, namely, to a large extent. First, I may say, that I think there should be, if possible, either a separate Act of Parliament, or separate clauses in any new Act relating to gunpowder alone, as distinguished from other explosives, and my reason for thinking so is, that I believe gunpowder to be of an entirely different character from those other explosives. Gunpowder has been manufactured for many centuries, and we know all about it. Those other explosives have, I believe, all of them been invented comparatively recently, and with respect to a great many of them our knowledge is not so perfect as with respect to gunpowder.

1007. Now, with reference to Section 4 of the sections, what have you to say?—I think that the Orders in Council should not be allowed with reference to gunpowder. I think the Act should be defined once and for all, so that we may know where we are; we ought in my opinion be able to know exactly what we are to do.

1008. The suggestion here is "Power to be given to Her Majesty in Council to extend the Act from time to time, or any part or provision thereof, to any explosive not specifically named or defined in the same?"—Yes.

1009. Then your objection would fall to the ground, would it not?—It would not apply in that case.

1010. Now, with reference to the fifth suggestion, what remarks have you to make to the Committee?—I think that licenses should be very carefully framed so as not to interfere with the gunpowder trade, in which so very much capital is invested; it might very easily happen that the licenses might be framed in a sense which would greatly interfere with the trade, particularly now perhaps more than in former years, when we are subjected to such very great foreign competition.

1011. Generally you would recommend caution, I suppose?—Very great caution.

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1012. But you have no special objection to take to that suggestion, have you?—The suggestion is not sufficiently defined, according to my opinion. I think that in Clause 6 the word "carrier" should be very carefully defined. At present that might be held to refer to persons in our own employment, carrying our own gunpowder about our own works. Then with respect to Sections 7 and 8, I notice that the chemical explosives are distinguished from gunpowder, and, therefore, a distinction can be drawn which I venture to hope may be preserved throughout the Act of Parliament.

1013. Now, coming to Section 9, with reference to licenses, what have you to say to that?—I am unable to see why those licenses for factories should not be local only.

1014. Instead of being personal?—Yes.

1015. Now, with reference to Clause 10, have you any remarks to make?—I think the conditions under which licenses are to be granted to retail dealers should be specified, and not left to the authorities, who might impose arbitrary and prohibitory regulations.

1016. You mean that you think the conditions should be specified by statute?—Yes.

1017. Now have you any remarks to make with respect to Sections 11 to 14?—I think the quantities to be allowed under licenses A and B may be too small to meet the cases; that is to say, the quantities suggested are too small. There are so many kinds of gunpowder that the retailers in some places might have great difficulty in keeping the stock down to 200 lbs., and it seems that with 300 lbs. it would not be very much better. I think it might be 300 lbs. or 400 lbs., or 500 lbs. even. The same remarks would apply to two tons in a common magazine. Where two mines, for instance, are adjoining, and they wish to have one magazine under one manager, the risk would certainly be diminished. There would be less risk of explosion in one magazine carefully managed than in two, because you are more likely to get one careful manager than you are to get two careful managers, and the quantity might very reasonably be too small for two mines.

1018. Is not your objection met by the special license?—I am speaking of common magazine licenses; and I think that it should be extended over a far larger quantity.

1019. What quantity would you suggest?—I should suggest that it might go up, on occasion being shown, to five tons; that would make the powder safer to handle, and the magazine need not be opened so often to put the powder in, at all events.

1020. Have you any remarks to make with regard to the 16th section?—I think that other explosives, such as cartridges, containing their own ignition, should not be allowed in the same magazine with powder, a regulation which does not appear to be contemplated here. With reference to Section 16, I think the Act of 1860, in Clause 13, gives sufficient power to the inspector. Of course we do not wish to be inspected more than is absolutely necessary. I think we are all prepared to acknowledge that a great deal of good has been done under the existing Act by the inspectors, and it is not our fault that the

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inspection was not commenced in the year 1860. In a very short time it has done a very great deal of good, and I fancy that the powers are now very nearly large enough. I am so afraid of ignorant or prejudiced inspectors (for we must look to the future) doing us, and the public also, a great deal of injury. I think that the inspector might very likely have wrong ideas as well as the manufacturer, and there is no reason why he should be allowed to force his ideas on the manufacturers. I think that an ignorant or prejudiced inspector might render new works impossible without any good reason, and might deprive a whole district of supplies if some of his perhaps needless conditions were not complied with.

1021. Will you now go to Sections 17 and 18?—I think that the present Act of 1860 is sufficient with respect to the licensing authorities, and if it is not sufficient I hope it will be so arranged that we shall get a public hearing and public reference.

1022. I suppose that in making those remarks on the question of licenses, you are bearing in mind that the licenses do not apply only to gunpowder, but also to other explosives?—Yes; but I also hope that the new Act may contain clauses relating to gunpowder only in matters of licenses as well as in other matters.

1023. You do not think that these regulations might be considered too stringent with regard to other explosives, do you?—No; I wish to offer no opinion on that subject at all.

1024. With regard to the 18th clause, have you any remark to make on that?—No; I have taken the two together.

1025. The next clause to which I believe you wish to draw attention is Clause 20?—Yes; I think Clause 20 and Clause 21, if carried out, might be fatal to businesses in which a very large amount of capital has been invested. I will suppose the case of our wishing to sell our business at Dartford after having held one of the proposed licenses for 25 years. It must very greatly diminish the value of the property to hold a license terminating in five years, with no certainty of it being renewed. I think also that licenses for a term of years would tend to produce carelessness on the part of manufacturers, who, through accidents or other causes, might not expect to have their licenses renewed; if so, they would prove a source of danger, not a precaution against it. If he did not think that his term would be renewed, he would perhaps let his machinery get out of order; and soon it would be contrary to the spirit of safety, which I suppose is meant to be embodied in those recommendations of Major Majendie. With reference to Clause 21, I do not think anyone could object to that if it stood by itself. At the same time its introduction seems to point to Government interference in existing factories to rather an alarming extent. It may be necessary in some cases to interfere; but looking at the enormous amount of robbery we should be subjected to by persons who would build close to us for the purpose of forcing us to purchase, I think it would be well to take other means which would not so punish us. We are not troubled much by builders coming close to us at present, because the houses will not let; but if they knew that we must buy them out, speculative builders would trouble us very much.

1026. Now with regard to Section 23, have you anything to say?—Yes; I do not see why

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the Secretary of State should not have full power; I do not see why he should be limited at all, for if he is to have so much power he may just as well have it all in his own hands.

1027. Have you anything to say with reference to Clause 24?—I would have that clause not to apply to explosions in magazines or gunpowder factories, nor to other magazines unless recklessness is proved. I think that Clause 24 might produce injustice if an explosion were to take place in the neighbourhood of a magazine, for the public feeling is so very strongly excited at the time, that the Secretary of State would no doubt be memorialised in every direction not to grant another license, though the buildings might be in a very good position, and though the factory might have been very well conducted.

1028. Now, to come to Clause 25?—With reference to Clause 25, I do not see how it would work at all; it has happened in our own factory, and, I believe, in many factories, that adjoining buildings did not explode; when one explodes it does not always communicate the fire to the adjoining building, but sometimes to one at a considerable distance; it depends on the direction of the wind, and on numerous other circumstances which it is almost impossible to specify.

1029. Clause 25 merely provides that the buildings are not to be re-erected without the permission of the Secretary of State and to his satisfaction, and under such conditions as the Secretary of State may impose; is not that so?—Yes; but obtaining the consent of the Secretary of State, and the Secretary of State deciding with regard to the conditions, and so on, might put a factory *hors de combat* for a long time.

1030. In the event of an explosion, you would think it right that the inspector should be made acquainted with the fact, I suppose?—Certainly.

1031. And this inspection would give him an opportunity of reporting to the Secretary of State, would it not?—Yes; but those are questions which can hardly be decided on five minutes' inspection, and therefore it would be his duty to look at the matter a good deal.

1032. After an explosion would it not be necessary that there should be some careful consideration on the subject before there was a re-erection of the building?—Yes, no doubt; but the Secretary of State or the inspector would come to the matter quite fresh, whereas the manufacturers would know all about the situation of the buildings, what the effect had been on former occasions, and so on, and they could decide at once whether it would be safe to erect them pretty quickly. Besides, there are many cases in which you cannot move a building; it must be re-erected in nearly the same place if the factory is to go on.

1033. I think this suggestion presupposes that mounds or some other precautions should be taken; it does not only apply to the distance, does it?—But the Secretary of State might say that no mounds would make the building safe, and he might be wrong for all that.

1034. Now, will you be kind enough to go to Sections 32 and 34, and state whether you have any remarks to make to the Committee on those points?—Yes; I have the rules in force at our factory, a copy of which I will put in (*vide Appendix*). I think that general rules are rather objectionable, the circumstances of each factory differing so much. If there are general rules, I think

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think there should be very few of them; the men employed in the factories are ignorant, and they cannot carry a whole book of rules in their head unless it is a very small book indeed. I would suggest that the manufacturers should be obliged to draw up rules, and that those rules should be submitted for the approval of the Secretary of State, and I think that there should be plenty of power in the new Bill to secure the making of new, sufficient, and efficient rules.

1035. Have you any remarks to make with regard to special rules?—What I have said will apply to all rules; each factory should draw up its own code of rules, to be approved by the Secretary of State.

1036. Do you not think that there are some general rules which should be imposed by Statute?—Yes; I think it is possible some very few general rules might be drawn up, but the fewer the better.

1037. You are aware that those clauses on which we are now dwelling, apply not only to gunpowder but to other articles, are you not?—Yes, certainly to other explosives, but I refer especially to gunpowder.

1038. Have you any remarks to make on Section 35?—Section 35, says, "Fit persons to be appointed inspectors under the Act by the Secretary of State." I would express a hope that those inspectors may be really fit and proper persons, and that some means may be taken to secure that they are so; we have been very fortunate hitherto, but it does not follow that because a man has been in the Army or Navy he understands gunpowder, or the arrangements of a factory; therefore I say some means should be taken to secure that he has that knowledge before he becomes inspector, because it is from a new inspector that we might anticipate a great many criticisms that are not required.

1039. The Statute would impose upon the Secretary of State the duty of selecting a fit and proper person?—Just so; only I would say that opinions might differ.

1040. Do you propose to explain in the Act what "fitness" is for an inspector, or do you propose to leave it entirely to the Secretary of State?—I should say that it should be defined in the Act of Parliament, or somehow I think it ought to be understood and approved by those who would be subjected to the inspection.

1041. I understand both from your evidence and that of the gentleman who preceded you, that the trade are satisfied with the present inspection, so that thus far we may presume that the Secretary of State and the inspector have done their duty?—Yes, thoroughly; we have been very fortunate in Major Majendie.

1042. Now to come to Section 36, have you any observation to make on that section?—I should like to see the word "only" so as to make it read, "An inspector *only* to have power to make such examination, entry, and inquiry as may be necessary to ascertain whether the provisions of the Act are complied with, and to take samples for analysis of any explosive," and so on. The inspector's deputy might be anything but a fit person.

1043. Have you anything to say in reference to Clauses 37 to 39?—Clauses 37 to 39 seem to me to tar all the factories with one brush, too much. I confess I do not like the idea of being subjected to all this inspection and dictation, 0.84.

*Chairman*—continued.

unless I am proved to be a defaulter in some way or other; unless I am a very bad character; I should like to see some limitation of the power proposed to be given in those three clauses.

1044. I suppose you mean with reference to the manufacture of gunpowder, but not with respect to the manufacture of other explosives?—With regard to those other explosives I can offer no opinion at all; I might be perhaps prejudiced on the question.

1045. The next clause to which you wish to draw the attention of the Committee is Clause 45, I believe; what have you to say on that clause?—Clause 45 refers to accidents in any licensed premises. I think that word "accidents" should be defined, and should be confined to accidents arising from explosions, because we have numerous little accidents in the factories where we employ a large number of hands, and it seems hardly necessary to report them all. A boy the other day in one of our workshops cut off the tops of two of his fingers with a chaff-cutting machine; he was at work the next day; it would be rather troubling the Secretary of State to report such cases to him.

1046. You would like to have such things more clearly defined?—Yes; even explosions in the incorporating mills need hardly be reported, I think, unless they are attended with loss of life or severe personal injury. We cannot help those explosions, now and then they will happen; there is not much in them, and there is generally no harm done.

1047. It is said that railway accidents cannot be helped, and yet we have railway inspection, is not that so?—Quite so; we are quite willing to have the inspection, but I think that every explosion in an incorporating mill, unattended by personal injury, should not be reported.

1048. Have you any remarks to make on Section 48?—I should wish to have the word "wilful" inserted between "substantial" and "departure," so as to make it read "substantial wilful departure." It is possible that in altering the rules, one might transgress the license without meaning to do so, and in that case to be called to order in the first instance, I think would be sufficient without being punished.

1049. You mean as it is inserted in the fourth line of that clause?—Just so.

1050. Now I think you desire to remark on Clause 50, do you not?—Yes; Clause 50 touches the existing works very nearly indeed, and though they are said to be specially guarded here, I cannot see that they are so; it seems to me that Clause E in particular, of Section 50, would enable the Government to shut up any existing factory almost at once, by requiring impracticable alterations in the mode of working, or in the number of workpeople employed. If in the continuing certificate, conditions were made involving the erection of a new building, that building might come under the clauses of the Act and be condemned, and so stop the factory or make it useless, besides putting the manufacturer to much needless expense. At present the general inspection, with or without a license, is subject to the discretion of the owner with reference to the arrangements, and if that discretion were taken away, it would diminish our responsibility which may be supposed to affect the care which we take of our works more or less. It would also be taking a right from us. With reference to sub-section B, it seems

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seems to me that our vested rights would hardly be protected by forcing us to go to law to prove them directly the Act was passed, supposing those rights to be questioned.

1051. To whom would you propose to make the reference?—I think that question is a very difficult one indeed; it only struck me as being a curious way to guard our rights, to make us go to law to prove them directly the Act is passed.

1052. But the question appears to be, with regard to a manufacturer thinking he has a right and the inspector or the Secretary of State thinking he has none, in which case a court of law is to decide; is not that so?—Yes; but I cannot see how that question could arise. The factory exists or does not exist, and therefore what question could there be to be determined by a court of law.

Colonel North.

1053. You seem to object to reports being made on a common explosion, unless there is loss of life?—Unless there is personal injury or loss of life.

1054. Do you not think, considering the evidence which we have before us of the grossest possible negligence on the part of some gunpowder makers, an explosion of a very serious nature might take place without loss of life?—Yes, if any of the workmen were guilty of gross carelessness, and were to cause an explosion, he would probably suffer for it by being injured, and that case would then be reported to the Secretary of State; but I was only referring to the incorporating mills.

1055. But other people might also be blown up as well as a man who, for instance, wore iron-shod shoes; might it not be so?—I do not say that explosions should not be reported; I only say that explosions in incorporating mills, unless attended by personal injury, should not be reported; but, if attended with personal injury, let them be reported at once.

1056. But very frequently explosions take place without loss of life, do they not; and surely there can be no reason why the inspector should not receive notice of such an explosion, can there?—No, it is not a very great point, only that an explosion in the incorporating mills is not generally a matter of much consequence.

1057. You say that the present Act gives a power of inspection?—Yes.

1058. But it does not give power to the inspector to call on powder manufacturers to remedy any immediate evil, does it?—The inspector has the power of pointing out (and it is a very useful power too) any defects which he sees in the works.

1059. Yes; but by Clause 37, the inspector is "to have power in the case of his observing anything unnecessarily dangerous and defective, to give notice to the licensee, and require the same to be remedied, and, if the matter is in the opinion of the inspector urgent, to require the same to be remedied forthwith." Now, I believe that the inspector does not possess that power at this moment?—No.

1060. Do you not think that he ought to have that power?—I think not.

1061. Not considering the evidence that we have before us, that after four inspections many of the manufacturers have not paid the slightest attention to what the inspectors suggested they should do?—I have not seen that evidence, and

Colonel North—continued.

however strongly it may point to the necessity of interference in some cases, I should say that those who conduct their business satisfactorily and safely, ought not to be required instantly to alter any practice at the dictation of an inspector, who might be mistaken as to its danger.

1062. You seem to have a doubt about the appointment of fit inspectors; do you not think that the power given here of arbitration would be a great protection to the manufacturer?—Yes, I think it would be a great protection.

1063. Because if the arbitrator reported against the inspector in any serious sense, it would be in the power of the Secretary of State to remove him directly, would it not?—Quite so. I think the power of arbitration would be of very great value, but it would not be an absolute protection against what might be a very considerable injury in the case of an incompetent inspector acting under Sections 36, 37, and 38.

1064. But why should you start with the supposition that the Secretary of State would appoint very objectionable inspectors?—I do not start with that proposition; I only suppose that he has been mistaken for once, and has for once done so.

1065. But if the licensee objects to the inspector's requirements, he may, except where the matter is required to be remedied forthwith, object in writing within a certain time, and, in that case, the matter is to be decided by arbitration; would not that give you every possible protection?—It is precisely the word "forthwith" that causes me to hope that the inspector may always be a judicious person.

1066. Take the case mentioned the other day of a powder magazine, where the doors were lined with iron in order that the bullets of the volunteers might not come through; is not that a case for the inspector to interfere in forthwith?—By all means.

1067. Then there is another case which Major Majendie mentioned, of a man going into a magazine with a lighted candle; was not that a fit case for immediate interference, and do you not think that the public should be protected?—Yes, certainly, I think they should be protected; but my remarks were meant to apply more with regard to factories than magazines. I see Major Majendie's suggestion is about the inspection of store magazines for gunpowder.

1068. But my questions go to the appointment of inspectors for the whole of the trade; I am quite sure that your own house, and houses like Mr. Curtis's would probably require no inspection at all, but that is not the case with a good many of them, is it?—No, I am afraid not; but then there might be a better way of bringing such persons under the power of the law; I have no objection to the inspector having power to remedy nuisances; I only object to being under his power till I really become a nuisance; this clause would give the inspector power to say "this is a thing that must be stopped," and whether it is wrong or not, the factory might be stopped too.

1069. Major Majendie has often mentioned things to Mr. Curtis' which were immediately adopted, but in other cases the inspector found that no attention had been paid to his recommendations, is not that so?—I think there might be a way of making persons who will not attend to the advice of the inspector do so; but so long

Colonel North—continued.

as they would listen to reason I very much object to this power being given.

1070. Does not that come to a matter of opinion as to what is reasonable and what is not?—In 99 cases out of 100 I have no doubt that the inspector would decide rightly, but in the 100th case he might not decide rightly.

1071. But if in the 99 cases great good was done, you surely would not restrict him on account of the one bad case?—I think, personally, I should with regard to my own factory, and with reference to factories where the law is carried out, and is meant to be carried out, I do not want to be under the power of the inspector more than I am at present.

1072. But though the inspector would merely have the power to interfere with those who did not follow out the law, you cannot say that one house shall be inspected and another is not to be inspected; would not that be the right way of putting the case?—I do not object to the power to visit the works, but I object to the power to say you shall do something “forthwith.”

1073. Is it not a great advantage to the public to give the inspector that very power?—He may judge wrongly. I am only imagining the case of his doing so.

Mr. Vivian.

1074. You say that you would not put any other explosive in the same category and under the same regulations in the new Act, as black powder?—I think not.

1075. And you gave it as your reason, that the character of those explosives was not sufficiently known?—Not so well known as that of powder.

1076. Do you say that from your own personal experience of those explosives?—I have had some experience of them, and I have heard still more about them.

1077. Have you ever manufactured them?—No, but I have gone into the question of manufacturing several of them, and learned something about them.

1078. What were they?—Dynamite, Horsley's powder, and several others.

1079. From the experiments which you have carried out, you thought they were far more dangerous to deal with than black powder, did you?—Yes; I believe that there is far more risk of danger, if not far more danger.

1080. What particular manufacture was that which you refer to?—I can hardly tell you the names of the people who brought it to me; it was some years ago.

1081. Three or four years ago?—Yes.

1082. What did the danger result from chiefly?—Generally speaking, I think it was from the exudation of the nitro-glycerine; the experiments I tried then were exceedingly minute, and the explosions that occurred were of no consequence whatever, with regard to danger. But I have been a good deal in the north of Europe, and in parts of the world where dynamite is used, and I know that a great many accidents have occurred from the use (I will not say in all cases) of dynamite, but other nitro-glycerine compounds, which have been apparently quite unaccountable.

1083. From your own personal knowledge, do you know of any accidents occurring in the use of dynamite?—I know of two accidents, one in Sweden and one in Norway, in mines, from the use of dynamite.

0.84.

Mr. Vivian—continued.

1084. Was that from carelessness on the part of the miner?—The miner was blown to pieces, and it was impossible to say.

1085. I suppose that accidents often occur with black powder in mines?—I believe that they do very frequently.

1086. And that the accident which you have just referred to might have occurred with black powder, might it not?—I cannot say, because I do not know the cause of the accident.

1087. Was it in firing the shot?—I do not know; in one case it was simply from the dropping of a case containing dynamite.

1088. Not nitro-glycerine, but dynamite?—Dynamite.

1089. Where was that?—That was in a mine in the south of Norway, about 30 miles inland.

1090. Was it long ago?—It was about four years ago, I should say.

1091. Is there much dynamite used in the north of Europe?—I cannot say, but I think that there must be a large quantity used.

1092. Accidents, are not very frequent, are they?—That I cannot say.

1093. But so far as your own personal knowledge goes they are not very frequent?—Just so.

1094. You spoke of the common license being restricted to 300 lbs. of powder, and you think that might be increased to 500 lbs.?—Yes.

1095. Would not the effect of 500 lbs. of powder exploding extend over a larger area than 300 lbs. exploding?—I do not think that it would produce a much greater effect.

1096. Not on the surrounding buildings?—No, I think not; I think that an explosion of 300 lbs. of powder would be quite bad enough.

1097. That is to say, to those immediately concerned; but as to the surrounding buildings, would they not be more affected by the explosion of 500 lbs. than 300 lbs.?—They would, of course, be more affected by the explosion of 500 lbs. than 300 lbs., but the effect would not be in the proportion of 5 to 3.

1098. If I rightly understand your evidence, you think that the manufacturers should have a voice in the appointment of the inspector, to see that he is well qualified for his post?—It would be a very good thing if that could be done.

1099. Would not the trade be protected sufficiently by the arbitration clauses, do you think?—No, I think not.

1100. Do you think that the action of a well-qualified inspector would be really detrimental to a well-conducted manufactory?—No, I should say that he would make no difference whatever.

1101. Might not the inspector suggest things that would be advantageous to the manufacturer?—Yes; the inspector has already been of very great advantage to us.

1102. With regard to accidents, you say that you would report only accidents from explosives, and that only in certain cases?—Yes.

1103. But although an explosion might be slight in one case, it might follow that the next time it exploded it might be a very heavy explosion, might it not?—Of course one explosion is no guide with regard to the next.

1104. Do you not think that any explosion of any kind in a powder factory or magazine should be reported?—Certainly, it should be reported in magazines, but in incorporated mills I do not think it necessary.

1105. Do

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Mr. Pigo.

Mr. Stevenson.

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1105. Do you approve of the inspector having the power to inquire, and if anything is unnecessarily dangerous and defective, to order it to be immediately remedied?—No; I do not approve of his having the power to require it to be immediately remedied.

1106. I do not suppose that you would object to the inspector having the power to enter a manufactory at all times?—Not the least.

1107. Nor would you object to his being, as it were, a prosecutor before a competent court, in case he found something dangerous to the public safety?—Just so, I would not object to that.

1108. Then in what court would you feel that he should bring that charge of want of proper precautions; have you thought of a tribunal?—No; but I should like it to be done as quickly and as publicly as possible, so that evidence might be brought before the court.

1109. Where the inspector has made an unreasonable requisition for a remedy, it is proposed, by Clause 39, that the county court should be the tribunal to hear the claim of the manufacturer for damages against the inspector?—Yes, I see that it is so suggested.

1110. Have you formed any opinion as to whether the county court would be a satisfactory tribunal for that purpose?—No, I have not; but I think that a claim for damages against the inspector would be very unsatisfactory.

1111. You object, I presume, to the inspector having the power of detailing the particular alterations to be made in a manufactory?—I do, with this qualification, I do not object to have alterations made in the factory or the mode of carrying on the work; but I think, in the first instance, it should always be done on recommendation, and not by a power of insisting.

1112. I understand you to mean that you would allow the inspector to say, "I am not satisfied with the precautions which you take, and you must take proper precautions"; but you do not like him to state them in detail?—Personally, I should very much object to that, and I should be very sorry to see him have the power to say, "You shall put up a copper pipe there, and an iron pipe there, or a cover here, and you shall do something to that," which I, perhaps from my experience, might think unnecessary.

1113. You are not content that he should be your engineer and architect?—No.

1114. But you would not object to its being laid down as an obligation under the general law, that the manufacturers should take all proper precautions, according to the best known methods, to avoid danger?—Certainly not; that would be well.

1115. You would willingly allow the inspector to be in the nature of a public prosecutor to bring the manufacturer before some competent court for a breach of this general law?—Yes.

1116. The next question is, what would be the most satisfactory court for trying such a question, is it not?—Yes; on that point I cannot offer an opinion at present.

Mr. Whitelaw.

1117. With regard to the inspector having the authority given in Sections 37, 38, and 39, to draw your attention to anything defective, would you feel a serious responsibility to lie on you if you did not comply with his recommendation?—Certainly.

Mr. Whitelaw—continued.

1118. Then if the effect of his having that immediate compulsory authority were to enable him to make changes in your works at his pleasure, would you feel the extent of your own responsibility diminished accordingly?—The sense of the responsibility lying upon me would be less; it would lie on the inspector in that case.

1119. It seems to you that the inspector's request, followed by compliance, would modify the owner's responsibility?—I think it would modify the owner's responsibility very considerably.

Mr. Knowles.

1120. With reference to the point of reporting accidents to the Secretary of State, would you object to have it as it is in the Mines Act?—I do not quite know what it is.

1121. I believe the words are, that all explosions shall be reported, and all accidents of a serious nature, where personal injury occurs; would you have any objection to having serious personal injuries reported, and explosions of any description?—Except in incorporating mills; but there is no parallel case in mines to the case of gunpowder factories.

1122. But why should you object to any explosion being reported?—I think it is hardly necessary, that is all.

1123. Are they of such frequent occurrence in the incorporating mills that they are not worth reporting?—They do occur now and then; I do not mean to say that they are unavoidable, but simply that we are unable to avoid them.

Mr. Hick.

1124. Have you had occasional explosions, resulting in loss of life, in the works with which you are connected?—I am sorry to say that we have.

1125. How long is it since the last explosion took place?—I should say it was 30 years ago since an explosion resulting in loss of life took place.

1126. Do you know from what cause that explosion resulted?—I cannot call to mind; I think that it was in the granulating house.

1127. Speaking broadly, are the causes of explosion generally ascertained or ascertainable, more or less?—It depends very much on circumstances; but, as a rule, we can generally find out what is the cause of an explosion, I think.

1128. At what stage of the manufacture do the greatest number of explosions occur, and in what portions of the works?—In the incorporating mills.

1129. I presume that your works are provided with what are called tipping systems, or tanks?—Yes.

1130. Are those articles used also in the granulating mills?—No, they would be no use there; tipping tanks are not for the protection of the mill in which the explosion takes place, but it prevents an extension of the explosion.

1131. Would the more general use of those tipping tanks be of service, do you think?—I think if they could be applied, it would be of service; but I am afraid that the application of them would be itself a source of danger. The houses which are most likely to explode, or at least which have exploded, next to the incorporating mills, are the press houses and the granulating houses. Those houses are built generally

Mr. Hick—continued.

as light as possible, in order to make the explosion as light as possible.

1132. So that there should be nothing to be driven about?—Yes, if we put a heavy tank of water on the top of the building it would probably increase the violence of the explosions; nothing would prevent the explosion being completed in the granulating house.

1133. Each pair of edge runners are usually separated from the rest, are they not?—In my factory we have not two pairs in the same house; but in some factories there are two in the same house.

1134. Do you think that a number of intercepting walls made hollow, water bulk-heads, in fact, would be of service in preventing the communication of an explosion from one house to another; I mean in the incorporating mills?—I think that is hardly necessary. I may state that during the last 12 years we have only had one case of explosion communicating from one mill to another; and the cause of this was, that in the mill which first exploded the shock was not sufficient to tip the tank in the adjoining mill, which thereupon caught fire.

Mr. Dillwyn.

1135. You have been cognisant of a good many explosions at various times, have you not?—Yes, at the incorporating mills.

1136. Only there?—Yes, only in the incorporating mills.

1137. Have you never seen any other accidents?—I never saw an explosion; but I have been on the scene shortly afterwards, at another factory.

1138. Have you assisted in inquiring into the causes of those accidents?—No, but I have read the evidence.

1139. Do you think that they are generally traceable to a certain cause?—Yes.

1140. In the case of accidents and explosions, have the cases been generally inquired into by the Government inspector?—For the last three years they have, I believe.

1141. Have you ever known, of your own knowledge, any difference of opinion to arise with reference to the cause of an explosion between the Government inspector and the manufacturer?—I do not know that I have.

1142. You say that you think, on the whole, the causes of explosions are generally traceable?—There is a great difference of opinion about this point, but I have my own idea as to what the general cause of explosion is.

1143. There is no general reason assignable I suppose?—No further than the general reason of carelessness in some shape or other.

Mr. Bell.

1144. I do not quite understand why you would exempt incorporating houses from the inquiry, unless the explosion in those houses had been attended with loss of life or personal injury?—Because I do not think that you can generally find out the cause; I have known a great many accidents in incorporating houses, and experienced people all differed about it; each has his own idea of the cause.

1145. I suppose you would consider it very

Mr. Bell—continued.

desirable that some good explanation should be arrived at, if possible, with respect to the cause of those explosions in incorporating houses?—I should very much like to know it if there is one general rule beyond the grand cause of carelessness.

1146. Then, would it not be desirable, if for no other reason, to hold inquiries in order that, if possible, the general cause might be ascertained?—I am afraid that it would not be ascertainable.

1147. But are there not many such things which have resisted inquiry for a long time, centuries in fact, but of which, at last, satisfactory explanations have been given?—Yes, where the cause has been constant; but the cause is not constant enough in this case.

1148. Why would you make inquiry when loss of life had ensued, or personal injury, since the same difficulty meets you there, does it not?—I think an inquiry should be held there, in order to, as far as possible, find out with whom the fault does lie.

1149. Would you not think after half-a-dozen explosions in an incorporating mill without personal injury, on the seventh one occurring, that it would have been just as well to inquire into the sixth preceding one?—Yes; but that is a case which I do not think has arisen; not in my factory, certainly.

1150. I understand you to say that accidents frequently happen in the incorporating mills?—Yes, more frequently than in any other parts of the factory, but not in the same mill.

1151. Is it not the fact that any one of those explosions might just as well have resulted in loss of life or personal injury as any other?—Yes.

1152. Are you acquainted with the Mines Regulation Act?—No.

1153. You are not aware that when a workman anticipates the possibility of danger from the impurity of the atmosphere, he is at liberty to acquaint the inspector of mines with the circumstance?—No; I think that would be a very useful power if you could obtain warning of the explosion.

1154. But in the case I put to you, a workman merely expresses his suspicion of the possibility of an explosion, and the mine inspector is enforced to come to examine the mine?—I should be very glad. We always encourage our men to tell us of their suspicions if they think that anything is wrong in the works.

1155. With regard to the comparative danger of dynamite and gunpowder, is it not the fact that the danger occurs from a very different class of circumstances with dynamite to those which accompany the use of gunpowder?—Yes.

1156. Therefore, in making any comparison you would of course need to have due regard to the frequency of one class of circumstances or another class of circumstances most likely to be encountered in their use?—Yes.

1157. For instance, in gunpowder you very frequently have the powder exposed to conditions almost certain to produce an explosion: for example, in placing the powder in the shot hole itself, you may strike fire, may you not?—Yes, certainly, it is very possible to do so.

1158. But that would not inflame dynamite, would it?—I am not prepared to say.

Mr. Pigou.

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Mr.  
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Mr. ALFRED DUDLEY KEIGHTLEY, called in; and Examined.

Chairman.

Chairman—continued.

1159. You are a partner in the Gatebeck Gunpowder Works?—Yes; the firm is W. H. Wakefield and Company, and it has been in existence since the year 1764.

1160. Do you represent the trade in any sense, or do you merely speak on behalf of your own firm?—I have had many conversations with powder manufacturers, but I now speak on my own behalf.

1161. Have you heard the general tenour of the evidence of those two gentlemen who have preceded you?—Yes.

1162. Do you generally agree with them?—Yes.

1163. You are prepared to speak with regard to the manufacture, storage, and conveyance of gunpowder?—Yes.

1164. Have you had any actual knowledge of other explosives?—No; it is only what I have heard and read.

1165. With regard to the regulations proposed, and of which, I think, you have the summary, will you be good enough to speak generally as to whether you think fresh legislation on the subject of explosives is desirable or not?—I think in many respects fresh legislation is required. In the first place, Major Majendie in naming the Acts which he proposes to repeal, alludes expressly to the Liverpool Floating Depôts Act. This Act was passed about the year 1851 I think, and it was passed in consequence of the apprehensions entertained by the inhabitants of Liverpool as to the Egremont Magazines then in existence, and after some time it was resolved that those magazines should be abolished, and the present floating depôt was established. Colonel Boxer was instructed to report on their construction, and he did so very carefully, and Major Majendie expressed much approval of the system. I understood him to be satisfied. I now ask why does he propose to repeal this Act of Parliament when those depôts involved a large expenditure of capital, and they are strictly private property.

1166. You have considered each of those suggestions seriatim, have you not?—Yes.

1167. You have been speaking now with reference to Section 1, in which a suggestion is made to repeal certain Acts of Parliament, have you not?—Yes.

1168. Have you anything further to remark on Section 1?—No.

1169. Now, on Section 2 have you anything to say?—That would be included. I think the word black gunpowder, as so defined, should be excluded from the considerations which would apply to other new explosives. Black gunpowder has been used for many centuries, and during that time experience has told us under what conditions it can be manufactured and used; but as yet we have no new explosives upon which we can so well rely.

1170. Is not something due to familiarity?—Yes; and when we have got as familiar with the others, I would not except them.

1171. With regard to Sections 3 and 4, what have you to say?—I would suggest, with regard to the quantities to be kept in the various buildings of the powder factory, that they should be clearly defined, and that the class of dangerous

practices to which Major Majendie alludes towards the close of his list in Sections 36 up to 43 should be carefully defined in the Act; and that the inspector's power of interference should be limited to breaches of the law with regard to quantities, and breaches of the law with regard to dangerous practices.

1172. You seem to think that the Act of Parliament should apply solely to gunpowder?—Yes, or gunpowder should have a special clause, I think.

1173. You think it should have a legislation of its own, I suppose?—Yes.

1174. What have you to say with reference to the proposed limitation of quantity?—I have to say that in the year 1872 there were frequent meetings of the leading members of the trade, with Major Majendie and Captain Smith, on which occasion all questions of manufacture were thoroughly discussed. A series of questions were addressed to all the members of the trade to ascertain their views and practice. Those questions I believe have all been replied to by the trade, and the trade have arrived at a substantial agreement with respect to the quantities in most of the houses. There were some few points left undecided, but we have come to a substantial agreement as was proved by the letter received by Mr. Curtis from Major Majendie on the 11th of May 1872.

1175. You mean that letter which has already been read to the Committee?—Yes; I have to say with reference to the suggestion of Colonel Younghusband, and Major Majendie to abandon the statutory limitation of the Act, and to leave the decision of the quantities in particular buildings to be determined by the inspector for the time being, that it would operate very adversely on many manufactories, and would give the inspector more power than we think he ought to have.

1176. With regard to new works, I believe that you have some observations to make to the Committee?—Yes; with reference to new works I should have no objection that a plan should be laid down on which they should be constructed; but the alteration of old works is a much more difficult question.

1177. You mean a plan laid down by the inspector, I suppose?—Yes, a plan laid down by the inspector; Colonel Younghusband used the phrase "proper machinery" in his evidence. That is a question involving very great difference of opinion. Where workpeople in a peculiar class of trade have been accustomed to use with safety a particular class of machinery, however much it may differ from other people's ideas, they have acquired confidence in that machinery. If an inspector, accustomed to the southern practice, comes to the north of England, he might see machinery which an educated eye coming from the south of England, would not approve of; but the workpeople would refuse to use it, and in a particular instance they have done so, because they say the old machinery is safer.

1178. You would not trust the inspector to say that such and such machinery under such circumstances must be proper?—It would be better to trust to the experience of the men who have used the machinery without an explosion  
for



*Chairman*—continued.

for perhaps 40 years, and spent their lives in it.

1179. Have you any remarks to offer to the Committee, with reference to Section 9 in the summary of suggestions?—If the license was made personal as well as local to the situation, it might happen on an occasion of a quarrel between a gunpowder maker and his manager, or his agent at a distance, that the license would remain with the agent, and might be held adversely by him in the face of the owner.

1180. Now, to come to Section 14?—There are many consumers to whom the two ton limit proposed in that clause would be less than their consumption; there are some consumers that use from five to 10 tons per month.

1181. Would not a special license apply in that case?—The special license for mine owners is limited by Major Majendie to two tons.

1182. That would be a common license, would it not?—Yes.

1183. But a special license would apply to a larger quantity, I believe?—Yes, that would be a special license for a mining magazine, I think; but Major Majendie only proposed to license mining magazines as common ones. With regard to Section 14 in mining districts, much evidence has been given by Major Majendie and my predecessor with reference to the reckless character of the miners who use the powder; the best regulations in the world would be liable to be neglected, and it is very difficult to ensure at a distance that the regulations shall be adequately carried out; the risk would fall on the mine owner. I would suggest that in mining districts the construction of the magazine would form a better defence than regulations for the men; an immense step would be made towards safety if the packages were made on a proper pattern, and if the powder were deposited on shelves, it would no longer be necessary to insist on the magazine clothing or shoes.

1184. I believe that you have something to say with reference to the storage of other explosives also?—Yes, I have a strong opinion that they should on no account be kept along with powder, because, in the event of an explosion, it would be very difficult to say which was in fault. At all events we know that powder will not explode except with fire, while we do not know so much with regard to the others; but they are known to be liable to spontaneous decomposition and exudation.

1185. I believe that Section 17 is the next on which you desire to offer a remark?—Yes. An Act of Parliament was specially passed, transferring the licensing jurisdiction from the court of quarter sessions to the petty sessions, probably for the reason that the local magistrates might be presumed to have a better knowledge of the intended site of the new works or magazine, and possibly also of the character of the intending applicant. I would suggest that the original application for licenses should be continued at petty sessions as now, the inspector having previously seen the site and approved of the plan; and if there was an appeal on either side, either by the applicant or by those who objected to the granting of the license, the appeal should be heard at the court of quarter sessions, where all parties might be heard by counsel.

1186. Now to go to Clause 20?—The capital involved in powder making is very large; I be-

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lieve I speak within the mark when I say that there is a million and a half of money engaged in the powder trade. The amounts spent on the works and plant is very large relatively, and 30 years would be too short a period of time, in a very competitive trade, for the owner to recoup the capital which he had expended. Major Majendie in his report expressly says that a short license would offer an inducement to the manufacturer to erect bad machinery, and to keep it in a bad state of repair.

1187. Would you be kind enough to name a term for the license according to your view of the matter?—It should certainly not be less than from 40 to 50 years.

1188. You propose to speak to Section 21 at the same time as Section 20, do you not?—Yes; if the inspector were compelled to mark out the surrounding danger area, the manufacturer might be exposed to very great difficulties from persons erecting buildings for the express purpose of obtaining damages from him, if I may use the term damages.

1189. What remarks have you to make on Clause 23?—In accordance with Clause 23 the Secretary of State is to have the power to grant permission to a person having a special license for a factory or magazine, to vary the conditions as to matters of technical and internal detail, but not as to extension of area; but why not give the Secretary of State full dispensing power with reference to the whole?

1190. You would not wish that to be settled by statute?—No.

1191. Will you please proceed to Clause 24?—It might operate very adversely to the manufacturer, if, as it is proposed under that clause the license was to be determined by an explosion. The instance given the other day at Dolcoath, where children laid a train of powder and exploded the magazine, could scarcely be said to be the fault of the owner of the magazine, though he imperfectly looked after it. There was a case which I know, belonging to a manufacturer at Bagilt, North Wales, where, on two occasions, the magazine was broken into, though the roof was strong. Slates were removed, and powder was taken away, and if an explosion had happened in that case, the powder maker would have lost his magazine and probably his license. It may be also said that under this clause a competitor in trade, or an obnoxious neighbour, might do something which might make the magazine untenable.

1192. Would there, in your opinion, be no case in which the destruction of a magazine should lead to the forfeiture of the license?—Yes, in all cases where there was wilful neglect or wilful defiance of the inspector's suggestions, then I should submit.

1193. Now, with regard to Clause 25 what have you to say?—The majority of the powder factories are driven by water power; their buildings are necessarily constructed along the course of the stream, where it allows of water power being used, and in cases of limited area the result of forbidding the re-erection of one out of two buildings after an explosion would be the ruin of the factory, because another site would not be available. With regard to the question of communicated explosions, it is entirely a matter of opinion as to what is likely or certain to cause that. I have seen a building (on factories which

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I have visited) at a great distance exploded by communication, while the one near to the other has escaped unhurt altogether.

1194. But in Clause 25 there is no suggestion that buildings are not to be re-erected, but only that they are not to be re-erected until the Secretary of State, through the inspector, has decided that they ought to be; this would put the onus of proving that on the owner?—Yes.

1195. To which you object?—Yes.

1196. Will you kindly proceed to Clause 26?—Yes. This clause gives power to a railway or canal company to carry without a license; but then subsequently, by Clause 29, they are required to frame bye-laws, which bye-laws require the approval of the Secretary of State.

1197. You think that is surplusage, do you?—Yes. It is quite necessary that a railway company should make proper bye-laws for the management of the trade, and that they should provide, as Major Majendie has suggested, proper loading places; but unloading places, particularly with regard to railway transit, would be almost impossible. The firm which I represent has railway rates to 418 different stations, to all of which we may any day be sending powder by railway; if they were required to make 418 unloading places they would refuse to carry the powder at all, and in that case, if the large monopolists of carriage were to refuse to carry the powder, we should be forced back on horse transit, which, in my own experience, before the railway companies began to carry powder, involved in the journey of 90 miles to some parts of the Durham district from our works, the transference of the powder through five different carriers, each carrier having his own cart and his own place of loading and unloading and deposit, and his own special danger. The further you remove the powder from the manufacturers' works, and the place where it is consumed or made, the more you increase the intermediate dangers over which the manufacturer, at all events, can have no control, though he may get a great deal of ultimate responsibility.

1198. Now, with regard to the general rules made by an Order in Council under Clause 32, what have you to say?—I should wish to see those rules defined in the Act; I mean general rules which Major Majendie, in concert with the trade, if we can agree, would define as to dangerous practices. Within those limits, I would give the inspector power of absolute interference to give notice to stop the practice instantly. With regard to suggestions afterwards, I should listen with the utmost respect to suggestions from Major Majendie. The report which he has been kind enough to give of our factory is a satisfactory one. With reference to suggestions, I would leave them in this way, that if the inspector were to see practices which he thought dangerous, he might give three official notices of it, and if they neglected such notice, then Clauses 37, 38, and 39 might be brought into effect, and the inspector might take summary proceedings.

1199. Might not the state of things be so bad that even the first notice should be arbitrary?—Such has never been the case inside a powder factory. There was an instance where Major Ford saw the nitro-glycerine exuding from dynamite on to the floor.

1200. You would think that summary powers

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were necessary there, would you not?—Yes, certainly, if he saw powder on the floor in a magazine in the country he might have summary power.

1201. There are certain circumstances under which you think the inspector should have summary powers?—Yes, there are.

1202. Now will you come to Clause 33, with reference to special rules for manufacturers?—I would say that the fewer and simpler the rules are, the better, as the persons who work in powder mills are not the best scholars, and the rules would be forgotten. The fewer the rules that are left to the discretion of the men, under any circumstances, the better; and with that view in framing the rules for that factory of which I have the conduct, I have made them as short as possible (*handing in rules, vide Appendix*).

1203. Now as to Clause 35, with respect to "fit persons to be appointed as inspectors," will you favour the Committee with your views?—When a gentleman has got such a large experience as Major Majendie everybody will bow to his decision; but this experience has to be learned, and especially with the probability that under the Act there would be a considerable increase in the number of inspectors, we cannot have the same confidence in raw hands.

1204. But how would you propose to restrict the Secretary of State in his selection of inspectors?—By seeking, if possible, to appoint some one who had had previous experience of powder and of powder makers.

1205. You would not trust to the Secretary of State to be guided by his own responsibility then?—We shall probably be obliged to submit.

1206. Now, with respect to Clauses 36, 37, 38, and 39, what have you to say?—I should desire to limit the power of entry into the powder factory to the inspector only, unless after repeated official warnings specifying any dangerous practice, the inspector found that certain persons were incorrigible, in which case I would hand them over to the secular power.

1207. You think, then, that there are certain works in the trade which ought to be placed under special supervision?—I should be sorry to define them, but I would not deny it.

1208. Clause 40 is the next on which you wish to say something with reference to searchers?—Yes, all those Clauses 40, 41, 42, and 43 would follow on the suggestion that the inspector only should have a right of entry and after repeated official warning to apply for a warrant for a search, if after repeated warnings the works neglected his recommendations. I have no objection to Major Majendie's suggestion on that point.

1209. How many warnings do you think ought to be stated in the Act as required to be given before the law could be put in force to protect the public?—Much would depend on the nature of the practices. I have already suggested that the dangerous practices should be defined in the Act.

1210. With reference to the arbitration clause 44, what have you to say?—I have no objection to offer to that clause.

1211. The next is Clause 45 as to the reporting of accidents?—I agree with Mr. Pigou, the previous witness, that with reference to the incorporating mills, it would be unnecessary to report all accidents. The practice at the works is that when the charge is placed in the incorporating

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porating mill, the man leaves it, and as the charge is limited by the Act to 60 pounds it is to be hoped that the explosion would be limited. In cases of death following such explosions, or severe personal accidents, of course, we think the explosions ought to be reported.

1212. Will you come now to Clause 48, as to the forfeiture of licenses?—That leaves us very much at the mercy of the wilful act of our own servants.

1213. Do you suggest the insertion of the word "wilful" before the word "substantial"?—Yes, we would then submit to such penalty as was thought fit.

1214. Now with regard to Clause 50 what have you to submit to the Committee?—The owners of existing factories have of course a legal existence for the manufacture of unlimited quantities of powder and for an unlimited period of time, and this clause might be used to operate to the restriction of those rights just the same as Clauses 23 and 24 with reference to re-erection might operate. Major Majendie professes to protect existing rights; I do not see why we should be required to take out continuing licenses.

1215. Do you think that existing factories should remain unlicensed?—The existing factories already possess their own licenses, and we do not see why they should take out another.

1216. You mean that they should remain under their present licenses?—Yes.

1217. Even if they are of that class which you have described, but do not name, as those which ought to be under supervision?—I cannot say anything about them.

1218. I think that concludes the remarks which you have to make on the suggestions?—Yes.

1219. But I believe that you wish to add something with regard to the licensing of vehicles?—Yes, with reference to country carts, the necessity for the extreme care which Major Majendie suggests, would be much obviated by a regulation that the packages shall be absolutely sound and safe. The package is constructed of wood, and unless the powder escapes from it, you may bring a light, and set a candle burning against it, without danger; it is only when the powder escapes from the cask that there is any danger; if the package is safe, any carriage conveying powder is safe. With regard to the vans which are in use on railways for the carriage of gunpowder, they were originally constructed on a plan furnished by the Government; and they are so tight, that in an instance within my own knowledge in South Wales, the consignee of some powder from ourselves was found to be missing; knowing that some powder had arrived for him at the station, search was made for him there, and he was found within the powder van, almost dead, through the door having suddenly closed upon him, and he being unable to open it, was nearly stifled.

1220. You are satisfied that those vans are sufficient?—Yes. In the construction of gunpowder factories, I think the geological formation of the country should be taken into account. In the Valley of the Thames there is a considerable amount of flint and grit, materials which are very dangerous, and very liable to cause an explosion; but such grit is unknown in the north of England; I do not know of my own knowledge of any accident which can be attributed to that cause.

0.84.

*Chairman*—continued.

1221. You would suggest in all cases that the geological character of the locality should be considered before a place for a new building was licensed?—Yes; and also that it should be taken into account in the consideration of the causes of accidents in any other building in the same locality. With regard to packages, I think, that a powder barrel ought never to be used a second time and refilled with powder, unless it happened that the district where the powder was supplied was one where the manufacturer, by his own servant, could exchange the package. In my own experience, I find that when the casks are returned they are sent back in a dangerous condition; sometimes with lucifer matches included within the hoops. On one occasion one of our large powder buildings very narrowly escaped an explosion from that cause.

1222. You propose to have the packages destroyed after being once used?—Yes; and never refilled.

1223. That is to say, empties never sent back?—Just so.

1224. Have you any further remarks to make with regard to the pattern?—I think the pattern should be one which every manufacturer should construct for himself, and one which should receive the express approval of the inspector.

1225. Have you anything more to say on the question of transit?—If there was a regulation, such as appears in Major Majendie's Report, that the quantity of powder to be sent in one train should be limited to two trucks, much danger to the public would follow. On many days the train maximum would be exceeded, which would require the superfluous vehicles to be shunted on to out of the way sidings, waiting for another train to go forward next day. The utmost celerity should be given to the transit of powder between the manufacturer's works and the place of consumption. A traffic manager would be a better witness on this point than I am. I am only speaking of the quantity of powder and the number of casks that we are in the habit of sending out without accident of any kind.

1226. What have you to say with reference to mine magazines?—That subject I have rather anticipated in my previous remarks. I merely wish for a better construction of mine magazines. Forbid, by all means, any breakage of bulk in the powder packages within the mine magazine; prohibit it absolutely.

1227. With regard to common magazine licenses, the present Act of Parliament limits the quantity to two tons, does it not?—Yes, in a mining magazine; but that Act of Parliament was passed at a time when the mining trade of England had not received its present development; particularly in the Cleveland district.

1228. But there would be no difficulty in granting a special license to a mine magazine, would there, and that would obviate that difficulty, I suppose?—Yes; precisely.

*Colonel North.*

1229. You have stated that you have no objection to give the inspector power to order a thing to be remedied when there is immediate danger?—Yes; I wish that dangerous practices should be defined within the Act of Parliament, and that, within that definition the inspector's power should be limited; but if he saw anything that, as a matter of opinion, he thought dangerous, which

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which was not in the Act, he might make a suggestion, but I do not wish him to have the power to come down suddenly upon us, and find out a fresh dangerous practice every day.

1230. But in a case of real danger you would not object to the inspector's power, would you?—No; but it might be a matter of opinion.

1231. You would not leave the option with the inspector?—No; I should like to define, in the Act of Parliament, all the dangerous practices over which he should have summary power.

1232. Would it be possible to do that, do you think?—Yes.

1233. But what time do you think should elapse between each of the three official warnings?—It would depend on the nature of the dangerous practices. If it was imminent danger it would be defined in the Act; that would be an immediate case. The points as to which I would give the power of the three notices are a matter of small detail.

1234. But they would not include the causes of immediate danger?—No; such should be defined in the Act of Parliament.

Mr. Vivian.

1235. I think I understood you to say that you only manufactured black powder?—Yes.

1236. You speak only of other explosives simply from what you have read and heard, I suppose?—Yes, simply from what I have read and heard.

1237. I believe you said you would suggest that, in cases of new works, the inspector should furnish plans?—That he should approve of plans to be furnished by the parties.

1238. Therefore the works could not be erected without the approval of the Government inspector?—Just so.

1239. Would not that be requiring rather too much of a new manufacturer?—It is merely this: that it was a suggestion in accordance with Major Majendie's own Report.

1240. You would not propose to have him in any way interfere with old existing works?—No; they have been laid out and all settled, and a sudden alteration might involve the ruin of the manufacturer. I would not interfere with the works until they were proved to be bad.

1241. In the event of the inspector finding in old works some gross want of care in the erection of the buildings, would you propose to give him any power to interfere in that case?—If you take a case in which it was impossible for the manufacturer to alter the work, that would amount to a confiscation of the whole of his capital.

1242. Is it impossible in the manufacture of gunpowder to have it carried on in several small and distinct buildings?—That we endeavour to do under the present Act of Parliament.

1243. You said that workmen were often unwilling to use new machinery, did you not?—Yes. I will give you an illustration which is within my own knowledge. Within the last 10 years, in the north of England, one factory was carried on with safety for between 40 and 50 years. In the year 1862 a new manager was appointed, who came from the south of England. At his instance the proprietors remodelled the whole factory, and introduced southern machinery; and in the year 1863 a very terrible

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explosion took place there. Another factory (to which I was alluding) is not many miles distant, and was built and furnished with machinery almost on the lines of the other factory; the men were also accustomed to work under the same conditions and rules. After this explosion, the manufacturer at the second factory, having procured a corning machine of southern construction, his men refused to work it, and it is not erected to this day.

1244-5. In the case of improved machinery, the fact of the men refusing to work is generally connected in some way with wages, is it not?—No, not at all.

1246. Nor on the ground of the work being harder?—No; the men objected to it on the ground of safety; they naturally attach very great importance to the continued safe use of machinery which has gone on well for 40 years.

1247. With regard to mine magazines, have you visited many?—I know a good many of them.

1248. You think that two tons of gunpowder is too small a quantity to be allowed in mine magazines, do you?—It is enough for the majority of cases; but for some of the very large consumers it is insufficient.

1249. What quantity of powder have you ever known to be used by one mine in a month?—Five tons.

1250. Would you suggest that five tons should be the limit?—Not to exceed five tons, and only that in special cases.

1251. It is suggested, is it not, that a special license would cover that case?—Yes.

1252. A special license would entail on the occupier of the mines the necessity of going to the court of quarter sessions to get that license granted, would it not?—It would be at the petty sessions at present.

1253. But in many of the mining districts in England the mines are a long way off from where the quarter sessions are carried on, are they not?—Yes.

1254. Now with regard to breakage of bulk; you mean that there would be more danger after breakage of bulk within the magazine?—Yes, there would be more danger to an unexperienced miner; it is almost certain to result in more or less spillage of the powder.

1255. What size casks do you generally supply to mines?—Twenty-five lbs. casks.

1256. In small mines, how long does it take to consume 25 lbs. of powder?—It would be a very small mine that used less than 200 lbs a month.

1257. So that 25 lbs. would take three or four days to use?—Yes.

1258. Where would you propose to have the powder stored during those two or three days?—If necessary the mine owner might have it within the porch of his magazine; every magazine should be constructed with double doors, within which the worn or broken casks might be deposited; that would avoid internal danger and avoid the necessity of wearing particular shoes, and other matters of that kind; always providing that the magazine has been properly constructed.

1259. Would you look more to the construction of the magazine than to anything else?—Yes.

1260. Would you imagine that it would entail much expense in reconstruction so far as you would

Mr. Vivian—continued.

would press the reconstruction of magazines?—No, not very much.

1261. In what way would you suggest that to be carried out?—It would be desirable that the powder should be deposited on shelves, very much like the way in which Messrs. Farrow & Jackson deposit their wine bottles in their bins. The floor might be wood, and it would be no longer necessary on such floors to insist on the same rigorous precautions.

1262. It does not require the same knowledge to inspect a mine's magazine as it would a powder manufactory, does it?—No, certainly not.

1263. The inspection of a mine's magazine might be done by someone not particularly well acquainted with the subject, might it not?—Yes, if he had received a reasonable good powder education. In fact a mine inspector not having received a special education with regard to gunpowder, might be disposed to be more stringent than probably a Government powder inspector would be.

1264. Are you acquainted with any Government inspector of mines?—No.

1265. Do you know whether they are persons of education?—They probably are much better educated than I know of, though not on powder matters.

1266. I suppose a well-educated person may be perfectly capable of inspecting mines?—Yes.

1267. You are, I gather, of the same opinion as the last witness, that explosions in incorporating mills should not be reported?—I am. In the majority of cases, the mill after exploding is at work again in less than 24 hours, but if you had to go through the process of reporting to the Secretary of State, and waiting for the inspector to furnish his report, you would have great delay, and there is no greater evil, in my opinion, than that the exploded material should be lying about the place; it keeps present to the men's minds the idea of special danger, and certainly does not advance the work.

1268. How large a quantity of gunpowder may there be on incorporating mills?—Sixty lbs.

1269. Did you never know of more than 60 lbs. in such a mill?—I have heard of more, but we never work over 60 lbs.

1270. Did you ever hear of an explosion in the incorporating mills communicating with other buildings?—Yes, but usually incorporating mills were formerly constructed in pairs, with strong division walls between them. Latterly the explosion, if any, has been limited to one mill; but it used to be the case that they were in pairs.

1271. Is it the fact that in old manufactories they are now to be found in pairs?—Yes, frequently.

1272. Did you ever know of a serious loss of life from an explosion in an incorporating mill?—No, but I have heard of persons being killed through disobedience to the rules, but it is a comparatively rare thing. Those explosions involving loss of life that I know of myself in incorporating mills have been entirely through neglect of the rules.

1273. You say that no serious loss of life, however, takes place from explosions in incorporating mills?—Just so.

Mr. Stevenson.

1274. Did I understand you to say that, practically, the existing Act actually limits the charge in incorporating mills to 60 lbs?—Yes.

Mr. Stevenson—continued.

1275. Do you approve of the Act of Parliament going into such minute details in any manufactory?—This restriction has prevailed since the year 1762, within which time all the existing works have expended their capital; and if there were to be very considerable relaxations, their capital would be very much jeopardized by those relaxations.

1276. Then you consider that a wise restriction, do you?—I do. If you had six incorporating mills lying together (they are called in the Act of 1860 a group of incorporating mills), and those mills were successively to explode with larger quantities of powder, they would carry their burning material to a greater distance.

1277. But if a larger charge was allowed to be used, would not a smaller number of mills do the work?—In certain classes of powder; it would not be so where the quality of the powder is an object.

1278. Considering the public safety, and considering the safety of the work people, and the benefit to the manufacturer, is 60 lbs. of powder that which you would have fixed as the proper charge for incorporating mills?—Previously to the Act of 1860, the charge was limited to 40 lbs.; but the practice of the trade, and the practice of the Government works, was to exceed that limit. Explosions were more frequent when the smaller charge was used than they have been since it was 60 lbs. Since the charge was increased to 60 lbs., the explosions are indeed much fewer. Not having experience of the working of larger charges than that, I have no opinion to offer to the Committee, except that I believe greater danger would be done to surrounding property through the explosion of a larger quantity of powder.

1279. Are the Government powder factories limited to any number of pounds?—I believe that the Act of Parliament expressly excludes the Government factories from any restrictions.

1280. They being free from any such legal restrictions, do they adhere to the limit of 60 lbs.?—I cannot say. Colonel Younghusband in his evidence proposed to give a dispensing power to the inspector in proportion to the machinery which was employed, and to the situation of the works, by which I take it that he proposes to allow an increased quantity under favourable circumstances.

1281. That is to say that there should be no such limit as 60 lbs.?—Yes; but the opinion of the trade generally is the other way. I believe there were only four manufacturers who expressed an opinion in favour of increasing the limit beyond 60 lbs., and out of those one factory has since been abandoned.

1282. Would they not be influenced by the consideration that their existing machinery was adapted to 60 lb. charges?—I believe that most of the machinery, and certainly our own, is capable of working 120 lbs. perfectly well, and it would double our producing power.

1283. Do you mean perfectly well with respect to safety?—That is another question. I think, if it goes off, there is more danger of the explosion spreading, at all events.

1284. You do not, I believe, object to the inspector having the power to control the plans of new gunpowder factories?—No I do not object to

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to that. It may seem invidious to say so; I only do so in deference to Major Majendie's greater experience, but I know how any alteration would operate on our own factory, but others who come after me may avail themselves of Major Majendie's experience, without suffering any such injury.

1285. Would you claim the power for an old manufacturer to alter the machinery and position of his works without requiring the sanction of the inspector?—Personally I should not contemplate an extension of our factory, without consulting the inspector.

1286. But with reference to expenditure of capital in such works, do you really think that it should be under the control of a Government inspector?—More in the way of suggestions than of absolute dictation. It all depends on what inspector you have.

1287. You will take the inspector's advice, but not his control?—I will take his control to some extent. I should feel that if I did not take his advice I should be acting under great responsibility.

1288. With reference to cases in which the inspector should have summary powers, you suggested that those cases should be defined in the Act, did you not?—Yes.

1289. Have you made any sketch of those cases?—Not as yet; that is a matter which should be discussed in concert with the trade.

1290. You think that the trade could agree on those cases, do you?—Yes.

1291. I think you said that the trade have agreed to the quantities to be defined in the Act of Parliament?—Yes; we agreed as to that in the year 1872 with Major Majendie.

1292. That is to say, you would make a general law, founded on the experience of the trade as far as that experience would carry you?—Yes.

1293. With regard to other points on which you could not agree, are you content to be at the discretion of the inspector?—With respect to the quantities, I say define them in the Act of Parliament. With reference to practices in gunpowder mills, which we know to be dangerous, include them also, and give the inspector summary powers. With regard to other matters, his experience will enable the inspector to suggest things. If the matter in question were of a dangerous nature, I would bring in force the three notices of which I have spoken.

1294. Suppose the inspector was in your opinion unreasonable, to what tribunal would you appeal?—The arbitration would then come in. The arbitrators to be nominated in the way that Major Majendie suggested.

1295. You do not contemplate any court of law, do you?—No; that would be very costly and unsatisfactory to most of us.

1296. With regard to the quarter sessions as a tribunal of appeal, do you think that it is a good court to decide whether or no the inspector or yourself might be in the right on a question of licensing?—Only in this way, that the court of quarter sessions is a legal tribunal before which we should be heard by counsel.

Mr. *M'Lagan.*

1297. Did I understand you to say, that you thought (speaking with reference to the bye-laws for purposes of transit) that the Secretary of State alone should have the power to make

Mr. *M'Lagan*—continued.

bye-laws?—No, I should let the railway companies do it, by all means.

1298. Those bye-laws to be submitted to the Secretary of State and approved of?—Yes.

1299. With regard to paragraph 32 of the Summary of Suggestions, I understood you to say that you disapprove of general rules for the manufacture, storage, packing, and carriage of explosives being laid down otherwise than by statute?—Yes; for this reason, that through those successive Orders in Council coming out from time to time, the trade would be kept in a fever.

1300. True; but circumstances alter very much, and would you propose to have a new Act of Parliament every five or six years?—At all events, if the Order in Council is to change the regulations let it be at statutable intervals.

1301. What period would you suggest?—Five years.

1302. But circumstances might occur when you would require an order for a slight change; do you not think that might be met by an Order in Council?—We should have no opportunity of being heard on the preparation of those Orders in Council.

1303. Looking at your rules, I find that you prohibit smoking?—Yes, everywhere on the premises.

1304. Do you find very great difficulty in carrying that out?—Yes.

1305. Do you take the pipes away from the men?—Yes, I make repeated searches myself, personally, and in a number of cases I have found lucifer matches.

1306. Do you search the men every morning?—Our works are a mile and a half in length, and it is perfectly impossible to have a stone wall built round them; but there is one common place where every man must present himself and change his clothes, and take another suit, while his own clothes have to be left in the room where we have the search. The quantities of things which we find in the men's pockets would astonish you.

1307. Are you aware that after the warehouse-keepers in Liverpool searched the men, always before going in, the effect of that was to put a stop to fires in warehouses?—I quite believe that; and with regard to the great majority of explosions in powder mills, I should say that they arise from the use of lucifer matches.

1308. The matches being used to light tobacco pipes?—Yes; there have been repeated instances in our own works where explosions have been narrowly avoided, and where lucifer matches have been the ascertained cause.

Mr. *Stanhope.*

1309. You object to the inspector having power to impose new machinery on a manufacturer; but would it obviate your difficulty if the local authorities had absolute power to regulate the conditions of the license?—My objection is this, I do not see why the presumption should be against machinery of which any works have had 40 years' safe experience.

1310. But surely the local authorities would be likely to do justice, would they not?—No, because the subject is so little known; in questions about powder making, the opinions of the men who actually work at it had better be taken; I would sooner take the opinion of an old experienced millwright than my own. Supposing the inspector

Mr. Stanhope—continued.

spector came to me about an old machine, and said that he should give me notice that it was dangerous, though I had been using it for 40 years with safety, I should be very much inclined to say, "You must give me a positive order to remove it, because you must undertake the responsibility of ordering a change.

1311. But supposing power was given to the local licensing authority to overrule the inspector, would not that meet the case?—I am afraid that the local authority would be inclined to attach more weight to what the inspector said than to what the manufacturer said.

Mr. Bell.

1312. I think I understood you to say that you agree with Mr. Curtis in his evidence, and generally?—Yes.

1313. Mr. Curtis stated that so far as he knew, there was in the trade a general observation of certain rules laid down, but on cross-examination it appeared that he spoke rather from hearsay than otherwise; do you speak in the same way?—I think, as a matter of conversation and general belief, that many manufacturers observe those rules.

1314. You spoke of consumers using as much as 10 tons of powder a month in the mining districts, and you mentioned the Cleveland district in particular; but I suppose you are aware that although a large quantity is consumed by individual firms, it is used at different mines?—If I might give an illustration to Mr. Bell, I would say that the firm of Pease & Co. were in the habit of taking five tons a month to one mine.

1315. You spoke of your disinclination to see the determination of a magazine license on account of an explosion, and I think you instanced

Mr. Bell—continued.

one case (cited by Major Majendie) of children having exploded a magazine by laying a train of powder; would you not think that there was some defect in the construction of a magazine which allowed children to get so near to it?—Yes; there was gross neglect no doubt on the part of the magazine keeper to leave the door in such a condition as it was found to be in. But the difficulty is this, that the magazine owner is made responsible for the neglect of a servant at a distance from him.

1316. You spoke about something like a geological survey being necessary before you determined the position of new powder works, did you not?—I merely said that it would be well if the geological formation of the country where the proposed works were to be made were taken into account and consideration.

1317. Are there not other kinds of material quite as dangerous as flints, of which you spoke?—Yes.

1318. For instance, quartz rock and sandstone?—Yes.

1319. Where they do occur they are very much more plentiful than you ever find flints, are they not?—Yes; but the difficulty which would occur is, that where the surface ground on which the factory would stand consists in a large measure of flints, some large and some small, there is much more liability of the small particles being blown into the building.

1320. I suppose that you would not say that it was worse than with the small particles from a sandstone quarries?—I do not know if it happened to be in close proximity to the powder factory; but I may say that I should consider all those things quite as dangerous as flints.

Mr.  
Keightley.  
15 May  
1874.

*Tuesday, 19th May 1874.*

## MEMBERS PRESENT:

Mr. Dillwyn.  
Sir John Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. M'Lagan.  
Colonel North.

Sir H. Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Vivian.  
Mr. Whitelaw.

VICE ADMIRAL THE RIGHT HONOURABLE SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Mr. JAMES PURDEY, called in; and Examined.

Mr. Purdey.

19 May  
1874.

*Chairman.*

1321. You are a Gunmaker, I believe?—Yes.  
1322. Does your trade include the filling of cartridges for your customers?—Yes.

1323. Is that trade generally carried on by the gunmakers?—I believe so.

1324. Is it possible for the majority of gunmakers to comply with those provisions of the Act of Parliament with regard to the filling of cartridges, which require that that operation should be carried on only under license, and not within 100 yards of a dwelling-house?—No, I should say that it is impossible, and I should say that it would interfere with the trade in the majority of cases, that is to say, if it is to be a distinct building not within 100 yards of a dwelling-house.

1325. You know the Act of Parliament, I suppose?—Yes.

1326. If those provisions of the Act of Parliament were enforced, the effect would, I presume, seriously injure the gunpowder trade?—Yes, they would.

1327. You are now working under the old Act, are you not?—Yes, certainly.

1328. You would, therefore, approve of a relaxation of its provisions, would you not?—Yes.

1329. I suppose you would not object to such statutory provisions as would tend to ensure the operation being safely carried on?—No.

1330. Would you consider it an unreasonable restriction if a person filling cartridges were forbidden to carry on the operation in a room in which there was a naked fire or light, or that he should be forbidden to carry it on in a general workshop where other people were at work, or in a shop where customers were coming and going?—No, I should say it would be advisable to do it in a place where there was no fire; I always do it so myself.

1331. Or that he should be forbidden to carry it on in the same room as he uses for keeping the bulk of his powder in?—Certainly.

1332. Might he not without inconvenience be limited to 5 lbs. of loose powder, that is to say, powder not in cartridges, in the room where the filling was carried on?—Yes, I think so.

1333. There would, I presume, be no objection

*Chairman—continued.*

to the manufacturer being required to observe due precautions to prevent accidents?—None.

1334. With regard to the quantity allowed to be kept by a gunmaker, what amount of powder would suffice?—The quantity set forth in Major Majendie's suggestion, No. 13; that is to say, 300 lbs. of gunpowder, or 1,500 lbs. if in cartridges.

1335. Do you not consider that the quantity of loose powder might be reduced if the quantity in cartridges were increased?—Not very well, I think, for regular cartridge makers or ammunition dealers; I have no doubt 1,500 is necessary.

1336. If, for example, you were able to keep 100 lbs. of powder loose, or five times that amount, or any part thereof in cartridges, would not that give you quite as great facilities as you have now where the limit of powder is 200 lbs., and where only 5 lbs. may be kept in cartridges?—Five lbs. in cartridges is, of course, no service whatever.

1337. But that is the present law, is it not?—Yes.

1338. Then I will repeat the question; if you could keep 100 lbs. of loose powder, or five times that amount, or any part thereof in cartridges, would not it give you quite as great facilities as you have now where the limit of powder is 200 lbs., and where only 5 lbs. may be kept in cartridges?—I do not think that 100 lbs. would be sufficient; I think if it is to be reduced, 1,500 lbs. would be more perhaps than would be required by the gun trade for loose cartridges. I think that they could do with less than 1,500 lbs. in cartridges, but not with very much less than 300 lbs. loose. I myself could do with 200 lbs. loose, but no less, and with 200 lbs. in cartridges. There are parts of the season when they have a great many orders coming in at the same time, and if their powder is obtained in the country the manufacturers must now and then have a larger quantity in stock.

1339. You think that 100 lbs. of loose powder would not be sufficient, even though you were allowed to keep 1,500 lbs. in cartridges?—No; but perhaps 200 lbs. would be enough.

1340. In



Chairman—continued.

1340. In your opinion, are the ordinary cardboard and metallic sporting and military breech-loading cartridges safe against explosion *en masse*?—Yes, so far as my experience goes. I have known cases where one exploded in a box in the times of pin-cartridges, and others have not exploded at all.

Mr. Vivian.

1341. You said that you thought that 100 lbs. of loose powder was not sufficient?—Just so.

1342. Notwithstanding that you might have five times that amount in cartridges?—Just so; five times is not necessary for a gunmaker.

1343. That is because different customers require their cartridges to be loaded with different charges, is it not?—No, not altogether. A great many gentlemen like to load their own cartridges, and then they require their powder to be sent to them in canisters.

1344. What do you understand by loose powder?—I was thinking, when I said loose powder, of the general form that we sell it in, that is to say, in canisters; but it is sold in papers.

1345. What are the sizes of the canisters?—They are 1 lb. canisters.

1346. Do you keep any powder in 5 lb. canisters?—No.

1347. You do not send the powder to your customers in 5 lb. canisters?—No.

1348. Could you keep any large quantity of cartridges loaded with powder alone?—Yes; but that would not be so safe as with shot.

1349. Why not?—Because in the case of one exploding, it would be more liable to ignite the others.

1350. Did you say that you only knew, in the whole course of your experience, of one case of an explosion?—No; I have known one or two cases where a cartridge has been exploded in the box, not upon my own premises, but when pin-cartridges were used. The box had been thrown down, and the pin exploded the cartridge in the middle, but not any of the others.

1351. You never knew an explosion extending from that one cartridge?—No, certainly not.

1352. Your customers generally require a certain charge of cartridge, do they not?—It varies.

1353. If you kept 500 lbs. of gunpowder in cartridge would you have those cartridges all loaded with the same charge?—No.

1354. You would have them loaded to suit your customers, would you not?—Yes.

1355. Could you with convenience to yourself carry such a stock of loaded cartridges?—I could myself, because I could store them; I should not require 1,500 lbs. of gunpowder, but others might where it is more of a cartridge trade than mine.

1356. You would suggest as necessary for the carrying on of your trade a larger quantity of loose powder, and you could do with a smaller stock than 1,500 lbs. of cartridges?—Yes; 1,500 lbs. is certainly a very large quantity for me as a gunmaker, but for a cartridge dealer that is a different thing, and I cannot give an opinion with reference to that.

1357. Do you think that it would be safe to keep a large stock of loaded cartridges in the same magazine as the powder in canisters?—I see no very great objection to that.

1358. You would not be afraid of the effect of a detonator being present, and being likely to

0.84.

Mr. Vivian—continued.

cause a serious explosion?—Not if the powder was in canisters.

1359. Nor would you in the case of loaded cartridges?—No.

1360. You would not be afraid of the explosion extending beyond that one cartridge?—No.

1361. You would see no objection, you carrying on your business on your own premises, to having a stock of loaded cartridges, and a large stock of powder in canisters in the same magazine?—No, I should not see any objection if it is not loose powder; but I do not know how it is to be defined. Powder in canisters, and then in a box, I consider safe with loaded cartridges in boxes in the same magazine. If any of the powder is loose or open, or if the cartridges are left loose, and not in boxes, then they should be separate.

1362. In what sized packages do you bring the gunpowder on to your premises?—In pound packages.

1363. In what sizes do you receive it wholesale?—In 50 lb. packages.

1364. In casks?—Yes.

1365. You unpack them into 1 lb. canisters?—No, the cask contains the canisters.

1366. And the largest package which you receive, are those 1 lb. packages?—Yes.

1367. In order to fill the cartridges with it, do they also come to you in 1 lb. packages?—Yes, but not in canisters; they come in 1 lb. paper parcels.

1368. In a cask?—Yes.

1369. How many?—We have the same quantity.

Mr. M'Lagan.

1370. Can you give the Committee any idea of the quantity of powder that a gunmaker in a good business will execute in orders, say in the course of a week?—Not off-hand; it depends so much on the time of the year.

1371. I want the largest quantity if you will kindly furnish me with it: say about the shooting season?—I should say perhaps 1,000 lbs. in a week; I am only giving a guess, however. I am speaking of loose powder, that is to say 1,000 lbs. a week in the busy part of the season; I have not supplied more than 800 lbs.

1372. Then you suppose that 200 lbs. would be inadequate as the largest quantity to be stored?—We could do with 200 lbs. in addition to the cartridges.

1373. You would require to have your magazine replenished every day in that case, would you not?—I do not know whether it is three times a week or every day we have the powder in, but I always try to keep the stock low.

1374. In the busiest season you would be putting out between 150 lbs. and 200 lbs. a day, would you not?—Yes.

1375. Do you live in London?—Yes.

1376. Your powder is delivered to you daily, I suppose?—It is delivered daily.

1377. I suppose there is no inconvenience or difficulty in your getting the powder delivered every day?—Not with me, but there may be with others, because they may not get it from the same source. I get my powder principally from Hounslow; if they get it from Scotland, for instance, they would, of course, be longer in delivering it; it would not come so regularly.

1378. Do you get your powder by railway?—No, we find that we cannot depend entirely on the railway.

N 4

Mr. Purdey.

19 May  
1874.

Mr.

Mr. *Dilwyn*.

Mr. *Purdey*.  
19 May  
1874.

1379. Do you think that all gunmakers should be allowed to keep the same quantity of gunpowder?—I see by the suggestions before the Committee, it is according to the place that they have for keeping it, which is in my opinion a wise suggestion.

1380. If they had detached premises you would propose to let them keep more powder than if they had not detached premises?—Yes.

1381. That might be adjusted according to the circumstances of storage, you think?—Yes.

1382. With regard to powder being sold in paper; is there much powder sold in paper?—We do not sell any powder in paper.

1383. Do any of the large respectable manufacturers of powder sell it in paper?—The intention of the paper packet is, that it should be sent up for immediate use by the gunmaker.

1384. Do you think that that is a safe way of keeping the powder?—Yes; but that is not so safe as the other way, of course. We have very little in that way.

1385. You would approve, would you not, of different conditions being imposed on gunmakers who sell powder loose in that way?—I would rather not give an opinion on that point.

1386. But there is a considerable quantity sold in that way, is there not?—Yes, I believe so.

1387. That is to say, for the purposes of the retail trade, I suppose?—No, I think not; I think it is mostly sent for their own use in loading cartridges.

1388. Is it ever retailed in pound paper packages or parcels, do you think?—I do not know.

Mr. *Vivian*.

1389. With reference to sending your loaded cartridges by rail; did you ever hear of an accident occurring to cartridges being sent by rail?—Never.

1390. You consider that they are perfectly safe sent in that way, do you?—Yes.

1391. Do you declare them?—Now we do,

Mr. *Vivian*.—continued.

because the railway people now make laws that we can conform to, but formerly when cartridges were packed up in packages, they only took them once a week, which would destroy our sale altogether.

1392. In your opinion, there is no risk whatever to the public in cartridges being sent by railway?—No; I think the quicker they are in transit the better.

1393. That being the case, may we assume that the railway companies now afford every facility for their transport?—No; not so much as they might I think.

1394. How often can you send cartridges to Scotland?—We can send once a day to Scotland.

1395. And the same all over the kingdom, I suppose?—Yes; but we find great delay in the delivery.

1396. How long do they take in delivering it?—In sending to Scotland, I should always send them about six or seven days beforehand, at least.

1397. Are they seven days in the transit between London and Scotland?—I cannot say; I only know that we have many cases where we send them two or three days beforehand, and our customers write to say that they have not received them.

1398. Therefore the cartridges are seven days in the hands of the railway companies, at all events?—I do not know with regard to that; I do it for my own security in having them delivered in time.

1399. Is the rate which the railway companies charge for cartridges a high rate?—Yes, it is a high rate.

1400. Do they afford you, now that they are declared, sufficient facilities?—Some of them do; the South Eastern Company only take it twice a week, which is a great disadvantage to us.

1401. I suppose if they were quicker in transit, the risk to the public would be greatly reduced?—Yes, I think so.

Major FREDERICK E. B. BEAUMONT, a Member of the House, called in; and Examined.

Chairman.

Major  
*Beaumont*,  
M.P.

1402. CAN you give the Committee any information with reference to the making, keeping, or importation of gunpowder?—With regard to gunpowder, I can not offer any suggestions that would be of value to the Committee.

1403. With regard to the making, keeping, carriage, or importation of nitro-glycerine, and nitro-glycerine explosives, have you any suggestions which you could offer to the Committee?—With respect to the manufacture of nitro-glycerine explosives, I think I am not in a position to offer anything to the Committee that they have not had fully before them; but with reference to the consumption of those explosives I consider I am in a position possibly to make a few remarks that may have some bearing on the inquiry. I am anxious not to take up the Committee's time with irrelevant remarks. My object in appearing here as a witness is from a consumer's point of view entirely. I believe that I was asked to attend with a view of pointing out or of emphasizing on behalf of the consumers generally, the grounds on which the present restrictions which bear on the use of

Chairman—continued.

nitro-glycerine should be taken off, and to give evidence also as to accidents in the practical use of compounds of nitro-glycerine; and what my reasons are for saying what I do say, namely, that in the use of dynamite I feel safer than in the use of gunpowder.

1404. Will you kindly give the Committee any information with reference to the undue restrictions which you think exist under the present nitro-glycerine Act?—That is summed up in a very few words. Under the present Act I cannot get the railway companies to carry it. At the present moment I have the residue of some gun-cotton near Bolton, where I have completed a contract, and I cannot get that dynamite transported from one part of the country to the other. I have other work going on at Bristol, in a tunnel which I am completing, and I cannot get the dynamite to the place. The only way in which dynamite can be transported is in a covered cart; this dynamite to the North of England has travelled 150 miles in covered carts. Now I am strongly under the impression that both for transport and for use, dynamite is far safer

*Chairman—continued.*

safer than gunpowder. The reasons that I have for making that statement are that I have had several accidents through the use of gunpowder, and I have never in the works under my charge had a single accident involving injury to life, or even to limb, with dynamite. There have been circumstances on the works that would have led to the most serious consequence had gunpowder been used: while with dynamite no accident whatever has resulted. Of course, if the Committee have made up their minds that it is desirable to put compounds of nitro-glycerine on the same footing as powder, my evidence will be needless.

1405. Will you kindly give the Committee what information you can on those accidents?—There was one accident in a shed at the mouth of one of the shafts in connection with a tunnel which we were making; the dynamite was warmed on a shovel (which was a most improper course of action) over a stove, and one of the miners' children came into the hovel and threw some straw or grass on the fire; the fire blazed up and lit the dynamite, and it simply fused away and nobody was hurt. The fumes were extremely unpleasant, and inconvenienced temporarily the people who were in the hovel, but it did not hurt any one permanently.

1406. Do you know what per-centage of nitro-glycerine was in the earth in that case?—No; it was the ordinary dynamite of commerce. There was another case in a blacksmith's shop in connection with our works in another part of the country. There was a box of dynamite open in the shop (which ought not to have been the case), and the smith was absolutely at work in the same shop; he cut off the end of a bolt, and the end of the bolt jumped straight into the dynamite box; that would have blown everybody to pieces if it had been gunpowder,\* but the dynamite burnt away and did no harm. In another case, at the bottom of a mine, there was a charge of 7 lbs. or 8 lbs. of dynamite sent down for use in the heading in a tin box. I was told that the men on looking into the box saw a blue flame at the bottom, and they ran away; before they had got more than a few yards up the heading, the whole thing burnt, and indeed there was a very slight explosion, blowing the box to pieces, and injuring the bench on which the box was standing, but with no damage whatever to the men; the accident was believed to have resulted from a spark from the candles which were used in connection with the works having got inside the box. Had any one of those explosions occurred with gunpowder it would have had a most serious effect. The result of that is, that the men, as soon as they have had experience with dynamite, always attach very much importance and value to its use, and they have, as a matter of fact, far greater confidence in it than they ever had in powder; the fear is lest they should have too much confidence in it, as it is desirable to get them to take every precaution. In that explosion which I mentioned just now, where the dynamite was in an open smith's shop, a man would hardly ever, unless he was quite without common sense, have had an open barrel of gunpowder there. Now, in such works as those I am connected with, viz., mining and construction of tunnels, in fact, all works where hard rocks have to be dealt with, the importance to the commerce of this country in introducing an explosive such as dynamite is so

*Chairman—continued.*

great, that I am within bounds in saying that it is hardly possible to estimate the value of it; it may be of interest to the Committee to know what the value and use of dynamite is in the carrying out of mining works generally; first of all the cost of gunpowder is about 4 *d.* per lb., whereas the cost of dynamite is 1 *s.* 10 *d.* per lb.; the cost of gun-cotton is about 2 *s.* per lb.; so that dynamite is about five and a-half times the cost of gunpowder; it will drive a heading at perhaps 10 to 20 per cent. quicker than if gunpowder were used. Opinion is divided as to whether there is any saving beyond that of time; some of my agents think there is a further saving, and some that there is not; my own idea is, that with dynamite at that price, though the work will cost a little bit more, you get it done certainly 20 per cent. quicker; that is to say, where the headings are driven by hand labour, and not by machinery; but where you are employing machinery to drive the headings, the advantage would be still greater. I believe if we could only get the railway companies to carry dynamite at the same rate as gunpowder it would be an enormous advantage, and if the public and the world at large could be persuaded that they really might use it with greater safety than gunpowder, and that it might be stored safer as well (but that is not so clear as the question of use), the result would be that dynamite would be made at a less rate than it is now made at, and a very considerable advantage would result to all those great industries that are using explosive compounds.

1407. In suggesting that the restriction should be taken off dynamite, you do not suggest, as I understand, that the restriction should be taken off the raw material, that is to say, the liquid nitro-glycerine?—Certainly not. I think, in the interest of the consumer, you cannot be too careful in preventing the general use of explosives that are not safe; and supposing that all the restrictions were taken off nitro-glycerine, I feel certain, in the consumer's interest, it would be the worst thing that could happen. What we want really is, efficient inspection, that would enable us to be sure that the material that we have got is what we have paid for, and that it is really safe to use. The remarks I have made apply to dynamite when it has the proper per-centage of nitro-glycerine in it, and when that glycerine is made perfectly safe by proper incorporation with the earth. But the very greatest danger, in my opinion, results directly it ceases to be dynamite, and the nitro-glycerine exudes, and it becomes free. I maintain that, in the interest of the consumer himself, he ought to be very glad of an inspection, and if the Government will take steps to secure him, as far as possible, against the disastrous consequences that in all probability would arise if he had in his magazine pure nitro-glycerine when he thinks he has dynamite. I am aware that there is a feeling outside against any Government inspection, but, as a consumer, I am of opinion that a Government inspection such as is proposed in Major Majendie's suggestions, does not go at all beyond what is reasonable. If I understand those suggestions rightly, they do not go beyond this, that it is proposed that the Act of Parliament should say what conditions are safe and what should obtain in the magazine. He proposes that this should be laid down so clearly that, so to speak,

Major  
Beaumont,  
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Chairman—continued.

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he who runs may read, and that then inspectors should be appointed with powers to enter the magazine, and see whether those conditions have been properly carried out or not. Now if the consumer has his magazine in proper order, and if his dynamite or other explosives are as they should be, I cannot conceive that such an inspection could be otherwise than in the consumer's interest; but I should object, as a consumer, to an unqualified person coming into my magazine and giving an opinion or interpretation, of the Act of Parliament, that is to say, giving an opinion on a technical subject. However, so far as I understand, the proposal of Major Majendie, it is only to the effect that certain broad rules should be laid down that everyone can understand, so that the inspector can only have power to go into the magazine and say, "Have or have not these simple conditions been complied with." Up to that point I think it would be most decidedly in the interest of the consumer that the inspection should be carried out. Nothing can be more likely to shake the confidence of the railway companies and the workmen who use those explosives, than accident to life or limb.

1408. Can you give the Committee any information with reference to exudation from dynamite?—I think I can; the only serious accident that I have experienced in connection with dynamite, was a very instructive one. The dynamite was used in connection with the construction of a tunnel at Bristol. As the Committee are aware, dynamite must be thawed before it is used. Now the thawing in that case was done by the dynamite being put inside a double-lined galvanized iron box, which box was put for convenience in connection with the exhaust of a steam engine used for winding purposes. About 4 lbs. or 5 lbs. of dynamite, being the residue of a 24 hours' consumption, was in the box, and it exploded. The result of that explosion was to blow down all the wooden sheds above and round the engine; it hurt none of the machinery, and it did not hurt the five or six men who were in the shed, nor did it hurt the 50 or 60 men who were in a building about 50 feet off; it destroyed at the same time the windows of some houses on the opposite side of the road, about 150 feet off. Now the question was how came the dynamite to explode? It was altogether improbable that it could have been the result of any malice. I believe the reason it exploded was this, that in place of the dynamite having been completely cleaned out of the box after each day's work, there was a residue left in it; of this residue, possibly a very small amount, one or two cartridges had been baked and rebaked, and the result was spontaneous explosion. That is the only case that has come under my knowledge where there has been any explosion from that cause. I believe it arose from the rebaking, which probably caused an exudation of the nitro-glycerine from the cartridges. It is quite a simple matter, provided nitro-glycerine as it is supplied, is pure, to prevent that, and a few rules which I have drawn up I believe are quite sufficient, if properly carried out, to make a magazine perfectly safe. A suggested reason of the explosion which I have just referred to, was the chemical action of the tin on the dynamite, and consequently in these regulations I have provided that the dynamite should be separated from the tin by

Chairman—continued.

having the lining to the boxes made of felt; the next provision is that the boxes should be cleaned out after each day, so as to prevent the possibility of the dynamite being warmed again, and the only other provision of any importance is that the water should be poured into the casing hand-warm.

1409. Will you kindly hand those rules in for the information of the Committee?—Yes. (*Vide* Appendix.) The object of my remarks thus far, is merely to show the Committee how safe I believe dynamite is if proper arrangements are made for its use, what confidence the men have in it, and the extreme value of the work which explosives containing nitro-glycerine will do in contradistinction to what gunpowder will do.

1410. Can you say at what temperature, so far as you know, the explosion occurred in the dynamite to which you have just alluded?—I presume that you ask me as a matter of fact, and not as a matter of opinion as a chemist. In answer to a question sent to my agent, he says the temperature never could possibly have been above 150° or 160°, but the Committee must receive that statement with caution, because in my opinion it may have got considerably higher than that; the double lining of the box was in connection with the exhaust of the engine, and while the engine was running there was a free flow of the exhaust steam into the lining, and I do not see why the temperature should not have got up to 212°. That was a very bad arrangement indeed. I had not the same knowledge of the subject then as I have now.

Colonel North.

1411. You say that there is great inconvenience to the trade in consequence of the railway companies not carrying dynamite?—Yes.

1412. From the instances which you have given, it certainly appears that it is safer to use dynamite than common powder, but has that been explained at all to the railway companies?—Major Majendie has been in communication with the railway companies, and I believe that certain manufacturers of dynamite, and also of lithofracteur, have been more or less in communication with them. I have tried to get the railway companies myself to carry out their suggestions; that is to say, my agents have written to the railway companies asking them to carry dynamite, and their answer is directly, that they will not do so. Directly you have used the word dynamite you have wasted a penny stamp in writing to the railway companies; they will have nothing to do with it. The only way in which you can get any compound of nitro-glycerine, not gun-cotton, taken from one part of the country to another is in a cart.

Mr. Vivian.

1413. I suppose that the railway companies have taken that view of dynamite, in consequence of the general tone of the Nitro-glycerine Act?—I think so entirely.

1414. Then your experience goes to prove that the storage of dynamite is no more dangerous, if so dangerous, as that of black powder?—If it is pure dynamite; if dynamite is not properly made, or if it decomposes in any case, then the danger would be enormous; now I have known this happen, and it was on the Festiniog Railway

Mr. Vivian—continued.

Railway. Nitro-glycerine was being carried in trucks; some of it exuded and ran over the trucks; a man threw a stone at it; it exploded and blew the truck to pieces; I have known this case also, where pure nitro-glycerine was used in a bore-hole; the shot was fired and the whole of the nitro-glycerine did not explode; a man in working with his pick afterwards fired the remainder of the glycerine, and was killed. That was not on works under my own charge, so that it is little more than a story told to me, and therefore the Committee must take it for what it is worth. But I am perfectly certain that unless you can provide against the possibility of nitro-glycerine exuding from the cartridges, the compound is very dangerous indeed. If, on the other hand, you can (and I believe there would be no difficulty with proper inspections and proper conditions of manufacture) provide against it, then it is far safer to use than gunpowder, and I think it would be safer to store also.

1415. In your opinion there would be no difficulty in giving the inspector such powers, and the inspector himself being able to find out any impurities in the dynamite; is that so?—I do not think that such an inspection as is contemplated by Major Majendie would do, but I think that if samples were forwarded to London, an analysis might be given that would show whether the condition of the magazine was safe.

1416. How would you propose to regulate the manufacture of dynamite so as to ensure its safety?—My opinion on that subject would be hardly worth the Committee's listening to; I will assume that it is made properly; then comes the question how can the consumer ensure its remaining so; and with regard to that point, I think if the consumer has an opportunity of sending samples to London where it would be officially analysed, it would be sufficient in 19 cases out of 20. But I go further; what I should like to see done is this, I should like the consumer to be able to write to the Board of Trade, or whatever department of the Government it might be, to send down at a fixed charge one of their inspectors to examine and report; however, there is this objection to such a course, that in the event of an explosion, the Government would have to report on circumstances which they would have to deal with afterwards possibly, in a judicial capacity.

1417. Do you think that a manufacturer being forced by Act of Parliament to send samples of dynamite to London at stated periods, that that would be a sufficient guarantee for the purity of the dynamite?—I am hardly in a position to judge of that, because it depends upon how far it is possible to make dynamite that shall be perfectly stable at all times; my experience enables me to say that it is quite possible to make it to be stable for six or seven months, and I should think far longer; but where the result of an explosion would be so disastrous, one would wish to rely on something more than mere matter of opinion; one's own agent might be capable of judging whether there was any considerable exudation, but I can quite understand a gradual chemical change going on, and of course a very slight exudation might not be in 99 cases out of 100 a source of danger, but a hundredth case might come when it would be a source of danger; nothing but the opinion of a professional person who has been in the habit of using the material

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Mr. Vivian—continued.

for some time, would enable you to provide against that. As a consumer, I would say, if I could write to the Government, and they were to send me somebody who would set my mind at ease, and to some extent take the responsibility off my shoulders, and if that could be done for 5*l.* or 6*l.*, it would be a thing that many consumers would be very glad to do.

1418. You think that in a general way, there would be no practical difficulty in ensuring good dynamite from the manufacturer?—I think not; in fact, I am sure there would be no practical difficulty.

1419. In case of a railway collision, do you think there would be any danger from good No. 1 dynamite exploding from a concussion?—I have no doubt that in the case of a railway collision, the dynamite would if it fired at all explode and not burn away, and when it does explode, of course the results are far more disastrous than in the case of powder; therefore, for a given amount of dynamite as against the same amount of gunpowder, in the event of a railway collision where both fired, the danger would be greater.

1420. Do you think that good No. 1 dynamite will explode from simple concussion?—It is a very difficult question to give an opinion upon.

1421. You do not know that any experiments have been carried on to ascertain this?—Yes, I believe that a variety of experiments have been carried on, which I have no doubt the Committee have had the details of. My own impression is that it is just as safe as powder.

1422. That is to say, that will not explode from concussion?—No; no more than gunpowder will. I should like to make this remark, if you fire a rifle ball into gunpowder you will never explode it, but if you fire a rifle ball into dynamite you will explode it. Now, there is a wide difference, of course, between that and such a blow as would arise, under any circumstances, in the case of a railway accident. I am aware that there were some trials made where some cases of dynamite were put between the buffers of railway carriages, and the result of that was that the dynamite did not explode. Now, to my mind that would be the worst kind of treatment that dynamite would get in railway accidents. On the other hand, you have got these facts, that the behaviours of the two things, when a shot is fired into them, are very different, and it must always be a matter of judgment how far the circumstances of railway accidents would lend themselves to one set of conditions or to the other.

1423. I suppose the same remarks would apply to dynamite No. 2 as to dynamite No. 1?—I am not in a position to answer that question, because I have used dynamite No. 1 almost entirely; but I fancy that one is about as safe or about as dangerous as the other.

1424. With regard to adulteration, I suppose that the adulteration would be over-saturation of the Kieselguhr?—I should think that it would.

1425. That is to say, more nitro-glycerine than the Kieselguhr could possibly absorb;—I should say so.

1426. Do you know any of any other forms of adulteration in dynamite?—No; that would be out of my line; I do not pretend to understand the chemical part of the question.

1427. With regard to the thawing case at Bristol, did I understand you to say that the case was placed in the exhaust of a steam engine?

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—No;

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—No; a double tin case was placed outside of the engine house, and a pipe from the exhaust of an engine led into the tin case, consequently the tin case was supplied with the vapour of the team, but under no pressure; it was alternately heated and cooled, however.

1428. It was a high pressure engine, I suppose?—Yes.

1429. The temperature of the steam from a high pressure engine is much more than 150 degrees?—It would be steam under the back pressure of the engine whatever that amount may be.

1430. Would not the steam from the exhaust of a steam engine be more than 150 degrees?—Yes; it would be more than 212 degrees, it would have a temperature corresponding to the pressure, perhaps 1 lb. above the atmosphere.

1431. It is fair to presume, is it not, that that box was subjected to at least 200 degrees of temperature?—Yes; but you must remember that while the temperature of the steam was over 212 degrees, the box was not hermetically sealed, and consequently the temperature inside was probably below 212 degrees.

1432. Was there any chance, do you suppose, of that box being super-heated?—No; the circumstances were shortly these: it was exposed all round to a temperature of something over 212 degrees, from which must be taken off the heat that would go off by radiation.

1433. What temperature is necessary to thaw dynamite?—I believe about 40 degrees, but I speak with reserve on that point: practically, what will thaw dynamite is the heat of water so that your hand can bear it. In the instructions, a copy of which I have put in, the Committee will see that No. 5 is to the following effect, "The water used in the tin box for thawing the dynamite must never be hotter than will permit of a man's hand being put into it;" that is sufficient, and it is perfectly safe.

1434. Then the box in question was subjected to a far greater heat than was necessary for thawing dynamite?—Yes.

1435. You spoke of a chemical action possibly arising between the tin and dynamite?—Yes.

1436. It was a tinplate box in the case referred to?—Yes.

1437. Do you suppose yourself that any chemical action could have arisen?—I should not like to advance an opinion with reference to that. I should say that chemical action did take place, because in conversations with chemists they have told me that it does happen.

1438. The Committee heard on Friday the 15th of May, of an explosion in dynamite which occurred in a mine in Norway, simply from dropping the case in which the dynamite was contained; do you suppose that if that had been well-prepared good No. 1 dynamite, an explosion could have occurred in that way?—I believe it to be perfectly and entirely impossible; but I can quite understand an explosion happening with dynamite if the dynamite should be exuding pure nitro-glycerine; but if there is no exudation, and if the dynamite is pure and good, I believe it to be perfectly impossible to have an explosion with it merely from falling.

1439. Would there, in your opinion, be any difficulty in arranging a simple test by which the consumer could find out the condition of his dynamite?—Not the least; all that would be necessary would be to send a few samples to

Mr. Vivian—continued.

London; and the precaution which I have suggested, namely, that of having an inspection made for a moderate sum would result in complete and perfect safety, greater than now obtained with reference to powder magazines.

1440. If the consumer was to send a small parcel from each load of dynamite to London for analysis, you think that would be a sufficient security against adulteration?—Yes; but I myself, also as a further precaution, should like to have an inspector to examine the whole of the works, to see whether the precautions taken were such as to make the magazine safe. It is always best to have some opinion extra to that of your own particular department.

1441. You know the way in which dynamite is now sent to the consumers, as to the packages, I mean?—Yes.

1442. Is there any improvement to be made on that plan?—No; I think it is a very good plan indeed.

Mr. Stevenson.

1443. Where is the dynamite made which you use?—We have got it from two or three sources; one from an agent in Wales, who procures it from a factory at Hamburg, or if not from Hamburg, from abroad, and we are now getting it from a manufactory in Scotland, of which a Mr. Downie is the agent.

1444. How does it come from Scotland to your works?—We have not had any yet from Scotland, we are only just beginning to use it. The works are on the Tees, and we shall employ it there. I believe that Mr. Downie has an agent at Middlesborough, and it is close to Middlesborough where we propose to use it. In the other case, there was a depôt in Wales, and the dynamite was sent in carts from Wales to Lancashire, where it was consumed.

1445. Before using the dynamite, how do you satisfy yourself at present with respect to its purity?—I assume that it is pure; I do not satisfy myself at all.

1446. You depend on the reputation of the manufacturer, I suppose?—Yes; in fact, there are no other ways of doing it; there are no other sources of supply except those two that I have mentioned.

1447. But what you propose is, that the inspectors in London should do what you have no means of doing, is that so?—It would be a matter of satisfaction to me if, instead of doing that which you see from the answer I have just given I now do, namely, depend on the manufacturer only, I say if I could write to an inspector in London, and say, "I am using two tons of dynamite, my magazine is at such a place, be good enough to report whether the necessary precautions are taken for safety, and also whether the dynamite in store is in a proper condition;" that would be a satisfaction, and then in a year's time it would be an additional satisfaction to me if I could repeat that operation, and have, in fact, an inspection yearly, or as often as it might be necessary, of the magazine, so that I should not depend only on the opinion of my agent with reference to the magazine being safe; and that the instructions which may have been given are being properly carried out.

1448. Could you not employ a competent trained chemist to test the dynamite before it is used;

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used; it is a matter of chemical training, I suppose?—I should think that there would be no difficulty at all about that, but I should prefer to go to the man who was recognised as the best person to go to, and I presume that would be the person selected by the Government.

1449. Would you be willing to be prevented from using dynamite, which had not been proved by the test of the Government inspector?—Decidedly so, because I should consider that the amount of safety which the certificate gave me, far more than counterbalanced any inconvenience which might arise.

1450. At what stage would you propose to apply the Government test, because you are of course not the only consumer of dynamite; would it not be more convenient to apply the test at the manufactory?—I do not mean a compulsory test; I said it would be a matter of convenience to the consumer if he had the power, if he so pleases, to obtain this inspection from the Government.

1451. So taking the responsibility off the user?—Yes, certainly; with regard to the compulsory examination, in the remarks which I made about the appointment of an inspector, that is exactly the point upon which I am trying to draw a distinction; I think the inspectors that are appointed under the local authorities could inspect the magazine to say what quantity of dynamite there was in the magazine, and whether the magazine was constructed according to certain printed conditions; but I should strongly object to their coming in and offering an opinion with regard to the dynamite being in good order or not.

1452. You would accept no one's opinion on that point, except that of the Government inspector?—Just so.

1453. What would you do if you found signs of exudation in any dynamite which you had got?—There would be nothing to do but to put it in the water as quickly as possible and destroy it; but whether it might be possible to reproduce it or not I cannot say; however, I should certainly destroy it directly.

1454. You would send it out and put it into the sea?—Yes; I would send it out to sea or bury it.

1455. As to what is called the freezing of dynamite, is that truly freezing?—Dynamite, when it is frozen gets quite hard, and if you attempt to force it into a bore-hole (and it requires a considerable amount of mechanical force to get it into the bore-hole), it would be a very dangerous thing to do, owing to the force being localised on to a particular part of a cartridge which might fit tightly into the hole and cause an explosion. When you do get it in it will explode, but it requires a much stronger detonation to fire it.

1456. This thawing is to make the material more flexible, is it not?—Yes; it would be unsafe otherwise.

1457. Is dynamite, after it is thawed, more likely to exude than it was previously?—Yes, I should say that it was, if you roast it. I fancy one result would be, to cause the nitro-glycerine to exude.

1458. It would be still more likely to exude if it had been repeatedly frozen and thawed, would it not?—Yes; and it is to provide against that danger that I say in these instructions in Article No. 4, "Each box to be cleared out every day, and wiped clean; any residue of

Mr. Stevenson—continued.

dynamite remaining over is to be put into a special wooden box, to be kept on board the barge under lock; and the dynamite in this box is invariably to be first used for the next day's work." The object being to avoid the possibility of re-thawing and freezing the dynamite.

Mr. Whitelaw.

1459. Do the people complain of the fumes after an explosion of dynamite in those mines?—Everybody complains of it who has ever smelt it.

1460. And they continue to complain, I suppose?—Yes; I have sometimes come out of a heading when I have been very nearly falling down; so far as I know, any of those explosive compounds require a more perfect ventilation in a mine than gunpowder does; and also the ill effects depend to a great extent on the total consumption of the dynamite in the blast hole; that is to say, if you have a shot that does its full work on the rock, and burns the whole of the dynamite, then the smell is, comparatively speaking, not bad; but in the event, on the other hand, of the shot doing only half its work, then the smell is much worse; there is no very great difficulty, under certain circumstances at all events, in providing the necessary amount of ventilation; but as a matter of fact, there is more ventilation required where dynamite is used than where gunpowder is used.

1461. Is it always used in cartridge, or is it sometimes put loose into the bore holes?—Our practice is to put the cartridges into the thawing box, and then they are sent down in the men's pockets, or some one conveys them down into the mine. The cartridge is put into the bore-hole and stemmed with a wooden stemmer, which smashes the cartridge up altogether; that is one of the great points of dynamite, that it is in a moist condition, and lends itself to the shape of the hole; that is a great advantage over gun cotton; I have had three or four men killed with gun cotton, owing to the charge going off in the act of ramming home, because the gun cotton charge was a disc of a certain shape that more or less exactly fitted the hole; it fits the hole tight, and if you apply pressure, you run the risk of the charge going off; perhaps out of 10 times that I have known a charge to explode, eight times it would burn out and do no harm, whereas the other two times it would explode violently, with disastrous results; that cannot happen with dynamite, nor, I think, with gun cotton if it could be in a plastic condition.

1462. It is never put into the bore-hole loose, it is always in the cartridge, is it?—I cannot say whether the men might not do it, but our rule is to send the dynamite in in cartridges, and then let the men do what they please with it; but that would not be a matter of great importance.

1463. In those cases of accident you have mentioned, in which the dynamite burned without exploding, can you mention the quantities of dynamite that were set on fire?—It was from 4 lbs. to 6 lbs. in one case, and in another case it was from 10 to 15 lbs.; the first case was at Bristol, where the dynamite was burnt on the top of the stove; and the second was a case that I mentioned where the dynamite was ignited at the bottom of the mine; it was contained in a box 15 inches by 10 inches, with an opening at the top 6 inches in diameter.

1464. There was some accident in which there

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was a very small explosion, was there not?— Yes, there was one in which there was a very small explosion; that was the third accident in the smith's shop; I do not know what the quantity of dynamite was in that case; but my impression is that it was about 3 lbs.

1465. You would not consider a blacksmith's shop a very proper place to use dynamite in, would you?— No; it had no business to be there, but it was evidence of the confidence that the men have in the safety of dynamite.

1466. Have you seen the suggestion of Major Majendie in Section 36 of his Summary, which provides that an inspector is "to have power to make such examination, entry, and inquiry as may be necessary to ascertain whether the provisions of the Act are complied with, and to take samples for analysis of any explosive," and so on; does not that provide for what you suggest?— What I should lay down is not only that he should have that power to make such examination, but that I should have the power to ask him to do it.

Mr. *M'Lagan*.

1467. I understand from the evidence that you have given that the great difference between the action of gunpowder and dynamite is, that gunpowder will explode if you bring a light to it whether it is confined or not, whereas dynamite will only explode if it is confined?—No; dynamite will explode if it is sufficiently confined under any circumstances, but (which is the remarkable feature about it) it will also explode if it is not confined, provided it is detonated; it is that which gives dynamite its extreme value.

1468. But not if you simply apply a light to it, I suppose?—No; if there was 5 lbs. of dynamite on the table I should not hesitate to light it with a candle; it would do no harm; but if on the other hand you fire it with a cap, the consequences would be enormous. I may say that there is an idea, which is very common, that there is something in the nature of dynamite which strikes downwards; I believe that to be a complete popular error; the fact is, that it strikes in every direction equally, only its enormous power or rapidity (and I suppose they are the same thing) is such, that it has a fulcrum in the air which gunpowder lacks, owing to the slow action of the latter.

1469. Suppose the cover of a box pressed lightly on dynamite, would it explode then if a light was brought to it?—It would require to be a strong box, and the cover to be very tightly fitted; at least that is my belief.

1470. A question was put to you by one of the honourable Members with reference to the explosion of dynamite in a mine from the falling of a cannister, and you were asked whether you thought that if it had been No. 1 dynamite it would have exploded, and from answers which you had given previously, I understood you to say that dynamite would be very apt to exude after it had stood six or seven months; did you refer to dynamite No. 1?—I did not mean to give that impression to the Committee, because I would not take upon myself to say so. All I meant was that I had stored good dynamite for that length of time, and I knew, as a matter of fact, that nothing happened to it up to then. I cannot speak to it myself beyond that, but as a matter of opinion, I believe that nothing would

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happen after a much longer time. I believe that exudation is the result of the impurity of the dynamite, in the first instance, and, in the next place, of moving about in transport; but the amount of the impurity necessary to result in exudation, and the amount of moving about necessary to result in exudation, or the amount of baking and re-baking are matters that, from a practical point of view, require further illustration before you could speak with certainty.

1471. Do you think that exudation would occur even in No. 1 dynamite, if it were moved about much?—That is one of the most serious questions in connection with the whole subject.

1472. That is why I put it to you: do you think that exudation would occur, in that event, in No. 1 dynamite?—I do not think that my opinion is worth giving. All that I can say is, that a moderate amount of moving about certainly would not result in exudation, because, to my knowledge, it has not done so when it has been found necessary to move it a great deal. As a consumer, I should have the dynamite examined, if I had the faintest reason to believe that it was becoming deteriorated.

1473. Do you not think that the whole difficulty of the subject, with reference to the transport of dynamite, lies in the question whether nitro-glycerine will exude from it in consequence of its being agitated?—Yes, I think so; I think that sums it up; the whole question turns on whether you can or cannot so hide the nitro-glycerine, as to keep it in the shape that it is in dynamite.

1474. Then you can scarcely blame the railway companies at the present time for the great caution which they show in carrying dynamite, can you?—They must be the best judges of their own interest; but I do blame them in that sense, because all the risk, as I have pointed out, is the risk resulting from impure dynamite; but if you ask me what the proportion of pure to impure dynamite is, then I say that it is a very small amount indeed that is impure; I believe that the railway companies could take the same precaution as I should take, and have it examined, and then it is safer than gunpowder.

1475. But then suppose you had an examination of it before you moved it, and you began to carry it, say 100 miles, at every station you find the carriages bumping against one another, and a great deal of shaking arises in fact; now if there is any risk of exudation in a case of that kind, is it not necessary to have very stringent rules with regard to the carriage of dynamite?—You do not want stringent rules with regard to the carriage of dynamite, but you want stringent rules to see it is dynamite you are carrying, and not nitro-glycerine. I quite agree that if dynamite were to be impure, and a collision were then to happen, it might have the most disastrous consequences, and in the interest of the consumer you want to guard against that; but the result of legislation will, I hope, be to give increased facilities; if an explosion happened, there would be such a scare throughout the country, that we should not be able to get these explosives carried any more. The great point is, to be quite certain that what you are carrying is not nitro-glycerine, but dynamite. I see no difficulty in doing that, but if you ask me whether it is likely that dynamite which was good when turned out from the magazine, is likely to become deteriorated and to exude



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exude nitro-glycerine in a 200 miles journey, my opinion is that no such fear need be entertained.

1476. You think it is quite possible to manufacture dynamite so that in its carriage by railway, after it has remained six or seven months in the magazine, there would be no exudation whatever?—It is quite possible.

1477. By having it properly manufactured before it is taken away?—Yes; with periodical inspection there would not be the slightest possible chance of its being deteriorated.

1478. The great difficulty, I feel, is that it may leave the manufactory as dynamite and become nitro-glycerine in its passage, and then if a collision happens there is an explosion, is there not?—Yes, there might be.

1479. You say that you think it quite possible to prevent that?—Yes, quite so.

1480. Do all the railway companies object to carry dynamite?—Yes, so far as I know they do.

1481. Is there not one Scotch line that carries it?—In every case where I have had to apply myself to a railway company they have refused.

Mr. *Stanhope*.

1482. How long have you had experience of dynamite?—I should say that I have had experience of gun-cotton and dynamite from about four to five years.

1483. Have you had any experience of other nitro-glycerine compounds, such as Horsley's blasting powder?—I have tried three or four different compounds at the works, at the request of the inventors, but none of them possessed the same power, or the same convenience in use, as dynamite. Gun cotton is as powerful, but in the solid disc shape it is more dangerous.

1484. Can you express any opinion as to whether the conditions attached to the storage and carriage should be the same in the case of other nitro-glycerine compounds as in the case of dynamite?—I think that the whole question hangs entirely on having nothing to do with free nitro-glycerine. If you can conceal it as in dynamite, or in any other way, I see no reason why all such explosive compounds should not be put on the same footing, but free nitro-glycerine ought, under no circumstances, to be permitted to be carried or passed under the same rules as other explosives. I think the Committee in any recommendation they may make, if I may be allowed to say so, should be particularly guarded in not putting an explosive that is uncertain by the side of one that is certain.

1485. You gave the Committee an account of an explosion which took place on a truck with dynamite; did the action of the exuded nitro-glycerine explode the dynamite?—I gave the Committee the account of the explosion as it was told to me, so that I cannot speak positively about it; but it seemed to me to be an accident that had a certain value in the way of instruction, for it was told to me that the nitro-glycerine was hanging about the truck like oil; no one would strike it with a hammer, but one workman took a stone some distance off and threw it at the truck, and this oily mass was sufficient to blow the truck to pieces.

1486. Does the explosion of the exuded nitro-glycerine invariably cause an explosion of the contiguous dynamite?—Yes, I should say so; but in this case there was no contiguous dynamite.

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Mr. *Hick*.

1487. You have large quantities of dynamite in store at times, have you not?—We are going to have. We have had, perhaps, a ton in store at one time. I should never care for storing more than I could help; my object would be to have as small an amount in store as possible.

1488. Is a ton the largest quantity that you would want to have in one place?—Yes.

1489. When receiving dynamite into store, you do not take any means to ascertain if it is pure, and if the component parts are in proper proportions, do you?—No; I do not do that, because I do not know how to do it.

1490. You have confidence in the source from which you get it, I suppose?—Yes.

1491. But could not any chemist ascertain that fact for you?—I should think that he could.

1492. Because it might be safe or very unsafe, might it not, when you received it into your stores?—Yes.

Mr. *Dillwyn*.

1493. Suppose a light was applied to a very large quantity of dynamite, say five or six hundred weight, would an explosion take place then, in your opinion?—That is another point of very great importance in connection with dynamite, that though it will not explode violently in small quantities when a light is applied, yet when a large quantity is burnt an explosion does take place, and then of course it is more disastrous than an explosion of gunpowder, because the explosion is so much stronger. Why it should burn in small quantities and not burn, but detonate, in large quantities, is, I believe, a moot point; but my idea is, that the inner temperature is raised in the mass, and by degrees the baking goes on in the remainder, which decomposes and brings out the nitro-glycerine, and then it is in the same condition as dynamite which is on a shovel over the fire, and it explodes spontaneously, and the result of a spontaneous explosion is always to detonate and not to burn.

1494. But as a matter of fact, a large quantity will explode on a light being applied to it, will it not?—Yes, I believe that it will; that is the principal difficulty in connection with railway carriage, but if you could be always sure of never carrying a greater quantity than would catch light without exploding, then there would be no question about it being a far safer thing to carry than gunpowder. If you could subdivide it in that way it would get over a great difficulty.

1495. Will electricity have the same effect on dynamite that a detonator will?—I never fired a charge by electricity; I have fired gun-cotton in that way. However, my impression is, that it would have the same effect.

1496. You have stated, I think, that you consider No. 1 good dynamite, to be nearly safe?—Yes.

1497. But is it liable to decomposition?—I have never known any to decompose if left alone; I never knew it to decompose dangerously, except it was under the action of heat in the way I have mentioned.

1498. Are there any premonitory symptoms of dynamite becoming dangerous; are there any signs in the appearance of it?—I do not know that there are; but I believe that there is no difficulty at all in detecting it directly you see

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M.P.  
19 May  
1874.

the cartridges are discoloured with an oily exudation on the outside. But that is an extreme condition, and there may be a variety of intermediate conditions more or less dangerous, and especially dangerous with reference to spontaneous combustion.

1499. Suppose the Government inspector reported in favour of a magazine of dynamite on one day in the week, could you ensure that on the next day it might not be dangerous?—I believe that it is altogether impossible so rapid a change could take place.

1500. You think that the decomposition is gradual?—Yes, very gradual. If I had a ton of dynamite in the magazine now, and the works were stopped, and the dynamite were left there for a year, I can conceive it being in a dangerous state in a year, though I should not expect it to be so.

1501. There would be good notice given in the appearance of the dynamite, would there?—Yes, I think it would be very gradual; I might say, with reference to the use of gun-cotton, that usually the accidents in gun-cotton have been in forcing the charges into the blast holes; gun-cotton, in its use, is as valuable as dynamite; and it is safe to store and safe to use, provided it is not made in solid discs, so that there is a chance of its igniting in being rammed into the hole. The accidents have been owing to the discs being a tight fit, and then forced into the hole. The work that it does is as good as the work of the dynamite; its value depends entirely on the question of cost. Dynamite being 1s. 10d. a lb., if you get it down to 1s. 2d. a lb., it would put blasting powder out of use in all the industries of the country where an explosive is required, and that would result in a very considerable saving indeed to the consumer.

1502. Supposing dynamite is put into water, does that totally destroy it?—No, that is one of the advantages of it.

1503. I understood you to say that you would put it into water in case you found it going wrong?—I said that I would put it into the sea.

1504. But if you put it into a river would the nitro-glycerine become decomposed and float on the surface?—It would sink to the bottom, being heavier than water, but it would be so sub-divided there would be no danger.

1505. Not to the shipping?—I should apprehend not.

*Chairman*.

1506. With regard to the explosion of a large quantity of dynamite owing to the application of a light, can you draw the line where the quantity

*Chairman*—continued.

is large and where it is small?—No; but it is a most important line to draw, because a part of the question in connection with the application of the law depends on that very question, namely, what quantity of dynamite can be burnt without exploding, and what cannot.

1507. Was there not an experiment at Llanberis of which you had some cognizance, on the subject of burning a large quantity of dynamite?—There may have been, but I do not remember it. I believe that quantities, say up to 5 cwt., could be burnt without an explosion, but it is only an expression of opinion.

Mr. *M'Lagan*.

1508. How is the dynamite brought to you; is it in sealed cases?—In wooden boxes, I think; but the dynamite is supplied to us in the same way as to the trade generally.

1509. Can you tell when exudation occurs; does the nitro-glycerine exude through the wood of the box?—That would be an extreme case; I have never known a case like that.

1510. Exudation may be going on in the box without your knowing anything about it, might it not?—I suppose it might.

1511. And consequently an explosion might take place by a box falling on the floor before there could be any examination or inspection of it?—If the nitro-glycerine did not come through the box, I do not think the fact of its falling on the floor would explode it, but until it was tried that could not be accepted as a fact.

1512. If there was a little nitro-glycerine on a floor, and anything fell on it, it would explode it, would it not?—Any blow on the nitro-glycerine itself would explode it, and I presume that a very violent concussion might explode it, even without a blow being absolutely struck.

1513. But there is a danger of decomposition taking place in the box without your knowing it, is there not?—Yes, but it has never happened to my knowledge. I prefer always to open the boxes, and then you get rid of the danger. I have every box opened, and the cartridges taken out and arranged on shelves, and then you see directly the condition in which the dynamite is.

Mr. *Stevenson*

1514. You have mentioned a case in which a truck was soaked with droppings from the dynamite; do you know what quantity of dynamite had been in that truck?—No, I do not; I merely mentioned to the Committee that story as it was told to me, as an interesting evidence of the danger that attached to free nitro-glycerine, but I have not got the details; it is just possible that it may have been pure nitro-glycerine in jars.

Mr. JAMES LANG, called in; and Examined.

*Chairman*.

1515. You are a Gunmaker, I believe?—Yes.

1516. Does your trade include the filling of cartridges for your customers?—Yes.

1517. Is this trade generally carried on by gun makers?—It is.

1518. I suppose it is not possible for the majority of the gun makers to comply with those provisions of the Act, as to the filling of cartridges, which require that the operation shall be carried on only under license, and not within

*Chairman*—continued.

100 yards of a dwelling house?—No, it is impossible, in my opinion.

1519. If those provisions of the Act were enforced, the effect would, I presume, seriously injure the gun makers?—Yes.

1520. You would therefore, I presume, approve of a relaxation of those provisions in the present Act?—Unquestionably.

1521. I suppose you would not object to such statutory provisions as would tend to ensure the operation

Mr. *Lang*.

Chairman—continued.

operation being safely carried out?—Certainly not.

1522. For example, would you consider it an unreasonable restriction, if a person filling cartridges were forbidden to carry on the operation in a room in which there was a naked fire or light; or that he should be forbidden to carry it on in a general workshop, where other people were at work, or in a shop where customers were coming and going?—Certainly not.

1523. Or that he should be forbidden to carry it on in the same room as he uses for keeping the bulk of his powder in?—I should not object to that.

1524. Might he not, without inconvenience, be limited to 5 lbs. of loose powder (that is to say, powder not in cartridges), in the room where filling was carried on?—Yes; there would be no inconvenience in that.

1525. Obviously also, there would, I presume, be no objection to his being required to observe due precaution to prevent accidents?—Certainly not.

1526. With regard to the quantity allowed to be kept by a gunmaker; what amount of powder do you consider would suffice?—I think that 200 lbs. is not too much; there are a good many kinds of gunpowder used. As the Committee know, rifle powders are of a different sized grain; and makers require at least 200 lbs. to carry on the trade.

1527. Do you not consider that the quantity of powder might be reduced if the quantity in cartridges were increased?—No, certainly not; 200 lbs. would not be one particle too much.

1528. If, for example, you were able to keep 100 lbs. of powder loose, or five times that amount (or of any part thereof), in cartridges, would not that afford you quite as great facilities as at present, where the limit of powder is 200 lbs., and where only 5 lbs. may be kept in cartridges?—Two hundred pounds is not too much for the cartridge business for three months in the year; for nine months in the year you could do with less powder, but for three months all the makers require 200 lbs. of powder at least, besides cartridge.

1529. In your opinion are the ordinary cardboard and metallic sporting and military breech-loading cartridges safe against explosion *en masse*?—Yes; my experience of 20 years confirms that.

Mr. Vivian.

1530. Would 200 lbs. of loose powder satisfy your trade, do you think?—Yes, I believe so.

1531. In order to meet your customers how many loaded cartridges would you require to keep usually?—At least 70,000 or 80,000 loaded cartridges at some seasons of the year.

1532. That would represent how much powder?—Eighty cartridges to 1 lb of powder.

1533. You would keep that quantity of loaded cartridges, would you; that is to say, 70,000 or 80,000?—Yes; at certain times of the year we require 80,000.

1534. You think that 200 lbs. of loose powder would be sufficient to carry on your business?—Yes.

1535. In canisters, you mean?—Yes, we prefer that; but there is some in cardboard boxes sometimes.

1536. Would that 200 lbs. be all in canisters?  
0.84.

Mr. Vivian—continued.

—Yes, in canisters or in cardboard boxes of 1 lb. each which are supplied to the trade.

1537. Is the greatest proportion of your stock of loose powder kept in cardboard boxes?—No, a great deal is kept in 5 lb. canisters or 1 lb. canisters, but we keep a large quantity in cardboard cases.

1538. That cannot be so safe as if it was kept in tin canisters, can it?—No; but really until you put a light to them they are safe; the powder cannot drop out.

1539. Would you keep that quantity of loaded cartridges in the same magazine?—Certainly not; no magazine is necessary.

1540. You keep them in the shop, do you?—Yes.

1541. Loaded cartridges?—Yes, certainly.

Mr. Whitelaw.

1542. Have you seen the summary of suggestions as to the amendment of the law relating to explosives, which have been put before the Committee by Major Majendie?—Yes.

1543. Section 13 runs thus, "The 'common retail' license to be on a sliding scale, and to authorise the storage by a retail dealer up to, say, 300 lbs. of gunpowder, or 1,500 lbs. if in cartridges." You think that the suggested allowance is not enough, do you?—Just so.

Mr. McLagan.

1544. The quantity of powder to be kept would depend very much on the situation of your business, would it not?—No, I think not; my idea is that a man who wants to keep 200 lbs. of powder should provide himself with a safe, to be approved by the inspector.

1545. Supposing he used 200 lbs. a day, he must have a delivery of 200 lbs. every day?—Yes.

1546. But as he might be situated where he could not get every day that quantity, the quantity would depend on the situation, would it not?—Yes, in most places you can get it two or three times a week; but if a man is in that position I suppose he must apply for a license for a special magazine. If he is in an out of the way district he would require a different license.

1547. Have you had any difficulty in obtaining the supplies of powder you want from the railway companies?—No, they always give us facilities, but not for sending away the cartridges until very lately.

1548. How long ago is it since they have done that?—About two years ago.

1549. Can you send the cartridges away every day to your customers?—On some lines we can, and on other lines we can send them twice a week.

1550. Would twice a week satisfy you?—No, not in busy times. Many gentlemen's shootings would be over if they waited that time; they are often five or six days on the road.

1551. Do they send them by passenger trains?—They send them every day, and I believe they do not send them by any special trains; I am speaking of cartridges, not of gunpowder.

1552. They will not take gunpowder in at passenger stations, will they?—No; they will only take the cartridges at certain stations; whether they would take them at outlying passenger stations, I do not know.

Mr. Lang.

19 May  
1874.

Sir H. Selwin-Ibbetson.

Mr. Lang.  
19 May  
1874.

1553. I suppose you are prepared to accept the conditions of varying quantities allowed to be kept with respect to the part of the premises in which the explosives would be kept?—No, I think not.

1554. Would not you consider that there was greater safety in keeping an explosive out of the house itself or in the yard, perhaps; and that, therefore, a greater quantity could be allowed than in the house?—No, I think not, provided there was an efficient safe; I think that only one of the large manufactures in London has a yard; other manufacturers would have to keep it in the house or an adjoining house.

1555. Do you not think that in the matter of

Mr. JAMES DALZIEL DOUGALL, called in; and Examined.

Chairman.

Mr.  
Dougall.

1557. You are, I believe, a Gunmaker?—Yes.

1558. Does your trade include the filling of cartridges for your customers?—Yes.

1559. Is that trade generally carried on by gunmakers?—Invariably, I should say.

1560. I suppose it is not possible for the majority of the gunmakers to comply with those provisions of the Act, as to the filling of cartridges, which require that the operation shall be carried on only under license, and not within 100 yards of a dwelling-house?—Quite impossible; it would stop the trade.

1561. If these provisions of the Act were enforced, the effect would, I presume, seriously injure the gunmakers?—Yes, they could not go on.

1562. You would therefore, I presume, approve a relaxation of those provisions?—Yes; but no doubt the trade ought to be carried on under proper provisions.

1563. I suppose you would not object to such statutory provisions as would tend to insure the operation being safely carried on?—Certainly not.

1564. For example, would you consider it an unreasonable restriction, if a person filling cartridges, were forbidden to carry on the operation in a room in which there was a naked fire or light, or that he should be forbidden to carry it on in a general workshop where other people were at work, or in a shop where customers were coming and going?—I should certainly consider it fair to object to loading cartridges in a room where there was an open fire, or an uncovered light, or customers going out and in; but I should like to see the difference well defined between what is a workshop and that particular room in which the cartridges might be loaded: to separate rooms there could be no objection, but I see no need for having a separate building.

1565. You would not object to the trader being forbidden by law to carry it on in the same room as he uses for keeping the bulk of his powder in?—I see no objection to that restriction.

1566. Might he not, without inconvenience, be limited to 5 lbs. of loose powder (that is to say, powder not in cartridges) in the room where the filling was carried on?—As a general rule, 5 lbs. would be quite sufficient. In my own case, I have invented a large machine, which will use nearly double that quantity at once, but as a general rule, 5 lbs. would be sufficient; car-

Sir H. Selwin-Ibbetson—continued.

safety the security is greater, in case of an explosion, if the safe is placed outside the house?—It might be hung outside on a wall, or something of that kind; to have small quantities would paralyse the trade, and they have very seldom yards.

1556. But do you not think that a larger amount might be allowed to the trade under conditions of that kind, than could be allowed for the public advantage in private houses as the trade is usually carried on?—I think if the manufacturer has a proper safe he might have the maximum amount of 200 lbs.; he could hang it outside the house.

Chairman—continued.

tridges are generally loaded in a machine doing 100 at a time, and those 100 take a pound and a quarter of black gunpowder.

1567. With regard to the quantity allowed to be kept by a gunmaker, what amount of powder do you consider would suffice?—I think the present law has acted perfectly well; the 200 lbs. is fixed by law, and accepted by the insurance offices.

1568. Do you not consider that the quantity of powder might be reduced, if the quantity in cartridges were increased?—It is a question depending very much on the nature of the man's business; there are oilmen and others who supply the miners and others largely with gunpowder, and I do not think that they could be reduced to under 200 lbs; but the gunmakers might be reduced under 200 lbs. perhaps; at the same time it is a very open question.

1569. If, for example, you were able to keep 100 lbs. of powder loose, or five times that amount (or of any part thereof) in cartridges, would not that afford you quite as great facilities as at present, where the limit of powder is 200 lbs., and where only 5 lbs. may be kept in cartridges?—That would afford general facilities, but it would very probably interfere with some of the gunmakers, though not many of them.

1570. In your opinion, are the ordinary cardboard and metallic sporting and military breech-loading cartridges safe against explosion *en masse*?—Yes; that has been proved beyond cavil; you may explode them in your hand without injury.

1571. I believe that an explosion happened in your house of business in the early part of the year 1871?—Not an explosion; there was a deflagration which the newspapers, with their usual ingenuity, exaggerated into an explosion. There was no explosion; this was thoroughly investigated by the insurance company, and they paid the damages, which they never do when a fire is caused by an explosion.

1572. What did Mr. Knox, the magistrate, say about it?—Mr. Knox acted under the old law applying to cannon cartridges, in which powder is enveloped in flannel, and the flames so rapidly communicated that the explosion of one cartridge is tantamount to the explosion of them all. That was an Act not applying to breech-loading cartridges at all. I then wrote to the Home Office, and I received a communication that Mr. Knox was thought to be in the wrong, but

*Chairman*—continued.

but that the Home Office was not a court of appeal.

1573. But according to the law as laid down by Mr. Knox, the filling of cartridges without a licence, in a dwelling house, was illegal?—Yes; Mr. Knox took his reasoning from some Act of Parliament which applied solely to large cannon cartridges in flannel.

1574. Then the law was not sufficiently distinct, in your opinion, I suppose?—There was not any law applying at all to the case, and that Act was before the days of breech-loading cartridges; a breech-loading cartridge is not a conventional cartridge at all, it is a temporary breech for each separate discharge of the gun.

1575. You have a house of business in Scotland, have you not?—Yes.

1576. Is there any difference between the Scottish and the English law with regard to the quantity of powder that you may keep?—The amount of powder permitted in Scotland is very small; it is 26 lbs. in my place of business in Glasgow.

1577. Your place is in Glasgow, is it?—Yes, in Glasgow.

1578. Is that a sufficient quantity for your use in Glasgow?—It is sufficient under this condition, that we can get supplies from the magazine every day, which is four miles distant.

1579. Is that 26 lbs. a day sufficient for you?—Not in the busy season; but we can despatch the powder from the magazine without bringing it into our house of business at all. To me it is tantamount to 52 lbs., as I have a second house (workshop) there. We fill the cartridges in that workshop, and not in our place of business.

1580. The Scotch law is more stringent than the English law?—Yes, it is. I gave evidence in 1862 on that subject.

1581. Is that a local Act of Parliament?—Yes; it is the Glasgow Police Act.

*Mr. Vivian.*

1582. Would 200 lbs. of loose gunpowder meet your requirements in the trade?—Quite.

1583. Do you now do much with Schultze's powder?—I believe that I am the most extensive consumer in the kingdom of Schultze's powder; I introduced it from Prussia.

1584. Is there any extra danger in keeping that powder, do you think?—There is much less danger, I think.

1585. Do you keep both black gunpowder and Schultze's powder together?—In Glasgow my stock of Schultze's powder lies in the same cell as the other powder.

1586. In what form of packages are they kept?—Various; in canisters and in cartons of pasteboard, just the same as black powder.

1587. When that conflagration took place in your premises, was it from Schultze's powder?—Yes, that took place under most extraordinary circumstances; a workman was casting bullets and left the fire for a purpose; a clerk, for mere amusement, went to cast some bullets, and finding the mould very hot, he went to the lavatory and poured water in it, and when he came back the lead had become perfectly red hot; without drying the mould he poured in the red hot lead, which blew up and lighted on a bowl of powder nine feet distant.

1588. What quantity of powder was there?—0.84.

*Mr. Vivian*—continued.

Two or three pounds in the bowl. Its blaze blew out 14 panes of glass; some two ounces or so of black powder afterwards did some very trifling mischief. There was no substantial injury done at all; no goods broken by explosion.

1589. How many filled cartridges do you generally keep on the premises?—A very small quantity; about 5,000; we load them daily, and we do a very large trade in cartridges.

1590. I suppose that includes both black powder and Schultze's powder?—Yes; but my name has been so coupled with Schultze's powder that I do a much larger trade in it than others.

1591. Does any exudation take place in Schultze's powder?—No.

1592. Is there no chance of decomposition?—I have now two samples, which are thirteen years old, and have travelled over 2,500 miles, and the powder shows no signs of decomposition.

1593. Is it always uniform in quality?—It is practically a mechanical mixture of wood and saltpetre in substance, not to be classed with chemical explosives; it is granulated powder, wanting sulphur.

*Mr. M'Lagan.*

1594. Do you have a much larger business from London than from Glasgow in the busy season?—Yes.

1595. Much larger?—Yes.

1596. How much larger?—My London business just doubles my Glasgow business.

1597. You can manage with 26 lbs. of powder in Glasgow, but you say that you require 200 lbs. in London?—The cartridges at present are loaded in Glasgow and sent to London.

1598. I am speaking of loose powder, how much do you require of that?—I have scarcely any demand for loose powder in London. My place is an office and not a shop, and therefore I have little or no demand as a retail trader for powder, whereas in Glasgow we have; but the 26 lbs. of powder is under the condition that we can get that quantity in two or three times a day; practically it is 52 lbs., we having the two separate places of business.

1599. You cannot do that in London, can you?—I can get it quickly, say in one or two days.

1600. You would be perfectly satisfied with 100 lbs. of gunpowder, would you not?—I personally should be; but that might be so invidious to my brother gunmakers, that I could only speak for myself. Formerly, a very large quantity of powder had to be kept because each sportsman had his favourite powder, Curtis's, Pigou's, Hall's, and so on; now that is done with, and the gunmaker has the choice of the powder.

*Mr. Dilhwyn.*

1601. I think you consider sawdust gunpowder safer than other gunpowder?—Yes; much safer.

1602. In what respects is it safer?—When it is fired it burns slowly upwards in an inverted cone; I made some elaborate experiments before the late Field Marshal Pollock and others at Wandsworth; I fired 24 lbs. of this powder in a dovetailed wooden box, with a lid and leather hinges; the effect was merely to lift the lid up, whereas a comparatively small quantity of black powder afterwards shattered the box all to pieces.

*Mr. Dougall.*  
19 May  
1874.

Colonel JOHN THOMAS SMITH, R.E., called in; and Examined.

*Chairman.*

Colonel  
Smith, R.E.  
19 May  
1874.

1603. You are the manager, I think, of the manufactory of Schultz's powder?—No, not at present; I resigned my office of managing director in the year 1871.

1604. But you have some knowledge of the process of manufacture, have you not?—I was managing director for two years and a half, and I take an interest in it.

1605. Will you kindly give the Committee any information you can with reference to the manufacture of Schultz's powder, I mean with regard to the safety of the public?—I think it is exceedingly safe compared with the manufacture of black powder, and the reason is, that all the processes are liquid, with the exception of the drying, sifting and packing.

1606. With regard to the storage, is it in your opinion as safe as any other explosive substance?—I should say that it is quite as safe as any other explosive substance at ordinary temperatures; I have not the slightest reason to doubt that it is absolutely and perfectly safe at higher temperatures, excepting that I think that our knowledge of chemical explosives has not been sufficient to assure us of their absolute security during the hottest weather; during the dog days it is just possible perhaps that some of the accidents that have taken place might be accounted for by the movement of the chemical explosives in large masses when thoroughly warmed through.

1607. Even in this country the temperature rises so high as to make the storage of Schultz's powder at times a dangerous process, is that so?—No; I only say that I have a doubt applying to all these explosives, founded on the non-explanation of all the accidents that have taken place, such as the one at Stowmarket for instance.

1608. Does Schultz's powder explode at a lower temperature than ordinary black powder?—Yes, it ignites at a lower temperature.

1609. Except with reference to temperature, has it any advantage or disadvantage as compared with ordinary powder?—It has this great advantage, that when it takes fire it burns, it does not explode, except when it is closely confined; Schultz's powder burns at 310° of the thermometer.

1610. Is Schultz's powder manufactured largely in this country?—No; we have only an amateur small company, consisting of a few friends who united together to introduce Captain Schultz and his manufacture into the country, and they have made a small beginning.

1611. Where is the manufactory situated?—At the New Forest in Hampshire.

1612. Is it at a sufficient distance from other districts?—Yes, it is very well situated in that respect.

*Mr. Vivian.*

1613. I suppose that Schultz's powder, and what is ordinarily known as sawdust powder, are one and the same thing?—Yes.

1614. You consider that the storage of it is as safe as gunpowder, do you?—Quite so, and if you look to the results in cases of explosions, you will find that it is a great deal safer.

1615. You spoke of the movement of the chemical component parts under certain con-

*Mr. Vivian—continued.*

ditions; does that mean decomposition of the component parts?—No, I merely referred to the handling and transport of chemical explosives in bulk, and not those actions which are now called chemical actions.

1616. Does nitro-glycerine come into the manufacture of Schultz's powder?—No, it has nothing to do with it.

1617. What is the explosive substance which is absorbed?—It is exactly similar in its chemical nature to gun cotton, except that gun cotton is continuous. When gun cotton is pulped and made into a mass it is all coherent and the particles are in close contact, but Schultz's powder is in grains like the large grains of gunpowder. There is no continuity of particles, and if any chemical action were to be set up in one part it is almost impossible for it to be communicated to the other part.

1618. Is there the same danger of chemical decomposition in Schultz's powder as there is in gun cotton?—I am not much of a chemist, but I should say not, because the particles of Schultz's powder are separate and detached cubes of wood cut by machinery, so that there is not the continuity which there is in gun cotton when pulped and made into a mass.

1619. You say that Schultz's powder burns at 310°?—Yes.

1620. At what temperature will it explode?—Not at all when unconfined, unless you heat the whole to 310° by a shovel or otherwise; if you put a pound of it into a shovel and hold it over the fire without allowing the fire to touch it, or heat it all in an oven to 310°, it would then explode at once.

1621. Is that explosion similar to that of black powder, or to that of dynamite?—I have never seen it, but I should say nothing like so severe as black gunpowder. I know nothing about dynamite. I will mention an experiment which will give the Committee an idea of the difference between the explosion of Schultz's powder and that of black gunpowder, and I have tried it very often; you may take a glass tube, a chemical test tube, and if you put in as much black gunpowder as will cover a shilling, at the bottom of the tube, and drop a match into it, it will shatter the tube to pieces, whereas you may cram it full of Schultz's powder, and light it on the top, and it will all burn out without injuring the tube; in fact, you may hold the tube in your fingers.

*Mr. Stevenson.*

1622. In Schultz's powder, I presume the sawdust is in substitution of the woody fibre of the cotton?—Yes, the wooden cubes are.

1623. In either case, you act by a mixture of acids on the woody fibre, but it is in the form of sawdust in one case, and in the form of the fibre of the cotton in the other?—Yes.

1624. So that, chemically, they are the same class of substances?—Yes, but not physically.

1625. I presume that Schultz's powder factory is only an experimental manufactory?—Yes; it is still going on.

1626. It has hardly become an article of commerce, has it?—Yes, a good deal is now being sold.

1627. What

Mr. *Stevenson*—continued.

1627. What quantity have you been making in a week, or in a year?—About three hundred-weight a week.

1628. You seem rather doubtful of all compounds of that class, when exposed to a high temperature?—Yes; I thought it right to express to the Committee the only doubt that I have; I have very little doubt, but I thought perhaps it might be wise to make some exception with reference to the movement of chemical explosives in very hot weather, unless moved at night or in a damp state.

1629. Therefore further experience is required in that direction, is it not?—Yes, further experience may be required in that direction.

Mr. *Whitelaw*.

1630. What is the comparative power of Schultz's powder as compared with black gunpowder?—It is exactly double the power.

Sir *Henry Selwin-Ibbetson*.

1631. Could you give any evidence to the Committee as to whether any spontaneous combustion is likely to take place from decomposition in Schultz's powder?—Not the slightest that I know of.

1632. You are aware, are you not, that there are authorities who have stated a contrary opinion with regard to Schultz's powder?—No; I was not aware of that.

1633. Have you had your attention called to a report made by Professor Miller?—Yes, I have heard of it, but I do not remember that he said that positively.

1634. He said that it must be jealously watched, because he believed it was possible, was not that it?—I can put in Dr. Letheby's certificate, in which he says that it is not liable to decomposition. I have also another certificate by Mr. Griffiths, a professional chemist, giving reasons why it is impossible for spontaneous combustion to occur.

1635. You are aware, are you not, that Professor Miller was a great authority on these points?—Yes; but I do not remember that he said that.

1636. He says that he knows of no instance of spontaneous combustion with the powder, but he thinks that the point is one which ought to be jealously watched, and he lays down certain

Sir *H. Selwin-Ibbetson*—continued.

rules with regard to conveyance?—Yes; I agree with him there, and more particularly during the hot weather; with the permission of the Committee, I will put in copies of Dr. Letheby's certificate and other certificates. (*Vide Appendix.*)

1637. Has there been any explosion at Schultz's factory?—Not during my time; there never was an explosion, but the powder has been burnt twice.

1638. There was one case in August 1871, was there not?—Yes.

1639. Can you assign any reason for that?—I did not investigate it myself, but Mr. Dale, who is now present, went and looked into it; I know the facts from hearsay, which were these: the drying room was used improperly for sifting the powder, and the powder man, who was an exceedingly cautious man, was absent, and asked the blacksmith to take his place; the blacksmith was a very steady man, but he had not the same experience and caution as the other man, and he emptied out a very large heap, three or four cwts., on to the floor, and put another quantity which he took from the drying shelves hot, into a large sifting machine; but it appears that there was a nut in the machine that was loose, and he got a pair of pincers and began to work away with them (at least this is what we suppose); a spark ignited the whole of it, and he was burnt to death.

1640. Is that the only instance of an accident that has occurred?—No; there was another instance afterwards in which three men were injured; no life was lost.

1641. Was that from a similar cause?—No; we never could find out what the cause was; I am speaking merely from hearsay, but a tobacco pipe was found among the refuse, and it is believed that one of the men was smoking.

1642. Therefore precautions are very necessary, are they not?—Yes.

1643. And the regulations ought to be very strictly enforced with regard to that manufacture?—No doubt, in regard to the drying process; I will, with the permission of the Committee, put in a report or circular from the Chief Commissioner of Police in Dublin (*Vide Appendix*), showing the prejudice that exists and which we want to remove; he speaks of Schultz's powder as a dangerous compound; it is not half so dangerous a compound as black powder, in my opinion; I think that is a total mistake.

Colonel  
*Smith*, R.E.  
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Mr. HERMAN EUGENE FALK, called in; and Examined.

*Chairman*.

1644. I THINK you are connected with salt mining operations in Cheshire?—Yes; and I represent the mining interest as President of the Salt Chamber of Commerce.

1645. This Committee is appointed for the purpose of inquiring into the making, keeping, carriage, and importation of gunpowder, and other explosives; I believe that you can give the Committee some information with reference to the mode of storage of powder, for the purpose of salt mining?—Yes; we consume in our district about 100 tons of powder in salt mining per annum. All the rock-salt is blown out by powder; quarried, in fact, in the shape of blocks and rubble. Our mines are from 300 to 500 feet

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*Chairman*—continued.

deep; they are excavated like a quarry. If you imagine yourself looking inside a church 18 or 20 feet high, with pillars eight or ten yards square, you have got a view of a salt mine; it extends from three to 30 acres; it is not mining, in the proper sense of the word, as it is understood in England generally, with coal, iron, or other things, as there are no drift-ways; salt mining is properly salt quarrying. We have stored our powder for the last two centuries in the disused part of the mine; as a matter of course there is only a small portion of the excavation under work at all times in the mine, and there is always a space of from 100 to 500 yards distant from the place where the operations are carried

Mr. *Falk*.

*Chairman*.—continued.

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on; and there the powder has been stored. It is generally brought in quantities of one ton at a time, and most carefully handled by the miners; the oldest man is generally chosen by them to do that work; the men in the mines do not often exceed 40, generally they average 20 at a time in the mine. They choose their oldest and most skilled members to charge the holes which are made, and to fire them; it is the primitive system of working; we do not even use fuses in our works, we only use the ancient straw filled with a charge of powder to light the blast with.

1646. And do you use any other explosive substance?—Nothing but gunpowder.

1647. The mine magazines are all below ground, I suppose?—They were all below ground.

1648. Have you no larger store of powder than one ton at a time?—That is the quantity at most, and that is divided by being put in two opposite directions—one at the north end, and the other at the south end of the mine. One side will take half a ton, and the other side will take half a ton; consequently, the quantity of powder which is mostly together in one place at any time is half a ton.

1649. What inspection are you subjected to?—We have been subjected to no inspection whatever until last year; but last year the Metalliferous Mines Bill brought the salt mines under the inspection of the Government inspector of the district. In that Act of Parliament there is a clause to the effect that the storage of powder shall not be under ground, but shall be above ground; and we are called upon, notwithstanding our remonstrances, to build magazines on the surface of the ground. Now, salt mines are so peculiarly situated within densely populated districts, that it is almost impossible to comply, in all directions, with the law as it stands; for we are not allowed to build our magazine within 100 yards of a human habitation; we are not allowed to carry powder for a long distance on a high-road or in a street, and consequently in many mines we are under a positive physical disability of complying with the law; the Secretary of State for the Home Department has got powers under the Metalliferous Mines Act to exempt us from the obligation of special clauses of the Act, one of which is that of erecting magazines for the storage of gunpowder, and I believe Mr. Bruce agreed that that was so, and that the most desirable place for the storage of gunpowder was under ground.

*Mr. Vivian*.

1650. Your objection, as I understand your evidence, is to the situation of the mines magazine?—Yes, it is.

1651. I suppose you are aware that the effect of half a ton of gunpowder exploding under ground, would have much greater power and probable loss of life under ground than on the surface?—I am afraid not; if a magazine blew up in the neighbourhood of our salt mines, populated as the district is, rotten ground, cracked walls, standing at all angles, we should have a far more serious loss of life with an explosion on the surface than with an explosion under ground; I may state that although we have been working our salt mines for two centuries, there never has been an explosion.

*Mr. Vivian*—continued.

1652. You think that half a ton of gunpowder exploding under ground would have no greater effect than half a ton of gunpowder exploding on the surface, do you?—I expect that it would have a far greater effect on human life on the surface than it would under ground.

1653. How many miners have you working under ground?—Twenty or thirty; at most 40 at any time; the average would be nearer 20 than 30.

1654. Would not the effect of half a ton of powder exploding under ground be very disastrous to all the men then in the mine?—That I must leave to scientific gentlemen, though I believe that when you have got an explosion of half a ton of gunpowder in a space of 30 acres, it could not be of any great effect; most of the mines are five or 10 up to 30 acres, and they are perfectly open; there is no obstruction whatever, except the natural pillars.

*Mr. Stanhope*.

1655. Does the Weaver Act, which is a local Act of Parliament, prohibit the storage of gunpowder within a certain distance of the river?—Yes.

1656. Are the principal mines situated within a short distance of the river?—Yes; all of them are nearly dependent for carriage on the river Weaver.

1657. If you are not allowed, as you say, to store gunpowder within the mine, you are in very great difficulty to find where you are to store it, are you not?—Yes, there is a physical difficulty in all those mines situated in the town as to the erection of magazines without contravening the Gunpowder Act with respect to the carriage of powder.

1658. With reference to powder magazines being erected on the surface of the ground, are there so many salt-pans where fires are kept burning that there is no safe place for the keeping of gunpowder above ground?—Yes, we consume nearly a million tons of coal a year for the evaporation of salt, and the furnaces exist side by side, with the mine.

*Sir Henry Selwin-Ibbetson*.

1659. Your objection is to the regulations laid down under the Metalliferous Mines Act of last year, is it not?—Yes.

1660. And also as against certain local Acts of Parliament?—Yes.

1661. But then let me ask what position you would like to assume before this Committee?—Under the Metalliferous Mines Act we contend the Home Office has the power of granting exemptions from different clauses of the Act, and amongst others to exempt us from the clause making it obligatory to store gunpowder above ground.

1662. How are we, as a Committee sitting to inquire into explosive substances, to deal with a question which, on your own showing, is under the cognizance of the Home Office?—The Committee must be kind enough to decide that; we are here simply because the Home Secretary (Mr. Cross) has referred us to your Committee, and whether he wishes to be fortified by your opinion on the subject or not I do not know, and must leave to your better judgment.



Mr. SAMUEL JOSEPH MACKIE, called in; and Examined.

*Chairman.*

1663. YOU are the Managing Director of Puncheons factory, are you not?—I am general Superintendent of the Patent Cotton Gunpowder Company's Works, near Faversham, in Kent.

1664. You are, I believe, prepared to give the Committee some information with reference to the manufacture of gun-cotton and its safety, in your opinion?—Yes. At the present time our works are not running commercially, although they are in immediate prospect of doing so; but we have made very considerable quantities of gun-cotton. I have already had 17 years' experience of gun-cotton, and I do not hesitate to say that, with proper care, it is one of the safest explosives we have.

1665. Had you any connection with the works at Stowmarket?—No, we have no connection with the works at Stowmarket; but I was acquainted with those works, and saw the results of the disaster.

1666. Was it due to the manufacture or to the state of the gun-cotton, in your opinion?—My opinion is, that it was due to defective manufacture; that, in consequence of their working at a greater rate than the works were fitted for properly, the gun-cotton was not properly washed and freed from acid. The main cause of that explosion was, I believe, that larger charges than should have been were put into the centrifugals, and were not thoroughly cleansed, and afterwards, when the gun-cotton was pressed into discs, a heating took place, just as happens in the interior of a haystack when the moisture gets to it. I would rather not express a direct opinion on the absolute cause of the explosion. The magazine keeper was, so far as I know, at the door of the magazine just previous to the explosion, and therefore the ignition may have taken place from another cause.

1667. Explosion takes place in gun-cotton at a much lower temperature than it does in black gunpowder, does it not?—It does.

1668. At a much lower point?—It is 634° in black gunpowder, and at 365° in our gun-cotton. There would be no fear of spontaneous combustion in gun-cotton if it were perfectly free from acid.

1669. With regard to the storage of gun-cotton, wet or dry, what have you to say to the Committee?—Gun-cotton at our works is stored entirely under water. Gun-cotton may be stored with absolute security under water, whether properly washed or not; but properly washed I think it might be stored under any circumstances dry, if in the magazines it were so placed that in case of a conflagration the residual mass would not become heated to explosion point. If the boxes were not isolated, then after a conflagration had lasted for some time, the remaining mass would get heated to explosion point, and would blow up.

1670. Is the process which you superintend not the same as that carried on at Stowmarket?—No, it is quite different.

1671. Is the gun-cotton pulped?—We do not pulp our gun-cotton; but it is crushed by a novel process to an impalpable dust, and then it is mixed with nitre and sugar.

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*Chairman—continued.*

1672. Is it used actually as powder?—It is used actually as mud; we keep it wet for the sake of safety; it would be more convenient to use it dry, because we could then weigh the quantity exactly, but as it is we weigh it by gravity.

1673. Do public carriers make any difficulty with regard to carrying your gun-cotton?—At the present time I am not aware what the railway companies will do at all. Since the explosion at Stowmarket the railway companies generally have refused to carry gun-cotton. Our company are very much interested in that question, and I may say that our powder might be carried with far more safety than gunpowder. In respect to an Act of Parliament like the proposed Act, the question occurs to me whether, on the report of the Inspector, the Home Office could not recognise certain explosives as being fit to be carried by railways, and then the companies might be compelled to carry those so recognised; they are common carriers, and in my opinion they should carry everything that is not absolutely dangerous. Then again if gun-cotton or cotton gunpowder should be more explosive than the same quantity of gunpowder, the bulk carried might be restricted to a smaller quantity in each waggon, which would give an explosion the same limited effect.

*Mr. Vivian.*

1674. If the railway companies were to carry a smaller proportion of gun-cotton than they can of gunpowder, of course they would be justified in charging you a higher rate, would they not; would it not be met in this way; if it was found that only 500 lbs. of gun-cotton could be carried with safety without exploding, the railway people would save themselves by charging a higher rate on that 500 lbs.?—I do not think that they ought to charge more for weight, as the cost of carriage to a railway company is the weight carried and the mileage run. If they choose to charge an extra per-centage for insurance against the higher risk if such existed, that would be open to them, and they would have the question in their own hands whether it was safer or not than black gunpowder.

1675. But it would be hard on the railway companies to require them to use their plant for a smaller quantity than they actually could carry of anything else, would it not?—That might be so, but we should probably send large quantities. It would tend very much to the safety of the public if they were forced to carry in small quantities at a low rate; because there is a great deal of carrying which goes on surreptitiously. If a railway company will not carry less than a ton of fireworks, at say 9 l. per ton for a certain distance, a 2 lb. box of fireworks would cost 9 l.; and therefore if the railways will not carry small quantities of gun-cotton for less than they carry a ton at, some surreptitious means will be adopted, whether with our cognizance or not.

1676. Is your gun-cotton used in mining operations?—Both for guns and mining we manufacture some powders which are milder than gunpowder and some which are as strong as nitro-glycerine.

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1677. Can

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Mr. Vivian.—continued.

Mr. Mackie. 1677. Can it be used in the blast in a damp state?—We make some powder for damp blast holes; but for general service we send it away dry. In that condition it can be carried with extreme safety; I have repeatedly fired a Martini-Henry hardened bullet at 20 yards through a 5 lb. box without setting fire to it.

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1678. Does it require any dry gun-cotton to fire that wet charge?—Unless it is very strongly confined it would require a detonator to fire it.

1679. The detonator alone would fire a wet charge, would it?—Yes, the detonator alone would fire a wet charge of gun-cotton if it were a small charge; if it were a large charge I do not think that it would be exploded without dry gun-cotton.

1680. Is your gun-cotton in use now in many mines?—No, we are not yet manufacturing commercially; we are just about to start; the new works are put up, and machinery running tentatively. We have made trials with marked success.

Mr. Stevenson.

1681. I suppose you make that gun-cotton in the ordinary way?—Yes; but we afterwards crush it into an impalpable dust, and make a veritable gunpowder from it by mixture with nitre and sugar.

1682. You then wet it, and mix it with nitre and sugar?—Yes.

1683. In what form is it ultimately turned out?—It is turned out as dry gunpowder cake, and broken afterwards into grains.

1684. You send it out in dry cakes, do you?—We send it out in grains the same as ordinary gunpowder, and that relieves us from one of the evils of gun-cotton, namely, the danger in ramming when filling the blast hole with discs.

1685. In what way do you pack your material?—In powder barrels.

Mr. Stevenson.—continued.

1686. What quantities do you pack it in?—In 5 lb., 10 lb., and 20 lb. barrels.

1687. You say the explosive point is 365°?—Yes.

1688. What is the proportionate power, taking an equal quantity of gun-cotton and gunpowder?—Our strongest is five times the power at least, and perhaps seven times in some cases; and we can make it much milder than black gunpowder. We make it all kinds of strength.

Mr. Whitelaw.

1689. Can you carry the powder damp?—No. We store the gun-cotton, of which it is made, under water; we never allow the gun-cotton to get dry. We can transport our gun-cotton in water.

1690. It is sent out to be used in a dry state, is it not?—Yes, it is only in the finishing operation that we press it into a cake dry; in all other states it is wet, and the operations are absolutely safe.

1691. You do not depend for safety in carrying it, upon having it in a damp state; it is dry, is it?—Yes; and it is very safe to carry in that condition.

Sir Henry Selwin-Ibbetson.

1692. What experience have you of the chemical stability of your particular form of gun-cotton powder?—We have had gun-cotton in our tanks since January last, and they are repeatedly tested; we know from the tests from time to time if it is stable; in some cases we find it remain perfectly stable, namely, where it is properly washed; in other cases it has run down, but that would be arrested if the washing were completed.

1693. It does vary, does it?—If the acid is not out of it it will run down, and the explosion point will become lower.

Mr. JOHN DOWNIE, called in; and Examined.

Chairman.

1694. YOU are Manager and Secretary of the British Dynamite Company, are you not?—Yes.

1695. The process is for making dynamite and not for making nitro-glycerine, I believe?—Just so.

1696. Will you be kind enough to state to the Committee what is the nature of the process which you carry on at the British Dynamite Company's Works?—I should prefer to give a slight descriptive account to show the whole system which has been undertaken under perfect surveillance; in the first place, I took over the whole of the patent of Mr. Nobel's. I took upon myself to form the British Dynamite Company. That has been done, but prior to so doing, I obtained from the Home Secretary the form of license under which we could manufacture nitro-glycerine and dynamite.

1697. In what year was that?—That was in the year 1869, after the passing of the Act; so soon as we had got something definite to go upon, and the company was finally formed; I obtained from Mr. Nobel plans of a factory for my guidance, with reference to setting out the works in this country, which plans I submitted to the Home Secretary, they are similar to what the factories are abroad, inasmuch as I wished to know what amount of ground would be necessary

Chairman.—continued.

for the erection of such factories. These Plans (*producing them*) will show the Committee how the factories are arranged abroad, and that the houses are contiguous to each other, all being very different from what we have been obliged to arrange under Government surveillance.

1698. Where is that factory situated?—This Map (*producing a Map*) shows the piece of ground for our factory at Ardeer, in Ayrshire. This (*referring to the Map*), represents a large sand patch of 1,400 acres, in the middle of which 100 acres have been taken off, on which the British Dynamite Company's factory is erected. There is three-quarters of a mile of frontage to the sea, and one-third of a mile inland each way. The natural contour of the ground has given us facilities in giving the necessary protection which the Government requires. This site would be totally and wholly unfitted for ordinary gunpowder works, for here you have shifting sand, and grit of all kinds blowing in with the gales of wind, but for our purpose it has not the least bad result. So soon as the plans were approved, they were submitted to the Home Office; and a plan like this was lodged in the Home Office, and signed by me on behalf of the Company, and by Major Majendie on behalf of the Home Secretary, and we cannot deviate ever

Mr.  
Downie.

*Chairman*—continued.

ever so little from any of those plans, in any way, without the consent of the Secretary of State. So far from being permitted to put the factory on 15 or 20 acres, we have been obliged to distribute the buildings very much wider. We have these houses 50 feet apart, and others in proportion; each of those houses is embayed in the sand-hills, which protect them like traverses on embankments, so that each house is separate, one from the other, and there cannot be any possibility of a total explosion, in our estimation. It is so isolated and localised, that if anything were occurring it would be confined to one particular building.

1699. Does anything ever occur?—Nothing has occurred yet at all; this is the case of a factory which has been erected in all its details to the thorough satisfaction of the Home Secretary. The isolation is not only complete in so far as the buildings are concerned; but the varying levels of those sandhills give us another advantage, inasmuch as the explosive material, or rather the material when it becomes explosive, is not handled at all, but flows from one department to another until it is absorbed in the safety vehicle that may be used; the consequence is that the chances of danger, through handling or manipulation, are very much reduced; in fact, we consider they are reduced to a minimum. All the operations, so far as the explosive portions of the works are concerned, are regulated by rules. I can produce the general rules and bye-laws to be observed by all employed in the works, signed by Major Majendie on behalf of the Home Office, and by me on behalf of the company. There are special rules and regulations applying to the separate buildings where explosive materials are stored. One condition of those rules is that all the workers employed in the factory shall have copies of those rules given to them on entering the employment, and shall sign their names in the book, having those rules read over to them at the time of the signature; and they are from time to time questioned with reference to their understanding of those rules; that is done regularly.

1700. How many persons are employed at your factory?—I have not the exact number with me: it is a little over 200, I think; but I speak entirely off book; that includes all classes, both men and women. We employ no boys at all in our factory. The manufacturing license under which we work binds us down, in every detail of manufacture, to observe the greatest possible care. I believe I am right in saying that the precautions which have been taken and approved by Major Majendie are perhaps the best in existence. All details in connection with the manufacture, the mechanism, and apparatus, have been passed under review by Major Majendie. They were approved prior to being put in position or used at all. Each of the houses (I am speaking now of the dynamite factory more particularly) has a stipulated quantity of material, which must not be exceeded. Each of the houses has a regulated number of workpeople, which is not exceeded. The clothing is regulated, and the men and women have pocketless, unflammable suits supplied them, and they change their dresses. Every time they go to the factory they are examined and searched. That searching is occasionally irregular, for the purpose of being enabled to detect any departure

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*Chairman*—continued.

from that rule. There may be careless people, who may perhaps think that they may smuggle in a thing. That has in one or two cases been efficacious. It has been reported to me that, when the examination has been delayed, this meal time, and taken up at the next meal time, we have in that way been enabled to have a more perfect surveillance. The advantage that system possesses is that the workpeople never know when they are to be searched; so that it exercises a beneficial effect. The whole process of manufacture, beginning at the very first, is exceedingly simple, and, so far as the operations are concerned, exceedingly safe. We manufacture our own nitric acid, which is of the greatest purity and strength possible, seeing we cannot get sufficiently pure or sufficiently powerful nitric acid in the open market. We do not manufacture our sulphuric acid yet, but we expect to do so. It, however, is most carefully tested, and is of the greatest purity and strength possible; the glycerine employed is also of the greatest specific gravity possible; 30 degrees Baumé.

1701. Where is it obtained from?—It is obtained from various parts of the Continent, from foreign houses in France, Belgium, Prussia, Russia, and, in fact, we require to spread our inquiries very much in order to obtain a sufficient supply; we require to purchase it for some months a-head. We have in contemplation to put up an apparatus for the purpose of the purification and the concentration of glycerine, but those are not yet perfected. We consider that it will be a very essential matter for us eventually, but in the meantime we have refrained from going very far forward with those preparations until the result of very interesting experiments now going on in Paris be ascertained, whereby the process is very much improved, the product made very much more pure, and the cost rendered much more cheap. Meanwhile, the laboratory arrangements in connection with the factory are of the most perfect kind; they have been carefully arranged by Mr. Nobel himself, assisted by our chief chemist, who combines, I believe, all the requisites for perfect guidance with regard to tests and everything necessary for the manufacture. It is possible, I believe, to increase the value of our laboratory, which we hope to do very shortly, because there are now and again fresh appliances coming out, which give greater facilities for those tests and operations; no expense has been spared by the directors of the company to obtain the best possible apparatus, not only with regard to the mere operations of manufacture, but particularly with regard to the mode of testing what is manufactured. The acids and other materials that are used in the manufacture of the nitro-glycerine prior to being sent from the acid manufactory on to the dynamite manufactory to be operated upon there, are first tested by the chemist, so as to ascertain, as far as is practicable, that everything is in order. The correct atomic quantities are weighed out into a large vessel called a mixing vessel, where the acids undergo the mixing process; I mean the nitric acid and the sulphuric acid are there mixed; and as the chemical reaction goes on heat is evolved, and all those vessels are surrounded by water which carries off the surplus heat. The acids remain

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there for a considerable period until they cool down, so that when they are brought in to be operated upon, there is no room for any increment of heat by chemical development. When those acids are in perfect order for operating upon, they are weighed off in the presence of the chief chemist; they are then taken up that incline (*referring to the Plan*) to the higher house, the nitrating house. I should explain with regard to this plan that those tumbling sand hills on the sea beach have varying levels; some are on the average from 28 to 32 feet in height, while those where the nitrating houses are erected have an average height of from 52 to 54 feet. These varying levels enable us by taking the material up this incline to discharge it by gravity down into those houses on each side; those are in duplicate, for the reason that if the apparatus in one side should give way there would be another ready at hand, or if we wish to increase the quantity largely we have the means of doing so at once, while the operation is going on, because one arrangement, and it is a wise one, that Major Majendie has made, is that we shall not nitrate in both houses at the same time. The first process of nitrating goes on here in a very large apparatus, where we treat 1,500 lbs. of nitro-glycerine at each operation. Prior to settling the plans for these works I visited all the factories abroad, under Mr. Nobel's control, and several others not under his control, so that I might see the process in actual operation, and judge for myself; and, finally, whereby more efficiently to assist in the construction of the works, seeing that the weight of the responsibility rested mainly with me. Mr. Nobel being abroad I could consult him by letter only; but he did not see those things in actual construction. I was obliged to design those works, if I may put it so, from the crude materials in the drawing which I produced, which gave me scarcely any good idea. The moment Major Majendie determined to make 50 feet instead of 10 feet the distance between the buildings, those drawings were of very little value indeed. Those places, (*referring to the Plan*) show an immense embankment, embaying those houses in such a way, that the access to each is completely isolated; the difference in the level is about 42 feet, so that those houses would be quite protected in the event of an explosion, while those houses lying about the base of those hills are also protected. The next operation after the nitrating, is the separating, down in this lower house; it flows down by gravity. These are the danger houses, (*referring to the Plan*); the whole of those operations are under the eye of the chief chemist, and controlled by him in every particular. He is supplied with all the necessary gauges and means of ascertaining precisely the condition of the charge being operated upon; in fact, he has every means at his disposal, whereby he can get rid of the charge in the event of anything occurring that he cannot control. This house in the centre marked D., has been called by some one the drowning house; it contains a large tank with 45 tons of water; that water is for this purpose, that in the event of the chemist not being able to control it, he may run the charge into the water, and by diluting the acid, stop the chemical action forthwith; and the nitro-glycerine being the heavier, it sinks to the bottom and can be after-

Chairman—continued.

wards operated upon again by careful washing; that is quite an abnormal state of things, and only used in the event of either the acids not separating from the glycerine, or from any cause over which we may not have, at the moment specific control. The stirring or mixing arrangements are all done by machine power. In the process abroad, at all the factories which I visited, it is nearly all done by hand labour, and I take leave to say not quite within their control; this is very different here. This is by machine power, and thoroughly under the control of the party in charge of it. The pressure and other things connected with it are regulated by valves, which are adjusted to the greatest possible nicety, so that they cannot be exceeded in any way. The remainder of the process, after the nitrating has been completed, is to run it down into a second house, where the separation takes place. The acid being heavier than the glycerine, it floats on the top and is then decanted over into a pre-washing vessel, where it is washed partially free of the acid by the water; three or four washings take place in this vessel with fresh supplies of water at each time, the waste being run off and the quantity being allowed to remain quiet for a short time, and the glycerine being allowed to sink to the bottom. The process of washing is done by compressed air at a pressure of from 45 lbs. to 50 lbs. of the atmosphere, and the whole contents of those vessels are surged over and over again a million times, right through the vessel, so that every particle and every atom is submitted for an infinity of times to the purifying process. Prior to the charge being decanted comes the final washing process, and the chemists take samples and test them with regard to their neutrality; that is done generally by means of liquid litmus, a very small proportion of nitro-glycerine, a 2 oz. phial of liquid litmus, and if it discolours the liquid he goes on until little or no trace, if possible, of the acid remains. So soon as the chemist is satisfied with the process in that particular department, it is then run still further down by gravity into the final washing and filtering house, and in this washing and filtering house it is treated with alkaline solutions, so as to neutralise any remaining acidity that may cling to the particles of nitro-glycerine.

1702. Is it run down at a great velocity?—It is in open gutters, and it is not run down at a great velocity. Those gutters are carefully washed out after every charge has been run through them; and having been run down to this final washing and filtering house, and treated in the manner I have indicated, by alkaline solutions, the chemist takes another sample and satisfies himself by a similar test to that in the final washing process, that it is neutral; but though he is satisfied of its neutrality by such a test, the washing is continued generally from a quarter of an hour to 20 minutes longer, so as to ensure that it is perfectly done. At the end of that time the chemist takes a sample, generally nearly half a pint of liquid, and goes down to the laboratory and there submits it to the most crucial test known to science with regard to its purity and its neutrality. This vessel is not permitted to be touched by any man until the chemist passes it or until he sends a written order to let it flow into the filter which is underneath; all this is done by gravity, no man touching it; so soon as  
the

Chairman—continued.

the chemist is satisfied with the sample which he has taken, it is put away in a sample bottle and placed in the laboratory magazine, so that we have samples of every charge made in the factory from the very first; then being satisfied of the purity of the product the next operation is to let it flow into a filter; this filter is a large oval vessel sufficient to contain nearly three tons weight; the object in having it so large is a future object. In the centre of the apparatus there is a central cylinder with a thick blanket fastened over the end of it by copper hoops, for the pur-

Chairman—continued.

pose of allowing this mixture to drain down into it, so that no foreign matter of any kind is permitted to get into the filter; any aqueous substance that may cling to the nitro-glycerine when so decanted floats on the top of the cylindrical vessel, and does not percolate through the blanket, as a rule, unless there is very great carelessness on the part of the men not attending to the processes; the charge being run down into this vessel is afterwards permitted to flow into the safety-vehicle that carries it, viz., the Kiesel guhr.

Mr. Downie.  
19 May 1874

Friday, 22nd May 1874.

## MEMBERS PRESENT:

Sir John C. D. Hay.  
Mr. Knowles.  
Mr. Laird.  
Colonel North.  
Sir H. Selwin-Ibbetson.

Mr. Stevenson.  
Mr. Vivian.  
Mr. Whitelaw.  
Mr. Whitwell.

VICE ADMIRAL THE RT. HON. SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

His Grace the Duke of SUTHERLAND, K.G., attending by permission of the House of Lords; Examined.

*Chairman.*

1703. I BELIEVE that your Grace is aware of the nature of the order of reference under which this Committee has been assembled?—I am.

1704. Would your Grace be kind enough to favour the Committee with your opinion of the safety of dynamite in use as compared with gunpowder?—I think that dynamite is safer in every respect; the carriage of it is so much safer, and the ease with which the men handle it makes it a much safer material to carry about than gunpowder.

1705. Have you found any difficulty in getting your agricultural labourers, and others who are unacquainted generally with blasting operations, to apply, and safely to use, dynamite?—Not the least, and one of our quarrymen, in Scotland, was so pleased with it, that he insisted on keeping the cartridges at a proper temperature by carrying them about in his breeches pocket; the men take to it very kindly indeed.

1706. Have no accidents occurred to any of your workpeople in consequence of the use of dynamite?—None.

1707. In your opinion, would this new explosive, if more generally used, be important to the agriculturist as tending to great economy in the removal of tree-roots, boulder-stones, and other obstruction to steam cultivation, and further land improvements?—I am certain that it would in my case. We are improving large tracks of moor land, and large tracks of very large tree-roots, covered with peat; the effect of gunpowder would only be to blow through the interstices of the root, and produce no very material effect, but dynamite seems to have such an immense power, and goes off so suddenly, that the vent-holes do not appear to diminish the effect of the discharge, and instead of perhaps only partially splitting the root, it splits the root right up into sections that makes the root very handy to be dragged away by steam-engines.

1708. Do you store large quantities of dynamite?—No, not at present; the difficulty has been to get it. One has to get one's friends to bring it down in hat-boxes, or smuggle it through in ways of that kind. Of course I must have it by some means, as it is so useful; I am very anxious that we should have a license, and be able to have as much as we require.

1709. Your confidence in dynamite does not

*Chairman—continued.*

extend to nitro-glycerine, pure and simple, I suppose?—I believe that nitro-glycerine is mixed with dynamite, but I do not speak to nitro-glycerine, pure and simple.

1710. Is it your Grace's opinion that it would be prudent to place agriculturists and others in a position to be able without a licence to buy dynamite in small quantities from retail dealers in explosives?—When a man is allowed to keep powder, I think he might be allowed to keep dynamite with much greater safety.

1711. I suppose your Grace has heard of the danger supposed to result from the exudation of the nitro-glycerine and the dynamite?—No, I have not.

1712. From your experience at your mines and quarries, is dynamite in your opinion equally valuable for those operations as it is for agricultural improvements?—I believe it is equally valuable; but from my small experience in quarries I can hardly say much about it. The mistake we made at first was working in the freestone; we put too much dynamite in, and the explosion was too violent; but with a little practice that can be easily overcome.

1713. Is it your opinion that under proper regulations, railway and shipping companies ought to be compelled to carry dynamite for distribution to consumers at moderate rates of carriage?—Yes, I think that railway companies would already have carried it under the same rules as they carry gunpowder, if pressure had been put upon them, but at present there has been no very great amount of pressure put upon them, and partly to save themselves trouble not to go into new things, they have declined to carry it; but of course, as it is acknowledged by nearly everybody that dynamite is safer than gunpowder, if it was carried in the same way as gunpowder, it would be very inconsistent for the railways not to carry it, if they carried gunpowder.

1714. I think your Grace's evidence would go to assume that it is satisfactorily established that the character of the dynamite which was to be carried, was safer than that of gunpowder?—Yes, I assume that.

1715. There has been some evidence given before this Committee, that at times it is impure, and that at those times an exudation of the nitro-glycerine

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*Chairman*—continued.

glycerine from the dynamite appears, in which case considerable danger arises, and until that risk was entirely done away with, you would hardly compel the railway companies to carry it, would you?—No, I should say not, unless it can be shown that it is as safe as gunpowder. As soon as it can be shown that it is as safe as gunpowder, then the railway companies ought in my opinion to be bound to carry it.

1716. Are there any other observations which you wish to address to the Committee?—No; I may mention with regard to the blowing up of those roots, we found that we could do for 7*d.*, by putting three or four cartridges underneath the root, what it would cost us 6*s.* to do in tearing the root out by engine power and manual labour.

*Colonel North.*

1717. I think your Grace has said that you have used this dynamite in blowing up roots of trees in bogs as well as other places?—That is where I find the great use of dynamite.

*Mr. Vivian.*

1718. Would your Grace have any fear in taking any quantity of dynamite in the same railway carriage as that in which you were yourself travelling?—No, certainly not, because so far as I understand dynamite, it requires both concussion and heat to make it explode; I believe that anyone may easily cause concussion, but it is very unlikely that you will get the concussion and the heat together.

1719. Has your Grace had experience of any drawback in the freezing property which dynamite possesses?—No, I never work in very cold weather; but there has been invented a warming pan to keep it at a proper temperature.

1720. You have never experienced any drawback from exudation, have you?—No.

1721. Have you had any experience of dynamite No. 2?—No, but I believe that No. 2 will suit us for blowing up roots better than dynamite No. 1.

1722. It is a little slower in exploding, is it not?—Yes, it is a little slower in exploding.

*Mr. Whitwell.*

1723. Has your Grace had much experience of its use in breaking up boulders?—We tried it on a small scale with very good effect, by putting three or four cartridges underneath the boulder, or by making a small hole at the top and exploding it in the usual way.

*Mr. WILLIAM T. ELEY, called in; and Examined.*

*Chairman.*

1738. You are, I believe, an extensive manufacturer of cartridges?—Yes.

1739. I believe that your trade includes the making of military and sporting cartridges also?—Yes, it does.

1740. I believe that you are also a manufacturer of percussion caps?—Yes, we are.

1741. Where are your factories situated;—Our factories in London are in Gray's Inn Road and at King's Cross, and our country factories are near Edmonton.

1742. About how many persons altogether do you employ in your works?—During the last 20 years we have never employed less than 1,000, and sometimes exceeding 2,000.

0.84.

*Mr. Whitwell*—continued.

1724. Your Grace would say, speaking generally, that dynamite was more powerful as an explosive than gunpowder, would you not?—Yes.

1725. Because it can be applied in the open without a bore?—Yes, certainly.

1726. How are your explosives ignited?—With a large copper cap; the common fuse; the copper cap is buried in the dynamite, and produces both concussion and heat.

1727. Do you think that there is sufficient heat created there to affect the dynamite?—Yes, I believe the copper cap to be the most dangerous article of the two.

1728. Then how do your people thaw it?—We have a warming pan, a tin case surrounded by hot water, which keeps the cartridge to the right temperature for three or four hours.

1729. That is the system of storage which you adopt, is it?—No, that is for carrying it on the hills from place to place.

1730. How do you store it?—We put it into a box and bury it in the ground; the damp does it no harm. I have got some at present in a gunpowder magazine.

1731. Your Grace has had no explosions whatever, I think, you said?—None.

1732. How long have you used dynamite?—About three months now, but never upon so large a scale as I wish, because we have a difficulty in getting it transported.

1733. If your Grace could get it easily, I presume that you would use it to a much greater extent?—Yes, decidedly.

*Mr. Stevenson.*

1734. Where is the dynamite made which your Grace uses?—At Ardcer in Argyleshire.

1735. The Committee have had evidence before them that the safety of dynamite depends altogether on its purity; that if it is properly made it is safe, but that if the nitro-glycerine, by any chance exudes, great danger may arise; what security has your Grace that the dynamite which you use is pure?—I trust to the honour of Mr. Downie.

1736. Your Grace depends upon the reputation of the manufacturer?—Yes.

1737. I presume that you would not undertake, yourself, to test the purity of it in case of any doubt?—No, I never thought of it; but I suppose there would be no difficulty in getting it tested.

*Chairman*—continued.

1743. Are all the operations connected with the manufacture of percussion caps dangerous to the public and to the workpeople?—No, not all of them.

1744. Are the operations of varnishing and foiling the caps attended with danger?—No, certainly not.

1745. Are you of opinion that the distance of 50 yards from dwelling-houses laid down in the Act of Parliament is a distance at which such operations may not be carried on is excessive and unnecessary?—Yes, I think it is much greater than is at all necessary.

1746. If those distances were enforced in your case, would it be attended with serious inconvenience

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inconvenience to your business?—Yes; when Major Majendie first inspected our premises he found that we were working on a system wholly different from that which the Act contemplated, inasmuch as we used the fulminating powder wet, whereas the Act was framed with regard to using it dry; Major Majendie said, when he first entered our works, “you are clearly breaking the Act of Parliament, and I cannot allow it;” I said, “are you prepared to take the responsibility of stopping our present system,” and he said he did not know that he was, and after writing to the Home Office we were allowed to proceed as we were then doing; our system involves the use of powder in much larger quantities in one building than the Act of Parliament allowed of, and we could not carry on our business to the extent that we were then doing it in the manner ordered by the Act without enormous alterations, and likewise we should consider it a very great increase of the danger; we have carried on this business now for 33 years, employing yearly a very large number of people using a very large quantity of fulminating mercury and other powder, and we never had an accident during that time which has caused loss of life, or injury to the persons employed.

1747. May I take it that while some operations in the manufacture of caps are attended with a certain amount of danger, others are of an entirely harmless character?—They are entirely of a harmless character.

1748. But with regard to the distance of factories from dwelling houses; I believe that no distinction is drawn in the Act of Parliament?—No, it is not.

1749. Now with regard to the mixing of the detonating composition, and the placing of it in the percussion caps; I suppose those operations are attended with a certain amount of danger?—The danger is certainly not very large, inasmuch as our experience is that for 30 odd years we have not injured any one; still there is danger, and it is necessary that restrictions should be placed with respect to distances; but an explosion from the percussion powder is so local, that great distances are very unnecessary; if you were to explode in this room as much percussion powder as would destroy everything within its reach, the chances are that it would not crack the wall; it might break the window, it would destroy the floor and the table if you were to explode three or four pounds of fulminating powder on the table, but it is a great chance if it would destroy the ceiling, and it would not crack the walls.

1750. Are the provisions of the Act of Parliament, in your opinion, suitable with regard to those operations?—No.

1751. Do you consider that if you were required to conform to the Act, the danger would be increased or diminished?—It would be very much increased in our case.

1752. How would it be very much increased?—We should be obliged to resort to charging the caps dry, and our system is that we do it wet, containing perhaps 20 per cent. of moisture in the powder, and the consequence is that the fulminate of mercury is never in a state in which it is likely to explode; we keep it always with 20 per cent. of water, and in that way it is perfectly harmless; you could not explode it if you tried, so that using it in that way you might really

Chairman—continued.

carry on such operations as we do almost anywhere.

1753. You consider that on the whole the provisions of the Act of Parliament with reference to the manufacture of percussion caps are unsatisfactory?—Yes; I think they are.

1754. Are manufactured percussion caps capable of being exploded *en masse*?—No, they are not; they burn separately, one slowly lighting the other.

1755. Then I presume that you would not propose that any restriction should be placed on the storage of manufactured percussion caps?—No; I would not.

1756. In the case of the very large caps called detonators, which are used in firing dynamite and gun cotton, is there not some risk of explosion *en masse*?—Yes, if you get large quantities of percussion powder together, there would be greater danger; the small quantity of powder in percussion caps, each being isolated, makes it harmless, but in a large quantity there would be danger.

1757. But with regard to detonators, I presume it would be necessary to regulate the storage?—Yes; I think so.

1758. Have you any experience of the manufacture of fulminating mercury for the charging of caps?—Yes, we have manufactured our own.

1759. Do you consider that the distance of 100 yards from a dwelling house for that manufacture is a satisfactory one, or do you believe that where it is conducted on a small scale the distance may, in some cases, be excessive?—I think it is unnecessary under any circumstances; it is not at all necessary that it should ever be in a dry state, you may dry it, but in manufacturing it, it is wet; it may be kept wet and exported anywhere wet, so that it is a very unnecessary thing to have such a distance as that. So far as safety goes, 20 or 50 yards would be more than ample.

1760. Is it not desirable that in all cases of this kind the distances should bear some regard to the quantities and to local circumstances?—Yes, certainly.

1761. I believe that the Act of Parliament is drawn without any reference to the quantities stored, and the local circumstances?—Yes, it is.

1762. You would make, I presume, the same objections to the statutory limits assigned with regard to the manufacture of ammunition and caps, would you not?—Yes.

1763. With regard to ammunition, will you be kind enough to tell the Committee whether the ordinary breech-loading sporting cartridges, and the metallic military cartridges are liable to explode *en masse*?—No, they are not; no cartridge where the case after being discharged is extracted whole from the gun is liable to explode *en masse*; we must make a very wide distinction there from other cartridges; wherever the discharge destroys the case they would explode *en masse*, but where it is taken out whole, I know of no instance of that occurring.

1764. Have any experiments been made on this point within your knowledge?—Yes; many cartridges, by way of experiment, have frequently been put into boxes and screwed down, and two or three have been exploded among the others, but always without lighting any of the others. There have also been numerous instances of these cartridges being ignited by accident, and always with the same result.

1765. Do you speak of all breechloading cartridges



Chairman—continued.

tridges as equally safe, or are there cartridges, such as the Chassepôt or skin or paper cartridges, liable to explode *en masse* if one is exploded?—Yes; they are liable to explode *en masse*, and they should be treated differently to the others.

1766. Then you approve of the distinction which has been suggested by Major Majendie to be drawn between safety and non-safety cartridges?—I do.

1767. I presume also that in your opinion the restriction in the present Act of Parliament to 50 lbs. of powder in any workshop, whether in or out of cartridges, is, in the case of cartridges of the safety class, unnecessary?—Just so.

1768. If enforced, would that restriction be attended in your case with inconvenience; for example, in those workshops in which cartridges of the safety class are finished and packed?—Yes; in our case it would be attended with very much inconvenience.

1769. I suppose you know the suggestions which have been put before the Committee by Major Majendie?—Yes.

1770. Have you any observations to make to the Committee with reference to those suggestions in connection with their bearing on your trade?—It is, of course, necessary that there should be a larger amount of inspection, and that a great many alterations should be made, but there are several suggestions which I do not think are altogether necessary, and some of them are rather objectionable. I think, amongst others, that the proposed power of the inspector should not be so very great as it is proposed to be. Now, there is one clause in particular to which I wish to direct the attention of the Committee with reference to inspectors stopping works in progress. There might be instances in which the inspector was not so much acquainted with the work as the manufacturer, and to stop the works in progress when probably heavy contracts were pending might be very disastrous. There is one thing with respect to licensing as to which I should like to speak a word or two. I refer to Section No. 17. I consider that licenses should be granted by people not locally interested. We had a case in point with reference to a magazine which we wished to erect at Birmingham. We had stores at Birmingham, and we had been in the habit of keeping loaded cartridges in those stores. As we considered that objectionable, and as it affected our insurance, we bought, two or three miles out of the town, eight acres of land, on which we wished to erect a small magazine for those cartridges. It was necessary to obtain a license from the local magistrates, and they refused a license, and compelled us to take the cartridges, which we had then removed to a small building on the land, back again into the town of Birmingham, and that land remains now unoccupied. It cost us about 3,000*l.* five or six years ago, and the cartridges which should have been there are removed within the town.

1771. Have you any other observations to make with reference to this Summary of Major Magendie's?—I have mentioned, I think, the inspector having the power to stop any work in progress; now, an inspector might object to a trifling thing, such as a thing as using machines made of iron or steel, instead of brass, in workshops, where, probably, such operations as bulleting the cartridge were carried on, and a brass tool would be just as likely to do harm as any other; if he objected to the use of a tool

Chairman—continued.

which was really as safe in use as the one the inspector might wish to substitute for it, it might be extremely inconvenient to stop the works whilst alterations of that kind were being made; I think those alterations should not be made in that way without reference to some third party who should decide whether or not they should be made.

1772. In Section 38 of Major Majendie's Summary is there not a reference to arbitration proposed?—Yes; but the suggestion says that the inspector should have power to order the works to be stopped immediately. I think that should be only so, in case there was anything so dangerous that he might always apply to a magistrate to order it to be stopped.

1773. The expression in the 37th suggestion is "unnecessarily dangerous and defective," is it not?—Yes; but I think that the words "contrary to the usages of the trade" should be added; and I think that Suggestion 39 should be omitted.

1774. You admit, do you not, that there may be certain processes which may be unnecessarily dangerous, which the inspector would be called upon to stop forthwith?—It gives him powers to say, "I object to this, and I will have it stopped." We may not always have to deal with so experienced and judicious an inspector as Major Majendie, and of course any person who is vested with a power of that kind might use it in an arbitrary way without really having sufficient experience to warrant him in doing it. We have had contracts where very heavy penalties were to be imposed upon us for non-compliance with the terms of the contract, with reference to time, and any interruption of that kind might be very inconvenient, and cause very great loss.

1775. What is the next point on which you wish to make any observation to the Committee?—I was going to say that I think the whole of these suggestions press more heavily on large works, than on small ones; most of the work that is now being legislated for, might be carried on almost as well in a lodging in London as in works of the magnitude of our works. There are very few of those operations which a small room would not enable a person to do, suppose he chose to run the risk; and if the restrictions of the Act were such as to make it inconvenient and expensive for people to erect large suitable works they would avoid doing so. Our Edmonton works are very expensive; they may have cost us 33,000*l.* and yet there are very few operations which could not be carried on in a London house; these works are an unremunerative part of the business, and a tax on the other portions of it.

Colonel North.

1776. With regard to cartridges; you said that some of your operations were not at all dangerous, did you not?—Yes; there are cartridges which are used now for breech loaders, which are generally made so that the case is taken out from the gun afterwards; nearly the whole of those cartridges are invariably safe; if the case is sufficiently strong to prevent the gunpowder tearing it to pieces in the gun, it is strong enough to prevent another cartridge exploding by the side of it, from breaking it up.

1777. You refer to cartridges when used, and not when stored I suppose?—What I say is, that a cartridge when the case is not destroyed in use,

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Colonel North—continued.

is likewise a cartridge that may be stored with safety; a cartridge where the case will not tear to pieces in the gun is perfectly safe in store.

1778. Have you separate places for keeping the safe and the unsafe cartridges?—Yes; cartridges that will ignite one another, and which we consider unsafe, are stored in different magazines.

1779. You have mentioned with regard to caps that they would not ignite each other; but are not the caps for gun-cotton or dynamite of a dangerous kind?—Yes.

1780. You keep those separate, do you?—Yes, but they are things which we have very little to do with.

1781. Do you know on what grounds the magistrates refused a license to your building at Birmingham?—Simply on the ground (as I think there was not a house within 300 yards of the place) that they did not choose to have it there. There was a worse case than that with regard to some works that Schultz's Gunpowder Company wished to make on Woking Common. One of the directors told me that after a great deal of trouble in making the application it was ultimately refused, and they were forced to remove their works 40 or 50 miles further down into the forest. I do not believe that there was a house within miles of the place where they wanted to build. But our own case was one where really the danger was very greatly increased by the action of the magistrates, for what we proposed to put on that land was almost harmless in Birmingham itself, but on that spot of land it was quite harmless.

1782. Clause 38 of the Summary of Suggestions gives you a power of appeal to the Secretary of State if any inspector issues an order that you think unfair or unnecessary, does it not?—Yes; but I think the Home Secretary would almost necessarily refer to the inspector again. I certainly think there should be some other authority to appeal to before any arbitrary stoppage of the work was made. The effect would be to make the works difficult to carry on, and to drive it into holes and corners where the inspector would never enter until after an accident had occurred.

1783. What sort of authority would you suggest as between the Inspector and the Home Secretary?—I think it would be almost better that before any stoppage of that kind should occur, the manufacturer should have the power of appealing to a magistrate where you could state your case. I do not suppose for a moment that Major Majendie would ask for anything unreasonable, but there may be other inspectors that would.

1784. Do you not think that there would be very few magistrates who would undertake to give an opinion against the inspector?—I do; but I also fear that an inspector might in a capricious manner object to something in which there was really no danger. I believe there are very many who would object to what Major Majendie approved with regard to our caps. He said, "You are clearly breaking the law;" but he was sensible enough to see that what we were doing was positively an advantage to the public as well as ourselves, and he allowed it, or got it to be allowed.

Mr. Vivian.

1785. You manufacture loaded cartridges as well as the cases?—Yes, we do.

1786. Do you keep any large quantity of loaded cartridges in store?—No, not in very large

Mr. Vivian—continued.

quantities; they are kept in a very limited way; the business is done principally in a small way; sporting cartridges, are loaded at hundreds of places in the kingdom, and therefore the quantity in any given place is not large.

1787. You have different magazines for the two classes of cartridges?—Yes.

1788. Now take the needle-gun cartridge, do you consider that a safe or an unsafe cartridge?—It is not a safe cartridge, and it is not very unsafe. I should say that needle-gun cartridges with the exception of the Chasepôt, are very little used, but I think the needle-gun cartridges ordinarily in use might be considered between the two qualities. I do not think that they will very readily explode one another, but still they might; we should consider them rather as dangerous cartridges, and put them where the dangerous cartridges were kept, or those that were supposed to be unsafe.

1789. You said that you kept all your fulminating mercury in a damp condition?—Invariably.

1790. In that condition you consider it perfectly safe and inexplosive, do you not?—Yes, perfectly so.

1791. Would you make it compulsory by Act of Parliament on manufacturers like yourself to keep fulminating mercury in that condition?—Yes, I would, except in very limited quantities indeed; it is not very fair for me perhaps to decide for others using a system which we do not adopt, but I do not think it is at all requisite to keep large quantities in a dry state. I think what is required might be dried daily, or about the quantity used daily.

1792. You think from your experience that there would be no injury to the manufacturer in compelling him to keep the fulminating mercury wet?—Certainly not, if it were in large quantities.

1793. With regard to the site at Woking which you have referred to, I suppose the refusal was after the ground had been purchased or arranged for?—Yes, they had made arrangements with the owners, but I do not know whether the purchase was complete or not.

1794. Did the licensing authorities refuse the license upon a petition from the neighbouring owners?—Yes, on a petition from the neighbouring owners.

Mr. Whitwell.

1795. Your trade is principally manufacturing cartridges, is it not?—Yes.

1796. You make a very large number, I believe; in fact, such a number, that it would be impossible to enumerate them?—Many millions yearly.

1797. You export a large quantity, do you not?—Yes.

1798. Do you know anything with reference to the law for regulating the transport of cartridges in other countries?—They are very various, and in some places rather stringent.

1799. Are any restrictions imposed upon you when you send your cartridges abroad, in the form of packing them, before they can pass into other countries?—As a rule the cartridges that are sent to other countries are obliged to be in cases, with, generally speaking, copper nails, but I think there is very little other restriction.

1800. I suppose that they pass as cartridges, and not as anything else?—They pass as cartridges.

1801. That

Mr. Whitwell—continued.

1801. That is to say, the waybill would show that?—Yes.

1802. And is the quantity of gunpowder specified?—The quantity of gunpowder is not specified. We may send them almost anywhere; that is to say, ordinary sporting cartridges, by simply stating what they are; they take them in the docks, and consider them harmless merchandise.

1803. Then what is the method with regard to military cartridges?—Military cartridges are generally sent in large quantities, and in vessels specially chartered for that purpose.

1804. You do not know much about them beyond the export from this country; you do not regulate their carriage after they are imported into a foreign country?—No.

1805. You manufacture Boxer's cartridges, do you not?—Yes.

1806. What is the area of your works at Edmonton?—Our Edmonton works are placed on about 130 acres; but do not occupy the whole of the land.

1807. You have stated that you had to break the law at your works?—Yes.

1808. You are allowed to break it, are you?—We are.

1809. You are not in favour of more restrictions, I suppose, than those you have pointed out?—I think that restrictions are very necessary, and most of the restrictions now imposed, are, in my opinion, good. I think, however, that the power of the inspector should certainly not be greater than it is now; I believe that his power is great enough at present. I believe that there are very few people who would refuse to listen to the suggestions of the inspector, backed as they would probably be by his opposition to getting a license, or anything of that kind.

1810. But the fact that the law has to be broken, and is allowed to be broken, shows that it is necessary that there should be fresh legislation, does it not?—Yes, certainly.

1811. The fact that the law is broken, and is allowed to be broken, shows that the restrictions on the manufacturers must not be more than the manufacturers can bear?—Just so.

1812. Otherwise the law is, so to speak, legally broken, is it not?—Yes; I would suggest that each manufacturer should be allowed to frame his own rules, and that there should be general rules which should apply to all, but that every owner of each separate works should make rules suitable to the character of his works, and those rules should be approved of by the inspector and should form the basis of any complaint. It is very difficult to lay down a hard and fast rule for anything of so various a nature as our manufacture; Government cartridges perhaps consist of two kinds, ours consist of 50 kinds, and it would be exceedingly difficult to make the rules applicable to all the different manufactures, such rules should never come in the way of a manufacture in which there are so many varieties.

1813. But is it not dangerous to make too many of those optative rules, by which a man might be prosecuted, but each of which is not sufficiently defined in the Act of Parliament?—Yes; I should say make them very broad indeed, and let the broad rules which govern the manufacture be as uniform as possible.

1814. But is it not generally consistent with the law of England that an Act of Parliament should define those rules under which a man is

Mr. Whitwell—continued.

to be penally adjudicated upon?—Yes; all I must ask is that the rules should not be very stringent, except in a few particulars which should clearly apply to all, because in that case they become impossible. The last Act of Parliament had four or five clauses in it which the manufacturers were obliged to break; it would have been impossible to have worked under them.

1815. Is it not necessary, do you think, that the Act of Parliament should define the regulations, as a protection to the inspector?—Yes, certainly.

1816. And also as a protection to the manufacturer?—Yes, certainly. I might mention, with regard to what I stated just now about the last Act of Parliament, the definition of the distances of buildings from other houses or highways at which the works should be placed, that I think that might be made definite, so that anybody acquiring land for the purpose of a manufactory should know beforehand that he can build his works, and carry on his manufactory before he does acquire it; take our own case at Birmingham, we of course did not know before we bought the land that we could not use it; there should be a fixed distance. Supposing the ground to be free from buildings of various kinds, anyone before acquiring the land should know certainly that he could use it; the distance might be made less under certain conditions, but certainly not more. The distances should be defined upon a supposition that the land is flat.

1816.\* Is it not necessary for the inspector, who is in some sense in, or who might be placed in, the position of a public prosecutor, to have his powers defined by Act of Parliament?—Yes, I think so; but I think that his powers should not be so great as to take away the responsibility of the manufacturer.

1817. You have stated that you were in the habit of using fulminating mercury in the manufacture of fulminating powder?—Yes.

1818. Do you mix it?—Yes, we manufacture it from first to last.

1819. What quantity of this dangerous explosive powder have you on your works in one day?—We pass through our works hundredweights and hundredweights in the course of the year, but it is always dried in very limited quantities.

1820. You spoke of preparing it mixed with 20 per cent. of water; what is your process for drying it, and how do you protect yourself from danger?—It is never used pure, the 20 per cent. of moisture is conveyed to the other powder with the fulminate; the fulminating powder contains perhaps 30 per cent. of water, and the other compounds, which are harmless until mixed, are dry; by mixing the two together the fulminating powder damps the other.

1821. No process of drying is adopted then?—No.

1822. It is simply by an admixture, is it?—Yes.

1823. What quantity of explosive powder is there in one detonator?—A very small quantity indeed; a grain or two.

1824. You have stated generally, that cartridges could be classified into safety and non-safety kinds, have you not?—Yes.

1825. That is to say, cartridges that would explode without destroying the cases you call safety cartridges, and the others unsafe?—Yes.

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1826. I suppose

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Mr. Whitwell—continued.

1826. I suppose that you would admit a further classification?—I think you might say those two.

1827. There would be no occasion in legislating to deal with any but those two classes, you think?—Just so.

1828. Now, with regard to your stores in Birmingham, you say you were driven back to the present stores which you have in Birmingham?—Yes.

1829. Are they licensed stores?—Yes.

1830. Licensed by the corporation?—Yes.

1831. Are you restricted to any limited quantity?—Yes, they are limited, but I merely know that we have licenses for holding cartridges there; I can hardly say the quantity.

1832. Are not the city authorities, or the borough authorities, the invariable parties for granting such local licenses?—Yes. But the magazine that I spoke of, which we wished to erect, was outside the town of Birmingham.

1833. But was it within the limit of the corporation?—I hardly know whether the town of Birmingham had anything to do with it.

1834. Perhaps it was the county magistrates who refused the license?—Yes, it was the county magistrates.

1835. They drove you back into the town, you say?—They drove us back into the town.

1836. You have had no inconvenience from your present magazine in Birmingham?—No other inconvenience than the inconvenience to the town. If a fire were to take place in the town, so many more cartridges would be burnt in the town.

1837. If there was a fire, or a large explosion, then the cartridges would explode, I suppose?—No, not *en masse*; there would be a certain amount of gunpowder burnt, but it would be burnt in detail.

1838. With regard to the suspensory powers which you say the inspector now proposes to have, you only wish that those suspensory powers, for the use of any machine, should not be put in force until an arbitrator had settled the case?—Yes, just so.

Mr. Stevenson.

1839. Are you content with arbitration as a mode of settling any question as to the reasonableness of the inspector's requisition?—I should be perfectly satisfied with that; with two sensible arbitrators and an umpire, and the inspector on one side, and the manufacturer on the other side, we should be quite sure of obtaining what was necessary.

Mr. Whitelaw.

1840. If I rightly understand your evidence, you desire that the general rule should be defined in the Statute?—Yes.

1841. Do you object to the power proposed in No. 32 of the Suggestions, that general rules may be altered by an Order in Council?—I should agree to that.

Mr. Knowles.

1842. Do you consider that the ordinary sporting cartridge is as safe as the central fire?—Yes, I think it is.

1843. With regard to the rules, would it meet your views provided that there were general rules laid down, in conformity with the Act of Parliament (if one is passed), for the manufacture and storage, and for the erection of maga-

Mr. Knowles—continued.

zines in a general way, and then special rules in detail for the guidance of the workmen?—I think those rules would need to be very carefully framed; it is exceedingly difficult to make rules that could be fairly made compulsory where the manufactures are very various. I think, broadly speaking, you might make rules, but they ought not to be very restrictive, if they are to be attended to.

1844. But your general rules must be in conformity with the Act of Parliament, as it is in the Mines Regulation Act, subject to the approval of the Secretary of State; is not that so?—Yes; but I think most manufacturers would be able to make rules for themselves that were specially suited to their works, and those rules might be made with the consent of the inspector, who would see that the works, and the place in which the manufacture was carried on, were suitable to each other.

1845. Do you think that the trade would be satisfied to leave the framing of the rules between the manufacturer and the inspector?—I think there should be general rules, but I do not think that it would do to make the rules too restrictive where the manufactures are very varied. There should be general rules with respect to distances, limits and quantity, which would, generally speaking, cover everything.

Chairman.

1846. There is one more question which I wish to ask you, with reference to a reply which you gave before; will you kindly look at Major Majendie's Summary of Suggestions, sections 40, 41, and 42; would not the danger which you apprehend from the increased restriction on large makers forcing the trade to be carried on in dwelling-houses be met by Suggestion No. 40, which provides for increased facilities for local inspection?—I think where a constable should be allowed to search, should only apply to what you might call unlawful storage for unlawful purposes. I do not think that a search should be allowed in anything like a manufacturer's works, such as ours.

1847. But you stated, as I understood you, that you feared if the inspection were of too strict a character on large works, that the manufacture might be carried on surreptitiously in private dwelling-houses?—Yes.

1848. Then I ask you whether the suggestions contained in Clauses 40, 41, and 42 would not obviate that risk to the public?—That is to say, provided it was known, but nothing is more easy than for a man to load half the cartridges used in London in a private dwelling-house; he might take in the powder in limited quantities, and even do it legally, because the present Act makes it very easy to be done, whereas there are a great many very stringent rules with regard to large manufactories.

1848.\* Have you any further suggestions to make?—I think that in the 45th suggestion the words "with injury" should be inserted after the word "accidents." Accidents with injury should be reported, but it would be useless and vexatious to report every trifling accident unaccompanied by injury, and the question must arise, what constitutes an accident or explosion? In a manufactory such as ours they occur almost daily, but are altogether unimportant, and the effect of having to report them officially would be very mischievous, as the workpeople to save themselves

Chairman—continued.

selves from possible blame would frequently conceal the occurrence, and thereby prevent remedies being supplied which might ultimately prevent a serious accident.

Mr. JOHN DOWNIE, recalled; and further Examined.

Chairman.

1850. YOU were explaining when the Committee adjourned on Tuesday the process of the manufacture of dynamite, at the works of which you are the manager?—Yes.

• 1851. Will you resume the process from the point at which you left off on Tuesday?—Possibly it may be necessary at this stage to give some little description of what Kieselguhr is; it is a sort of fossiliferous earth; it is nearly pure silica, and it is found in deposits in Germany and various parts of the world; it is a very singular deposit.

1852. In describing the remaining details of the manufacture of dynamite, will you inform the Committee whether you have any means of ascertaining the quantity of nitro-glycerine, which a given portion of prepared Kieselguhr will take up and retain absorbed without exuding?—The Kieselguhr on being received by us goes through a process of calcining, so as to drive off all organic matter; it then goes through a process of grinding and sieving, so as to get nothing but the perfect absorbent; the exact method of meting out the atomic quantities in the licensed proportions is what I will now describe. In front of this filter vessel there is a weighing machine on which a receptacle for the Kieselguhr is placed; the quantity is carefully weighed off, and a tap connected with the filter being opened, a quantity of the nitro-glycerine is allowed to flow into the quantity of Kieselguhr in the trough.

1853. You used the words “licensed proportion;” is there any regulation by law of the quantity?—Yes; our license says that No. 1 dynamite shall not contain more than 75 per cent. of nitro-glycerine with 25 per cent. of fossiliferous earth or Kieselguhr. So soon as the proper quantity has flowed in from the filter, the weights on the scale being adjusted to get the precise quantity, a man stands by with a jug in his hand and turns the tap and puts it under the nose of the tap, so that not a drop more is allowed to flow into it. The balance that may be left over in the jug is put back into the filter, so that you have the precise licensed quantity. The next process is the mixing of this with the Kieselguhr; it undergoes in that house a rough mixing, and is then transferred to the mixing houses proper, where it undergoes a most thorough mixing, passing through a number of sieves, five or six sieves, until it has become thoroughly absorbed, and is thoroughly distributed through the whole mass. By the time it has got into this safety vehicle it is no longer under the eye of the chemist, but under the eye of the overlooker. Those overlookers are most careful men. We are bound by the license to see that the overlookers shall be to the satisfaction of the Government inspector. Condition G of the 7th clause of our manufacturing license says that proper and sufficient overlookers, according to the judgment of the Government inspector, are to be provided

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Chairman—continued.

1849. Under the present Act there is no appeal, is there?—No; I think that the proposed Act has many very excellent points in it, and the power of appealing is one of them.

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throughout the works and magazines, and in following out that order we have taken what we consider the best possible means of getting first-rate men, by employing good service men from the navy and the army, men recommended by Captain Preedy, of the “Excellent,” General Schomberg, Colonel Williams, Colonel Barnard, and many other men whom we all know. Those men being accustomed to exactitude and discipline have been found most efficient in taking charge of those various departments, and I think I am warranted in saying that they have given satisfaction to the Government inspector, whose judgment is called into action here. The question was asked how we ascertained the precise quantity of nitro-glycerine which any given sample of prepared Kieselguhr would take up and retain. Now that is ascertained in a very simple manner. A little cylinder of Kieselguhr an inch in length by an inch in diameter, is subjected to a certain amount of pressure. That pressure indicates whether any exudation takes place, whether the Kieselguhr has been super-saturated, or whether it is under-saturated; it is exceedingly simple, and it has been found very efficient in every case in every charge that is applied, so that if there is an appearance of exudation at all, a little more dry Kieselguhr is added to the charge so as to bring it within the limit of exudation; the pressures vary according to the kind of Kieselguhr; some Kieselguhr may absorb a little more, and others a little less.

1854. What is the kind of packing which you use with dynamite, and in the event of nitro-glycerine exuding, do you take any means to prevent its coming to the outside of the packing cases, and have you any proof to offer that if exudation existed, it has not been dangerous?—I have one of the packing cases with me (*producing a packing case*); this is one of the ordinary packing cases; there is no iron permitted about it; it is fastened with brass screws, and fully declared by the branding on the top, preparation of nitro-glycerine—explosive “dynamite;” explosive, with the name of the maker upon it; this gives an indication of the precautions which are taken to prevent any leakage at all.

1855. Is that case filled with dynamite now?—No; only with some clothing; this package is positively water-tight before it is sealed at all; after it has been packed thoroughly, and everything in order, this is sealed with a kind of marine glue, so that the package is water-tight inside the casing; you might immerse this for weeks, and no amount of damp would get inside; the paper wrapper is oiled paper; just to utilise the box I brought with me some of the uninflam- mable dresses; here is a woman’s uninflam- mable dress; there are uninflam- mable pocketless suits for the workmen; here are magazine shoes and a magazine lamp, which cannot be blown into (*producing the articles*). This represents one of the ordinary packages, and shows a 5lb. package

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of dynamite; the first thing that presents itself to the user is a caution by the Government, and the instructions on the face of it, so that any man taking up a package of the material is at once cautioned as to what he has in his hands.

1856. What is the box made of; is it wood?—Yes; I will open the box and show it to the Committee; the next thing is the instructions for using, which is placed in the lid of each package, and with every ton of dynamite sent out; we send out 400 of such instructions; this box holds 10 packages of 5 lbs., making 50 lbs.; the instructions and the cautions are printed in three languages, namely, English, Gaelic, and Welsh; the moment the man opens a box he finds the instructions for blasting accompanying each package; another precaution is used; here is the parchment paper which is used for cartridges; it is vegetable parchment, and it is water-tight; those small ones are the primers; those are the cartridges proper (*the Witness produced the same.*) Every box is declared and ticketed, and those tickets are put on with copper tacks; we do not even use iron tacks for them; that is a water-tight box up to this point because it is seamless, and we hermetically seal it besides that with liquid marine glue, so that it forms a perfect protection from any liquid passing through the box; that has been found very effective; that is the usual kind of package for dynamite; every box is fully declared as indicated by the brand; for heavy charges it is sometimes made up in india-rubber lined bags, so that in cases where we conceive that exudation is possible to take place, there is an impossibility of its escaping; this is a little Kieselguhr which I have in a bag (*producing it*), that has been calcined and is ready for use; examined under a microscope with a power of 600 diameters, it is found to be a fossiliferous earth full of foraminifera diatomacea, and other species; it stands a considerable amount of pressure, and soaks in the nitro-glycerine by capillary attraction, and then retains it, simply separating the particles in the same manner as Gale's ground glass separates the gunpowder and prevents the spread of an explosion, except by detonation; it is so inert that when set fire to in very considerable quantities it will only flare away; with regard to exudation not being dangerous, from what I have explained of the packing box and the care taken to prevent any moisture getting out or into the box, I think we have fairly met all the requirements of that question; moist or damp cartridges which might be looked upon in this country as exuding cartridges are regularly and systematically made in Sweden, Norway, and Germany, and generally the miners prefer them, and yet they have no accident whatever from exudation; this is a striking fact, but it is a fact.

1857. But now with regard to the acid re-action said to be found in some samples of dynamite, can you prove the stability of dynamite over a lengthened period?—I should wish to say that "the very feebly acid re-action" referred to has been traced to the Kieselguhr itself, I believe, the coals with which some of it was calcined having been rather sulphury at the time, and the water used for washing the nitro-glycerine holding also certain salts which our chief chemist can more minutely describe to the gentlemen on the Committee; I have no doubt that you will see that all those salts are inert mineral salts not readily decomposed, having no chemical action whatever on nitro-glycerine, in fact they may be put into

Chairman—continued.

it in almost any proportion, not only without danger, but with the effect of making it more inert and more difficult to explode than when pure. This our chief chemist says has been ascertained by actual practical tests. I say that for the purpose that when his examination comes round he may be asked on those points. Much of the foreign made dynamite contains free acid, and yet cases of spontaneous explosion are unknown with such dynamite, though it is used regularly in tropical countries, in fact it can be easily proved that the presence of most acids exerts no influence whatever on nitro-glycerine or dynamite, and that really hyponitric and nitrous acids are the only ones that should be guarded against. With regard to those particular acids, they are completely neutralised by the alkaline solution. At the factory in Ardeer many experiments have been made, both with nitro-glycerine and dynamite, the details of which may be given if desired; but it may be enough to say, that the nitro-glycerine has there been kept for about four months in dilute mixed acids, and exposed to a varying temperature, without any signs of decomposition, and during that period it was over and over again frozen and thawed. We have had nitro-glycerine containing free acids heated to 150 Fahrenheit again and again, and without any sign of decomposition, much less of explosion. We have also kept ordinary No. 1 dynamite standing for many days at heats varying from 150 to 180 degrees Fahrenheit, and without the slightest appearance of decomposition in any case, and certainly without any explosion. I believe it is a fact, that Mr. Nobel has kept acid dynamite cartridges standing for years without spontaneous decomposition. But on that point Mr. Nobel may be examined, if the Committee wish it.

1858. What have you found to be the principal obstructions to the carriage or transport of dynamite, and what steps have been taken by your company to inform railways, and other carriers, about dynamite?—In the incipient stage of any new manufacture, slight irregularity will occur. We thank Major Majendie and Major Ford much for exercising a surveillance, and pointing those irregularities out the moment that they came under their observation, but I have to call the attention of the Committee to the fact, that there has been no proved danger; we have simply theoretical fears. But considerations of this nature have induced Mr. Nobel himself to exercise the greatest possible care in the purification of the nitro-glycerine, so as to ensure the stability of the product, and the proof of his success rests on what I believe to be indisputable, namely, that up to this moment there has never been any explosion whatever, either in the transport or storage of Mr. Nobel's dynamite, although about 10,000 tons of it have been carried immense distances, since its introduction, by road, rail, and sea, and subjected to rough usage of every kind, and climatic influence in all parts of the world. I do not now speak of or include the more complex forms of dynamite, or the nitro-glycerine compounds, to which Dr. Dupré made reference, as likely to be less stable than the dynamite of the British Dynamite Company. I speak of the 10,000 tons which has been made under Mr. Nobel's more immediate control. This dynamite has been subjected to tests that I think completely set at rest any fear with regard

*Chairman*—continued.

regard to concussion, or as to shaking in carts, or any extraordinary usage in the transport. The experiments that have been carried on in the presence of the Railways Goods Managers Committee were very satisfactory, and on this particular point I can speak more particularly with regard to the experiments carried on in the presence of the directors of the Glasgow and South Western Railway Company, when a series of the most crucial tests were made with reference to the ill-using of dynamite. I may mention one very severe test as being a kind of double test. A keg of gunpowder was buried in a sand hill, and on the face of that keg of gunpowder a thick plate of iron was placed, and on the face of that thick plate of iron a box like this, containing 50 lbs of dynamite, was placed. The powder was detonated, and then the box shot up into the air; it was smashed to pieces without any explosion. It is just possible that that experiment might not be enough to indicate a railway concussion, but it may a very severe kick. We have allowed weights of three or four cwt. of iron to fall 40 feet smash on to the box, scattering the contents about. I speak still of the experiments carried on before those directors. The experiments carried on before the War Office Committee were equally satisfactory, and I believe conclusive, with reference to the safety of dynamite in transport. One of the honourable gentlemen on the Committee, I think it was Colonel North, put a question as to whether we had not informed the railway companies as to the properties of our dynamite. The transport of dynamite, I believe, has been before the railway clearing house since October 1871; at that date it was brought before the quarterly conference of Railway Goods Managers, and they appointed a committee of investigation, the results of which, no doubt, will come in some way before this Committee.

1859. Have you any suggestions to make to the Committee with reference to the proposal for granting licenses, which is in Paper B, Section 8, which says, "No chemical explosives to be imported without a 'special' license, other explosives under 'common' license"?—We have found the licensing system for small quantities very troublesome, in fact such as that we cannot carry on the business under it at all; nearly everyone who desires to use dynamite prefers a trial at first, but they must get a license before they can even try it. That difficulty we have endeavoured to meet by producing for consumers this document (*producing a paper*); so that they can have full information about the storing, and about the licensing and everything connected with it. We give them the form of application for either a special or general license, information with reference to the storage, and everything necessary to guide them. It may be interesting to the Committee to know that only a limited number of licenses have been absolutely granted, many thousands of these papers having been circulated among the consumers ending in the parties refusing to take any license at all. Our business has been very much trammelled in consequence. I think Major Majendie has it in contemplation to give relief in that direction, but I am not clear on that point; if so, it would be a boon to our business, and I believe would act with good results. I am not at all in favour myself of a retail trade; our arrangements for agencies and such like have all been made with a view to

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*Chairman*—continued.

obviate such a result; we have established agencies and magazines in nearly all parts of the country; and our agents have power to put up as many magazines as may be found necessary for the wants of every district. From our present point of view all could be supplied from such magazines, provided sufficient facilities were given for the free distribution of the material. Those magazines that have been erected, I may add, have all been erected, so far as the regulations are concerned, in strict accordance with the Government requirements. All the rules pertaining to them have been approved by Major Majendie, so that we leave nothing undone to render the trade as far as possible safe and correct. I will put in some of the rules connected with the working of the factory; I mean rules for the working (*handing in the same, vide Appendix*).

*Colonel North.*

1860. Are you of opinion that there is no danger whatever in the storage of dynamite unless a percussion cap is attached to it, and that no concussion of any kind will cause any injury whatever?—Yes; all experience so far has proved that to our satisfaction.

1861. You think that it is perfectly safe, whether carried by a common carrier or anyone else?—Yes; large quantities have been carried by common carriers over large distances of country. Just now the dynamite used for the Settle and Carlisle direct line is carted away all the way from Carlisle to Settle; the London and North Western will not carry it, but the Glasgow and South Western carry it, and so do the North British carry it all over their system, and many other railways lately have taken to carry it; but when we come south we are prevented carrying it by many of the lines, who have determined not to carry it by passing a special resolution under the Railway Clauses Consolidation Act, which empowers them to decline anything that they consider unsafe; and that has been done while the Committee of investigation are yet sitting; meanwhile Dr. Odling has had no hesitation in saying that dynamite may be conveyed by railway without the necessity for greater precautions than are required in the case of gunpowder and indeed with less risk.

1862. Do you mean that all the railways except those you have mentioned carry any quantity of dynamite?—There are railways which will carry it in the licensed proportions; previously this seemed to us to be unlimited under certain conditions of separation of the powder vans, but Major Majendie has now given a new interpretation, and six tons are permitted to be carried in any one train if the vans are separated by other trucks between them with non-explosive materials on board.

1863. Some of the evidence before this Committee tends to show that people cannot get it at all in any quantity, is that so?—In some parts of the country it is so; but the Glasgow and South Western taps our factory, so to speak, and they carry it regularly.

1864. His Grace the Duke of Sutherland says that he is forced to get his friends to smuggle it in hat-boxes, did you hear that evidence?—He has hitherto been forced to do something of that kind I believe, but recently we sent a quantity to his Grace by the North British to Perth, leaving him to convey it to his mines; but the condition

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of carriage by the consignment notes, are almost prohibitory.

1865. Is the objection to carry dynamite mostly confined to England?—We carried down to Hexham by the North British system, and it has been carted from Hexham all over Yorkshire and different parts of Lancashire; we tap the canal systems of England and Wales by means of little steamers passing round the coast and supplying the outlying district magazines.

1866. But in all cases in which dynamite has gone by railway there has been no accident, has there?—None of any kind, in this country or any other country; that stands undisputed; there is no doubt that no explosion has ever occurred in the transport of dynamite.

Mr. Vivian.

1867. With regard to Kieselguhr, you spoke of some Kieselguhr having different absorbing powers to others?—Yes.

1868. Do you test it before you make your mixture?—Yes, generally we do, but we find the difference very little indeed; it may not be more than  $1\frac{1}{2}$  per cent. difference of absorbing power.

1869. What is the absorbing power of Kieselguhr?—You may take it that it is close upon 80 to 82 per cent., but we never take it at more than 75 per cent.

1870. Do you always keep it at 75 per cent.?—Yes, for this reason; we are licensed not to exceed that, and also the quantity meted off is measured to that quantity, and no more.

1871. From the system you describe, do you suppose it is possible for the dynamite to leave your works containing too much nitro-glycerine?—That never has been the case, and never can be, for one reason, among others, that the cartridge-making machines would themselves express or expel the superfluous nitro-glycerine, were it super-saturated, and besides, the appearance of the article would show that in the mixing vessels.

1872. I understood from what you said that the Kieselguhr was calcined?—Yes, it is calcined.

1873. In what sort of furnace is that process carried on?—It is a peculiar furnace with a series of reticulated passages; it passes in at the top and passes along them nine times before it reaches the fire at the bottom, and during its time of transit the whole of the flame and heat is acting on this Kieselguhr, and it is kept for nearly 32 hours on an average, at what you may call a cherry-red heat, driving off all organic matter.

1874. You have attributed adulteration of sulphuric acid to sulphur from the coal?—Yes.

1875. If the Kieselguhr was calcined in a closed furnace, or muffle, surely there would be no risk of that adulteration, would there?—I believe that it has been tried, but it is not efficacious; we have been recently trying to get fuel free of sulphur; we have now set inquiries on foot throughout the country to get a constant supply of it.

1876. Do you consider the presence of all free acid alike to be sources of danger?—Not if it is only a mere trace of sulphuric acid, but we would consider that hyponitric or nitrous acid would be a source of danger.

1877. You express great confidence that all trace of such acids is got rid of before the product leaves your works?—Yes, the effect of the alkaline solution is to neutralise them.

1878. Is it washed with an alkaline solution

Mr. Vivian—continued.

afterwards?—The last washing before it passes into the filter is with an alkaline solution.

1879. Is it sent away from your works perfectly neutral?—Yes, perfectly neutral; all our tests are directed to that end.

1880. After the alkaline washing it is again subjected to washing with water is it?—No, not afterwards.

1881. Should not it then give any alkaline re-action when it leaves your works?—I think not, but I am not competent to answer that question; that can be put to our chemist or Mr. Nobel himself.

1882. What is the weight of a box of dynamite?—50 lbs.; 10 5 lbs. packages in each case.

1883. How much powder would 50 lbs. of dynamite represent?—It depends very much on the application of it with reference to the work done; it would represent possibly from 350 lbs. to 400 lbs. weight of powder with regard to the actual work done.

1884. But that power could only be developed in case it was fired by a detonator?—Just so; otherwise it simply burns away.

1885. If fired with an ordinary match or with an ordinary fuze, or by, say in a railway accident, by a coal fire, there would be no power developed at all in your opinion?—None in my opinion.

1886. You would have no fear whatever, I suppose, in setting fire yourself to half a dozen 50 lbs. boxes loose?—None whatever; I have assisted in setting fire to so many before the War Office Committee, that I should have no hesitation in doing so. I have seen a box such as this with a gimlet hole in the end, a fuze inserted, and fired, and the dynamite burnt without exploding in the box; it simply spread the fire through the whole until it was all burnt out.

1887. You do not agree in the opinion that a large heap of loose dynamite, if set on fire, would generate such internal heat, as to cause an explosion?—It depends on the dimension of the large heap. I can conceive that a very large heap might do so under certain conditions, but the chances are that it would only flare away.

1888. Would you say that one ton of dynamite could be safely set fire to?—I have never known such a quantity burnt, and therefore I could not give an opinion.

1889. How much have you ever seen burnt at a time?—Nearly 500 lbs.

1890. Do you think it possible to guarantee the quality of the dynamite leaving your works so that it shall not exude in the transit?—Yes, perfectly.

1891. You would submit yourself to any Act of Parliament which would make that imperative, would you?—Yes, we are quite under such control now; we rather invite it.

1892. At what temperature does dynamite explode?—At about 420 degrees, it becomes very sensitive and liable to explode at that heat if it gets any knock. You may distil the nitro-glycerine over it altogether, and it is so done sometimes in the recovery of our waste acids, and it is done without explosion.

1893. There would be no danger in conveying it by railway, except it was subjected to a temperature above 400 degrees then?—I see no possible means of getting at that temperature in transporting it.

1894. You do not fear any explosions resulting from concussions, except at that temperature?—

I do



Mr. Vivian—continued.

I do not fear it even at that temperature, because you would then only scatter it about.

1895. Not even if it was 400 degrees?—It might possibly be under those conditions, but I think that the shock would not come on the dynamite direct; it would be relieved from the mass of the van.

1896. You said, I think, that Mr. Nobel had kept a quantity of it in dilute mixed acid for a long period?—Our chief chemist did it at the laboratory for four months.

1897. What acid was it?—Mixed acid, nitric acid and sulphuric acid.

1898. If it had been kept in nitric acid, what would have been the result?—If it had been kept in nitric acid without any mixing, the chemist says that the result would have been equally satisfactory.

1899. I suppose you heard what Major Beaumont told us about a truck which had conveyed dynamite, as he believed, a quantity of nitro-glycerine having been exuded on to the truck, the truck afterwards exploded, are you of opinion that even impure dynamite would exude such a quantity of nitro-glycerine as to make it possible for a truck to explode after the dynamite had been unloaded?—I think the answer to that question is that no dynamite was in the country at that time; it was pure nitro-glycerine that had leaked from the cases that had been conveyed on that truck.

1900. But was pure nitro-glycerine ever conveyed by railway in England, do you think?—Yes, unquestionably; it was used largely in the quarries in Wales at one time.

1901. That was not on a passenger railway?—No, not at all.

1902. Did you know of that accident?—I heard of it; I do not know much about it personally, but I could obtain all the information about it if the Committee would wish it.

1903. There was another accident spoken to as having taken place in a mine in Norway from the dropping of a can of dynamite, about three feet, what should you say to that?—I do not believe that it is at all possible; it is a mere imaginary thing. I believe that so far from a can dropping a yard and causing an explosion, you may drop a can of dynamite, or a packet of dynamite, as many as 300 feet without danger.

1904. I suppose that must depend on the quality of the dynamite?—Yes, in some degree; but I believe that in any condition it would stand a far greater shock than that.

1905. Of course if the dynamite used in Norway is made to exude on purpose, in order to be more powerful, it must be much more liable to explode?—We do not think so; there is no proof that it is more liable to explode; we have used such cartridges very severely indeed; we have put them on a piece of wood and thumped them with a sledge hammer, and they do not explode.

1906. But do you not think that dynamite made of 75 per cent. of nitro-glycerine, and 25 per cent. of Kieselguhr, must be much safer to handle than dynamite made of 85 per cent. of nitro-glycerine and 15 per cent. of Kieselguhr?—It could not possibly be so made; there is no Kieselguhr which would absorb as much as 85 per cent. to retain it.

1907. What do you suppose is the proportion of nitro-glycerine in the Norway dynamite?—I have no information on that point.

0.84.

Mr. Vivian—continued.

1908. Is it more than yours, do you think?—It may be; I cannot say.

1909. You stated, I think, that Mr. Nobel had sent over 10,000 tons of dynamite away to different parts?—No, I did not mean to convey that; I believe that the quantity made under Mr. Nobel's patent in the different factories now amounts to about 10,000 tons; I believe that the quantity can be set right from records, if desirable.

1910. There has never been an explosion with that dynamite you say?—No there never has been an explosion in transport or storage, but there have been accidents in mines through unwarrantable carelessness.

1911. But not in transport or storage?—No.

1912. What proportion of that 10,000 tons has been made in your works?—A very small proportion, we have only been in operation 12 months. I should say that of that proportion we have made within a little of 500 tons.

1913. Where has it been used chiefly?—Throughout this country generally, and a portion has been sent abroad to Canada, Peru, and elsewhere for mining purposes.

1914. And you have had no explosion whatever with it in transit?—None.

1915. Have you had any explosions in the consumption of dynamite?—No.

1916. The railway rates are excessive now, are they not?—Yes, a double fifth class rate seems to me to be out of all character, and it seems to me an illegal rate.

1917. What is it per ton per mile?—I have not got that without referring to our railway rates, I will add that to my evidence.

1918. Some of the railway companies you say will not carry it under any conditions?—No, the London and North Western, the Great Northern, the London and South Western, the North Eastern, and the Staffordshire lines, are the companies who have formally declined to carry it. The Caledonian Company subsequently declined to carry it; at first they did carry it, but latterly they have declined to do so.

1919. Have those companies been made aware of the experiments which have taken place with respect to the safety of dynamite?—Yes, certainly, because the experiments were made at the invitation and under the surveillance of the railway goods managers' committee, and reports of those experiments are placed on the records of the Clearing House. But I may refer particularly to the reports of Dr. Letheby and Dr. Bischoof, dated the 28th of January 1872, or about that date, which bear on the face of them that they consider, after the most crucial tests, that it is safer than gunpowder under all conditions of carriage.

1920. I suppose those companies which you named are not satisfied with those experiments?—It appears so, for their special resolution has not been rescinded or withdrawn.

Mr. Whitwell.

1921. I think you said, in reply to a question just asked you, that you are endeavouring to find a new combustible substance, instead of coal, for the purpose of drying the Kieselguhr?—We have been in correspondence with some of those peat fuel manufacturers, with a view to obtain a supply of it.

1922. You think it possible that some other fuel may be less likely to create danger, I suppose,

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Mr. *Stevenson*—continued.

acids, is it not?—This particular kind of explosion has been provided against in future; there is no such thing that can now happen, because the arrangements were altered to meet such contingencies, so that nothing should be left to the discretion of any workman in that matter.

Mr. *Whitelaw*.

1987. After repeated thawing and freezing, can you tell the Committee whether dynamite is more liable to exude?—We have not found it so, nor have the War Office committee; you will find at the end of the report, it appears that no bad effect from the repeated thawing of dynamite occurred over a series of experiments extending over 12 days.

1988. In your little book I see you say that a smart blow with a hammer on a thin layer of dynamite explodes the small portion so struck, whereas you stated just now that you might drop dynamite 300 feet, or hit it with a large sledge hammer, without its exploding?—Yes, I have done that; I have taken a large handful of loose dynamite and put it on an anvil, and thinned it away at the centre, and struck it with a hammer in the centre, and it has simply cracked off that portion immediately struck, but it has not communicated the explosion to the surrounding quantity.

1989. Do you state that you may strike the thicker portion with a hammer, and that it would not explode?—With a box like this you might take the lid off and hammer into it with a sledge hammer, and it would not explode.

1990. In the book you say again that dynamite is perfectly safe when the instructions are observed in the handling, transporting, and storing of it; evidently, then, the safety depends very much on the observation of the instructions?—It is very well that they should be observed.

1991. You mean that the safety is not perfect when the instructions are not perfectly observed?—We think it is, and they are not always regarded perfectly.

1992. I understand you to say that you rather invite inspection?—Yes, I do.

1993. You would like the inspector to come to your works and take samples?—Yes, we would be very pleased to give him every facility.

1994. That is to say, to examine the purity of the nitro-glycerine incorporated into the dynamite, and also to examine into the quantity put into the dynamite?—Yes, to inspect in every way.

1995. Have you seen the 36th suggestion of Major Majendie?—Yes; those powers Major Majendie and Major Ford possess already, so far as we are concerned; we rather invite inspection at all times.

Mr. *Knowles*.

1996. Have you found any indisposition on the part of workmen, such as miners or quarrymen, to the use of dynamite?—No, we find that it is the reverse.

1997. Not in consequence of its supposed explosive character?—It is quite the reverse; in every case where a miner or a quarryman has had his first trial of it, he becomes clamorous for larger supplies.

1998. If your instructions were totally disregarded by the workmen (and such people are not always pleased to read long instructions), would you consider dynamite quite as safe as

Mr. *Knowles*—continued.

gunpowder?—Very much more safe, because there have been no accidents at all scarcely, in the hands of the workmen, whereas there have been very many with gunpowder.

Sir *H. Selwin-Ibbetson*.

1999. Would you desire to see the restrictions on liquid nitro-glycerine removed, or only those restrictions which bear upon such applications of nitro-glycerine as well-made dynamite?—I have no desire to remove the restrictions on nitro-glycerine pure and simple; it is a very good restriction. We are bound not to permit any nitro-glycerine to get beyond our gates, nor do we.

2000. You do not consider that the development of the dynamite trade has been at all seriously prejudiced by the Nitro-glycerine Act, I suppose?—Yes, it has been very much prejudiced by the Act in consequence of the difficulties which we have found in getting it into use by the consumer.

2001. Will you be kind enough to state to the Committee what are the particular restrictions which you consider have tended to produce that result?—I think it is the necessity for a license for any quantity, no one being permitted to have such a thing in his possession without a license. Those restrictions bind us to ascertain that every-one has a license before we sell any dynamite. The first thing we do is to furnish them with some information about it, and also the means of informing themselves with reference to the storage and the licenses.

2002. Do you consider that the Nitro-glycerine Act has tended to prevent the railways from carrying dynamite?—Yes, undoubtedly, it has raised a feeling of dread in connection with it; nay, more, it has had this effect, that in obtaining sites for magazines I believe that it causes the greatest possible difficulty. A proprietor of land naturally enough comes to the conclusion that if it requires to be fenced round with these terrible precautions it must be very dreadful, and they cannot believe, nor can they bring their minds to bear on the fact that you can have such immense power along with such perfect safety.

2003. Are you aware if railways carry gun cotton, in respect of which there is no Act of Parliament?—Yes, several parties who have been inquiring for dynamite have been asking whether they can have it sent on like gun cotton at ordinary rates by ordinary trains.

2004. You are, I have no doubt, familiar with the forms of licenses at present issued, are you not?—Yes.

2005. Those forms of licenses are issued by the Home Secretary, are they not; I mean for nitro-glycerine preparations?—Yes.

2006. Now will you kindly state if there are any particular conditions in those licenses which you object to or consider unnecessary?—There are some of the conditions of the transport license which are rather unnecessary in our opinion. We think that condition A in the 17th clause, that such transportations shall not be made in a conveyance carrying public passengers, might with advantage be modified with respect to small quantities, trial lots.

2007. That is to say, you would propose that this material should be carried in omnibuses, or other such vehicles?—Yes, I think it might be if it were openly declared.

2008. How much would you propose that a person

Sir H. Selwin-Ibbetson—continued.

person should be allowed to carry in an omnibus?—It is very difficult to say how much a person might be allowed to carry in an omnibus, but I would very much like to have a 50 lb. box permitted to be carried.

2009. Now with respect to omnibuses; would you propose to allow any number of people to come in with 50 lbs. each?—It is very unlikely that that would take place.

2010. But how would you propose to protect the public against a number of people so coming in, each with 50 lbs. of dynamite under his arm?—I do not precisely see how that could be done.

2011. With regard to the manufacture of dynamite, I presume that you have no objection to its being carried on under license and under inspection?—Not the least; we rather invite it, as I have already stated.

2012. I gather that in your own case the very elaborate arrangements which you have described for securing safety throughout the factory have been established under the supervision of the Government inspector?—Yes, I think that was a very wise provision; but it is to be wished, in one sense, that the experience and opinion of those who have had greater experience in such manufacture than the inspector, might perhaps be allowed a larger scope; but it is wise in the preliminary stages of a new business that the greatest possible precaution should be taken.

2013. In fact, the inspection by the Government inspector has not been disadvantageous to the trade, has it?—Yes, it has been disadvantageous to the trade in one respect, that it has caused a larger expenditure of capital on the factory than otherwise would have been necessary; but we have got a much more perfect factory in consequence, I believe.

2014. Now, objection has been taken by some of the gunpowder makers to the inspector having a power, if he observes in a factory anything "unnecessarily dangerous or defective," and tending to endanger life or limb, to require the same to be remedied forthwith, and if the manufacturer objects, to refer the matter to arbitration; do you entertain the same objection?—No, not at all; I think he should instantly interfere, and that the inspector's power should be compulsory; I do not think that it is a question for arbitration.

2015. I think I understood you to say that you conceive the British Dynamite Company are now in a position to supply thoroughly pure and well-made dynamite?—Yes, they are.

2016. And such dynamite as would be wholly free from all liability to exndations?—Entirely free from all liability to exudations.

2017. I suppose you consider that the production and issue of impure or exuding dynamite could only be the result of gross carelessness on the part of the manufacturers?—I think with our arrangements it would be so.

2018. And you feel satisfied that such gross carelessness in your case is sufficiently guarded against by your system of supervision?—I think so.

2019. Are you able to state if any issues of impure or exuding dynamite have been made from your factory?—Those that I referred to must have come from our factory without our knowledge; it was only afterwards, when Major Ford came with one of those specimens, and called our attention to it, that we came to know

Sir H. Selwin-Ibbetson—continued.

it at all, and our directors took instant action on the suggestion of Major Ford, and we had a thorough investigation of every magazine.

2020. Can you explain how that dynamite got into existence?—No, I cannot explain it; it is a question for our chemist.

2021. Can you answer of your own knowledge that you think, under no circumstances, the issue of defective dynamite, such as that which was then discovered, would be likely to be repeated?—I think it will not be repeated, because one of the results of the surveillance exercised over us has been to increase our vigilance in that particular; it has had the most beneficial effect, and I have to thank Major Ford very much for the manner in which he brought it under my notice.

2022. There was, however, a case in which Major Ford discovered a certain issue of dynamite in which there was great exudation, was there not?—Not great exudation.

2023. Major Ford said that there was a stream of liquid nitro-glycerine flowing from the box, did he not?—Yes, we have repeated the same thing, and danced over it since.

2024. What date was that?—I do not know.

2025. Was it during the present year?—No, it was not this year.

2026. Might I call your attention to an examination which seems to have taken place in a depot belonging to your factory, in which as much as 760 lbs. of dynamite, in which exudation had taken place, was found on inspection as recently as the month of March of this year?—I think that refers to another point. The person in charge was sent to investigate the matter, and he felt the responsibility to be so great that he withdrew a large number of cartridges that Mr. Nobel said he should not have withdrawn, but in the exercise of his judgment, in which he was left solely to himself, in his over anxiety to keep everything straight, this happened.

2027. What was the person's name?—I think it was Serjeant Hammond.

2028. But I think the inspector was present on that occasion, was he not?—I do not know that that was the case, but Major Ford was present at part of it, I think.

2029. I am informed that this took place at or about the month of March, and that it was certified to as above, 760 lbs. of nitro-glycerine, all exhibiting a greater or less degree of exudation?—The time at which Major Ford discovered what he considered objectionable cartridges was in last year, but, of course, it is quite understood that a considerable time would elapse in looking over those stores.

2030. But did not that state of things occur subsequently to the improved conditions under which you say that it is impossible exuding dynamite should re-issue from your works?—Previously.

2031. Did all of this occur previously to the rules or regulations which you spoke of as a safeguard for the future?—No; I beg your pardon, the rules and regulations connected with the works were all arranged and approved before we were put in operation at all.

2032. Admitting the possibility of similar results being arrived at in the future, you would not consider that a satisfactory state of things, would you?—Far from it; nay more, if that were so Major Majendie has a perfect right to revoke our license, and I would put it so.

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2033. On what ground do you say that you believe the conditions under which you now work would absolutely prevent the recurrence of such things when they have occurred so recently as to lead the Committee to suppose that they must have taken place since you took these fresh precautions?—Because the machine in which pressure is thrown on a circular inch of dynamite was not then in operation; it has since been introduced by Mr. Nobel as a safeguard.

2034. I suppose that previously to that, under your old system, you were then satisfied with your system of supervision?—Not quite so satisfied as we are now; I thought we might find further safeguards, and we are always willing to adopt any suggestions either from Major Majendic or Major Ford, or anyone else.

2035. But then all the precautions which you now say are safe may be as liable to changes in the future as your regulations in the past have been; may it not be so?—We do not think so; we think that we are very much improved.

2036. But you admit, at all events to the extent of altering the regulations, that the supervision of the inspector has been beneficial?—It has been very beneficial undoubtedly.

2037. Can you state to the Committee any reasons why you believe your present system has come to perfection, so that no future risk can arise?—I think the fact of those things being brought before us has secured much greater vigilance in all the departments. I believe that our chemist has redoubled his care with respect to tests and surveillance over his men, and improved processes. I think it has exercised a most salutary influence.

2038. I suppose with respect to the storage of dynamite you would have no objection to its being kept in proper well-conducted magazines?—We hope and think that all our magazines are well conducted.

2039. I suppose you would not like to see it kept as gunpowder is often kept in dwelling-houses?—Since I have been in this room I have changed my opinion very much, with reference to the desirability of having it stored with gunpowder; it may be a matter of convenience to some mines, but I would not now recommend such a course.

2040. Does any retail trade in dynamite exist at present?—Not any.

2041. You do not think it is desirable that such a trade, which is essentially a shop trade, should be established?—We think not, and I think that our restrictions against it are sufficient for that purpose.

2042. In assigning distances and quantities in any new Act which would be considered reasonable, would it not be right that the greater power of dynamite should be taken into consideration, and that the quantities should be less than for gunpowder with given distances, or that the distances should be greater for given quantities?—No, I think that a misconception prevails as to that point. Our experience, so far as explosions of limited quantities of dynamite have gone, is that there is very little lateral action at all, and that has been proved in various ways. Take the case of two boxes of dynamite set apart a distance of two yards; one has been exploded while the other has not exploded at all, and a little paling set up within three yards of the box has not been destroyed. Everything in such cases shows the extreme velocity of the explosion

Sir H. Selwin-Ibbetson—continued.

meeting the resistance of the earth: it has made a ricochet, so to speak, and gone off to a great distance above the earth before it began to spread laterally.

2043. Do you think that any new Act of Parliament should lay down regulations with reference to special risks as to each class of explosives?—I think that in the new Act of Parliament the distances might be assimilated. With regard to distance from public buildings, Major Majendic made a very striking remark, namely, that if the distance from mine magazines were strictly enforced, a large number of mine magazines would be beyond the scope of the law; it struck me that if such be the case, and this goes on, we shall soon be unable to find places for magazines at all.

2044. I understand that you consider dynamite is as safe to carry as gunpowder, or safer?—Much safer.

2045. I suppose you refer only to dynamite which may be called safe dynamite, and which has been thoroughly purified?—All the dynamite that has been carried has been safe, and has been carried safely.

2046. But there was dynamite from which there was exudation, was there not?—This exudation is a bugbear; it does not in practice obtain so as to cause any danger.

2047. I understand you to say, with respect to the explosion of dynamite, that it would not occur except at a certain temperature, and that the safeguard as to dynamite being carried by railroad was that if it was carried in boxes similar to the one which you produced, you could not get sufficient heat in the surrounding portions of the dynamite to create the conditions necessary for an explosion?—I cannot conceive a case in which it would explode in transit.

2048. Suppose an accident like that which took place at Abergele were to occur, a truck running down the line on to a train coming at full speed, the truck being charged with a certain amount of dynamite, the truck would be broken to pieces, and the whole of the cases would be destroyed; the dynamite would then come in contact with the falling coals of the engine, so that there would be heat and concussion, and what do you think would be the result?—I think that the dynamite would be scattered all round; you might drive an engine through it without causing an explosion, except little reports like fog signals.

2049. You do not believe that in that case an explosion would occur?—It is not likely at all.

2050. But you will admit, I suppose, that the dynamite might be in the condition of that specimen which Major Ford discovered in the colliery magazine; that would not be safe to be carried by a railway?—Yes, perfectly safe; no such thing could ever take place with this packing; it is a perfect safeguard; it is very much a question of packing, so far as that goes.

2051. Now, supposing this exudation had taken place, even in a box that had been properly fastened, and that box was struck by some violent concussion, an explosion might take place, might it not?—No, never; you might let it fall, as you did in the presence of the War Office Committee, over a cliff 130 feet in height, and it would not explode.

2052. But was the box which you let fall a box in which exudation had taken place to the extent

Sir H. Selwin-Ibbetson—continued.

extent shown in this specimen which Major Ford instanced?—I cannot say.

2053. But supposing the box to be in a state in which exudation could take place, would there not be a possibility of dynamite exploding?—I think none whatever, for the reason that the elasticity, or the softness of the dynamite, could never possibly give such a blow as to produce an explosion. Perhaps it would be satisfactory to explain to the Committee that the cartridge such as was described by Major Ford had been operated upon by a sledge hammer, and smashed as flat as a pancake.

2054. Supposing a box of that kind were full of nitro-glycerine, I suppose the concussion would create an explosion, would it not?—I do not think so; it would be scattered about without an explosion; it is not necessary that it should explode; nitro-glycerine is not that extraordinary substance that people conceive it to be; it is a very safe substance indeed compared with many others.

2055. Dynamite is affected by damp, is it not?—Yes.

2056. With regard to dynamite in a box, such as you now produce, would it not, in your opinion, be likely to be affected by damp or by jolting in the carriage?—No, not at all; we have found the packing a perfect safeguard in that respect.

2057. But supposing that water were to get to it, and that motion were set up such as might exist in a vessel tossing on the water, would there not then be a danger of some of the nitro-glycerine being washed out of the packet?—No, it is hermetically sealed.

2058. Has not there been a case within your own knowledge of something similar to that happening?—Yes, prior to our introducing this packing; in fact, that was the cause of Mr. Nobel bringing out this packing.

2059. As the result of that, those packets have been adopted?—Yes; and I think I am right in saying that Major Majendie and Major Ford approve of it very much.

2060. Now, with regard to a case of gunpowder, under conditions of that kind, when the damp got to it the danger would be destroyed, would it not?—Very completely, I should say.

2061. It would therefore appear that while fire is more to be dreaded with gunpowder, water is more to be dreaded with dynamite?—

Sir H. Selwin-Ibbetson—continued.

Yes, in one respect; but in case of gunpowder concussed in an accident, such as that which occurred at Abergele, or any case of that kind, it is likely that it would go off in consequence of the attrition of the particles.

2062. I suppose that seeing that a variation in the ingredients of nitro-glycerine preparation, or any want of chemical purity, or any tendency to exudation would be attended with risk, it would, in your opinion, be advisable to exercise a control not only over such preparations as may be manufactured in this country, but over those imported into this country?—Yes, I think that surveillance should be exercised over them all.

2063. Therefore the importation of explosives of this kind should be conducted under license?—Certainly, I quite think that should be done.

2064. Would you be willing that the inspectors should have the power, which they now possess, of taking samples of dynamite for examination?—I would insist on the inspectors doing so even if there was nothing in the Act of Parliament to that effect; I should myself prefer the Act should compel them to take samples, because their surveillance is so useful.

2065. You have stated that the presence of nitrous and hyponitric acid would be dangerous?—Yes, I believe those are the only two acids that would cause any danger in the shape of decomposition; but on that point my opinion is not valuable, because I am not a chemist.

2066. You cannot state what would be the effect of sulphuric acid or nitric acid in the presence of organic matter?—It was so kept for four months in the presence of sulphuric and nitric acid diluted and subjected to all manner of temperatures, from 150 to 180 degrees. It was heated and thawed alternately over and over again without any change.

2067. With no danger?—None whatever. If chemical decomposition is once set up it very soon shows signs of danger, and it is propagated very rapidly.

2068. Are not traces of nitrate to be found in all dynamite?—No, not in all; there are some entirely free from nitrate. But possibly our chief chemist will speak to that.

2069. Nitrates of lime and sodium have been found in dynamite turned out of your works, have they not?—That has been accounted for by our chemist satisfactorily to himself.

Mr. THOMAS KAY, called in; and Examined.

Chairman.

2070. WHAT are the rules with regard to the carriage of gunpowder on the London and North Western Railway, with which you are connected?—I may say that all the railways in England are joined together in what we call the clearing-house, and make regulations from time to time for the conveyance of articles, and these are the regulations for the conveyance of gunpowder which are agreed upon by all the railway companies in England and Scotland: "The following are the modes in which gunpowder may be packed, and the qualities which the cases or receptacles must have: 1st. Kegs or barrels, in quarter, half, and whole barrel sizes. Thickness, according to size of barrel and quality of wood used, minimum,  $\frac{1}{2}$ -inch. 2nd. Canisters, made of tin, copper, zinc, or other approved metal, and 0.84,

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cardboard boxes sufficiently strong and well-made to prevent leakage, enclosed in wooden cases. Thickness of cases  $\frac{1}{2}$ -inch, ends 1 inch. 3rd. Metallic cylinders, of an approved pattern, and similar in construction and security to those used by Government for the conveyance of small quantities of powder by rail. 2. Gunpowder in kegs, barrels, or wooden cases, must only be carried in gunpowder vans, and, except by special arrangement, in the same van throughout, and on certain fixed days to be named by the respective companies. 3. Gunpowder, in metallic cylinders, as described above, may be conveyed either in gunpowder vans or in ordinary goods vans, but must not be loaded in ordinary goods vans with other dangerous articles, such as acids, lucifer matches, fuses, petroleum, or cartridges. 4. Each

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4. Each package must be labelled 'Gunpowder' with letters of not less than 1-inch in depth.  
5. To be carried at owners' risk, and a special consignment note, on which the conditions of the contract must be embodied, is always to be used." Then follow the charges that we make.

2071. Are those charges largely in excess of the charges for articles which are not dangerous?—They are in excess of course, but within the last two or three years we have modified them very much, enabling small quantities to be sent at reasonable rates.

2072. What precautions do you take with reference to the truck or vehicle in which gunpowder is conveyed?—For gunpowder in kegs or barrels we have gunpowder vans; we have vans of our own for the conveyance of Government stores, and most of the gunpowder makers have their own vans built in the same manner as our gunpowder vans; those vans are air-tight and built very strongly; and constructed in such a way, that we believe no accident can arise from sparks getting into the van.

2073. What precautions do you take with regard to loading or discharging those vans?—The loading is done by ordinary porters, and the unloading in a similar manner; I am not aware that there are any special precautions taken, except at Garston, and such places where there is a very large quantity of powder sent for export; at Garston our men are not allowed to go into the trucks except in shoes that we provide.

2074. Are the barrels or casks when taken out of the vans set down on the ordinary stone platform?—They are set down on the ground in the ordinary way.

2075. With regard to the class of ammunition and cartridges made up, will you be kind enough to state to the Committee what are the Clearing House regulations?—The regulations are somewhat similar to those for gunpowder, except that they are not quite so strict; for instance, "these cartridges must be packed in wooden boxes of not less than three-quarter inch in thickness throughout; they must be carried in gunpowder vans, but not with gunpowder, and except by special arrangement in the same van throughout, and on certain fixed days to be named by the respective companies; a label, upon which must be described the contents in legible printed characters must be affixed to each box."

2076. Now with regard to fireworks, what are the regulations?—There are two descriptions of fireworks, those that are what we call explosive, and others that are non-explosive; the regulations are these "coloured fires and firework compositions liable to spontaneous ignition must be packed in hermetically closed bottles, or metallic cases, and enclosed in strong wooden boxes; no case to contain more than one pound, and no box or package to contain more than ten of such cases; large fireworks, shells, and maroons must be packed in wooden boxes of not less thickness than half-inch, and ends one-inch; these articles must be carried in gunpowder vans, but not with gunpowder, and except by special arrangement in the same van throughout, and on certain fixed days to be named by the respective companies; a label must be affixed to each package, on which must be described the contents and mode of the inner package in printed characters;" then we have what are called "regulations for the conveyance of ordinary non-explosive fireworks; these articles must be packed in strong boxes,

Chairman—continued.

and each must bear a label on which is to be described the contents and mode of the inner package in legible printed characters, to be carried at sender's risk, and a special consignment note on which the conditions of the contract must be embodied, is always to be used; the packages must be loaded in a covered van which must be labelled with a description of the contents and placed at the end of the train, next to the guards' van. No articles of an inflammable nature, nor any goods which can be damaged by fire must be loaded in the same van," then we make regulations with regard to charges, and we say "sundry lots from one sender to several consignees in the same town may be charged as one consignment, provided the carriage be paid by sender." That is to enable them to send a number of small quantities to different shopkeepers in the same town.

2077. Now with regard to substances under the Nitro-glycerine Act, and especially with regard to dynamite, it seems the Clearing House are not agreed?—They are not.

2078. There has been a recent meeting, I believe, of the Clearing House, but at present the practice differs in England and Scotland with regard to the carriage of dynamite, is not that so?—There have been several meetings of the Clearing House in connection with the subject; and some of the railway companies, my own among the number, are not satisfied that the article can be carried with safety; we have declined to take it on any terms. (I now speak of dynamite). Among those companies who have declined to carry it, there are the Caledonian, the Great Eastern, the Great Northern, ourselves (the London and North Western), the London and South Western, the North Eastern, and the North Staffordshire. I will read the regulations with regard to the carriage of dynamite by other companies. Of course they are somewhat similar to the gunpowder regulations. With regard to the charges, they are the highest charges that are known; they will not carry it, except at what they call double fifth class rate, the fifth class rate being the highest rate that we have in existence. The following are the rules with regard to dynamite: "Dynamite carried by railway companies, is subject to the following regulations, and its conveyance must only take place between certain places to be fixed by special arrangement, under the written consent of the principal goods manager of the companies concerned. Dynamite will only be received at the railway station on the forenoons of certain days. The dynamite cartridges must be first packed in paper or linen bags, containing fossil, silica, or sawdust, of not less than 10 per cent. of the bulk of the explosive, and thereafter packed in wooden boxes with rope handles at each end. Not more than 56 lbs. will be allowed in each wooden case, and a greater quantity than two tons will not be forwarded by any one train. Consignments of dynamite will not be received, unless plainly and fully addressed, and with a description of the contents of each package written or printed thereon. The sender's address must always appear on the packages. Immediately on arrival at the receiving station, a special notice of arrival shall be sent to consignee, and the company shall not allow the packages to remain in their premises longer than is absolutely necessary; not exceeding 24 hours after arrival; and if not accepted by the consignee,

*Chairman*—continued.

signee, they shall be immediately returned to sender, who shall be called upon to receive them at once, and pay the whole charges incurred for carriage, back carriage, and re-delivery. The duties of common carriers in respect of goods conveyed under this agreement, are not undertaken by the company, nor are the company to be subject to any risk of loading, stowage, or unloading; nor are they to be answerable for loss or damage actual or consequential, nor for discrepancy in the delivery, as to either quantity, number, or weight, nor for the condition of articles so carried, nor for any consequences arising from over carriage, detention, or delay in, or in relation to the conveying, or delivery of them. The rate for conveyance shall be double the fifth class rate, with a minimum charge as for one ton from station to station. The loading and unloading to be performed by senders and consignees, and this service must always be performed during daylight. The percussion caps for exploding dynamite, shall not be carried in the same van or waggon with the dynamite, and in conveyance, any waggons carrying the percussion caps must be kept as far as possible apart from the dynamite loaded waggons. No person shall ride in a van containing dynamite, in consequence of the vapour which it is liable to give off being poisonous. Senders of dangerous articles, who do not give notice in writing of the contents of the packages containing such articles, are liable to a penalty of 20*l.* These regulations and conditions cannot be altered or dispensed with by any person whomsoever, and are applicable for the whole distance the articles are carried."

2079. Can you state to the Committee the reasons which have influenced the London and North Western Company and the other six railway companies which you have named to agree to the clearing house regulations therein set forth?—We are not satisfied with regard to whether we can take sufficient precaution to prevent the explosion of dynamite; it may be mere fear on our part, but we can fancy an explosion of this kind; that a train might break down, and a box of dynamite might fall on the rail in front of the train and the waggons coming behind it, the wheels of the waggon might pass over it, and in that case there would be concussion, and heat at the same time, and we are not satisfied that an explosion would not take place. That is only one of the cases which we think might happen.

2080. Will you be kind enough to give the Committee any other that occurs to you?—It is just possible in working the train that there might be a load of iron next to the waggon containing dynamite, and in the event of there being a collision or other accident, a rod of iron might project into the waggon containing the dynamite, and we think it might cause an explosion in that way.

2081. Are you aware of any accident which has happened which confirms your fears?—About five years ago I think there was a cart which I understood contained dynamite, but which I am told was nitro-glycerine; was passing Cwm-y-glo, on the line between Carnarvon and Llanberis; there was an explosion took place just outside the station, which killed the two men who were with the cart, and knocked down a part of our station, and made a very deep hole in the earth immediately opposite the station.

0.84.

*Chairman*—continued.

2082. Was that explosion caused by a collision on the railway?—No, there was no accident on the railway; it was in a cart passing the station; we understood that the package fell off, and this was the result.

2083. Are you aware that on any of the railways which have agreed to the arrangement you have just read, any explosions have happened which would confirm your fears?—No.

2084. Does the present Nitro-glycerine Act influence you at all in estimating the danger of dynamite?—No.

2085. It is entirely from other causes, is it?—Yes, entirely from other causes; we prefer not to carry it if we can help.

2086. You have no desire that you should be compelled to carry it?—Not the least.

2087. No rates would tempt you, I suppose?—No, we do not carry these explosive substances as a matter of profit.

*Sir H. Selwin-Ibbetson.*

2088. In the two cases which you have pointed out as likely to produce an explosion with dynamite, a similar result with gunpowder would not, in your opinion, take place, I suppose. In the case of a barrel of gunpowder, for instance, falling on a rail and a train going through it, would the concussion be likely to explode the gunpowder?—Our present impression is that the result would not be the same with gunpowder as with dynamite. Supposing a cask was got on the line and was run over it might not explode.

2089. Did you ever have an explosion with gunpowder?—Yes, we have had an explosion with gunpowder, and a very serious one.

*Chairman.*

2090. Will you be kind enough to state the nature of that to the Committee?—It was in February 1867, at a place called Yanworth, near Clifton, on the Lancaster and Carlisle line. A down train was going from Preston to Carlisle when a salt van broke down, I think through the springs failing, causing a gunpowder van to run off the road foul of the up line. At that moment a goods train came up in the opposite direction and ran into the powder van and crushed it; the fire from the engine exploded the powder and killed the driver and fireman of the up train; it destroyed about 30 waggons, there were about two tons of powder.

*Sir H. Selwin-Ibbetson.*

2091. But surely a similar accident would occur with dynamite to that which happened in the case of that gunpowder, would it not?—Yes, if this van had been loaded with dynamite, the same results, but probably to a more serious extent would no doubt have occurred.

*Chairman.*

2092. Do you take any greater precautions now with reference to gunpowder than you did before?—No.

2093. Did the accident at Abergele lead you to take any greater precautions than previously?—We were more particular with regard to the receipt of those oils; we could not take more precautions with reference to the loading, but we were more anxious to know what we were really carrying. That accident at Abergele occurred through a goods train running backward and coming in contact with the engine of a passenger train.

S 4

Colonel

*Mr. Kay.*

22 May  
1874.

Mr. Kay.

Colonel North.

Mr. Vivian—continued.

22 May  
1874.

2094. Were any steps taken to ascertain what were the contents of that cart after the accident at Cwm-y-glo, that is to say, whether it was nitro-glycerine, pure, or whether it was dynamite?—My impression at the time I came into the room was, that it was dynamite.

2095. Were any steps taken to ascertain what it was?—Yes.

2096. And was it proved that it was pure nitro-glycerine?—My impression up to to-day was that it was dynamite, but I have been told since I came into the room that it was nitro-glycerine.

2097. But when the explosion took place did the company try to ascertain whether it was pure nitro-glycerine or dynamite?—Yes. It was not anything that was being carried by ourselves; of course after the explosion there was not a remnant of the article left.

2098. The Committee have had very strong evidence that, even if your train had gone over the dynamite, it would have had no effect unless there was a cap to the dynamite; what do you say to that?—My impression was that the article in the cart was dynamite, but I have already stated that I have been told since I came into the room to-day, that it was nitro-glycerine.

2099. Have you not heard of any explosions occurring on those lines which do carry dynamite?—No; I think there has been none.

2100. Were any reports sent to your company of the different trials made with dynamite?—We were present at several of the trials; I was present myself.

2101. Did you find from those experiences that dynamite was dangerous?—The experiments that were made in my presence I considered to be very successful in showing that there was not that amount of danger which we still think may exist.

2102. Now with regard to the carriage of powder, you have mentioned the powder-taking companies have waggons of their own?—Yes; they have.

2103. Are those waggons merely put on to your own line, or are they unloaded and the article put into your own carriages?—They are waggons that run on the line but made according to our own plan; the whole waggon is carried.

Mr. Vivian.

2104. You gave the Committee the rate and conditions on which certain companies carry dynamite?—Yes.

2105. I suppose those terms being double fifth class rates, with severe conditions also, are almost prohibitory?—Yes.

2106. In fact, as prohibitory as they can be made by the company?—Yes.

2107. Your company, however, refuse to carry dynamite; on what experiments made have they come to that decision?—Not on any experiments of our own; we should prefer some one else making the experiments.

2108. Do you think that other companies have been injudicious in taking on themselves to carry dynamite?—Apparently they have not the same fear that we have; I may consider myself to some extent, responsible for advising the company not to carry it at present.

2109. I suppose the line which has had most experience in carrying it would be the Glasgow and South Western line which taps the works?—Yes.

2110. Are you aware of any accident having taken place on that line in the carriage of dynamite?—No, I think there has been none.

2111. Did the directors of that line take any pains before they carried it to ascertain its nature?—Their goods manager attended the experiments from time to time.

2112. But they made no special experiments themselves, I suppose?—I cannot say that they did. They probably may have done so.

2113. You spoke just now about a box of dynamite being broken and falling in front of an engine, as likely to explode when a wheel passed over it; but surely it would be the same with gunpowder, would it not?—We do not carry gunpowder by choice, and we would rather not carry it at all.

2114. But being public carriers, and being forced to attend to the commerce of the country, you are obliged to carry gunpowder, are you not?—Yes, and if we were satisfied that there was no more danger in carrying dynamite than in carrying gunpowder, we should carry it under the same restrictions.

2115. You base your doubts on the experiments which you have personally attended, I suppose?—Not exactly so, because if I had been guided entirely by those experiments I should have said that it was safe; but knowing that nitro-glycerine is so dangerous, and that dynamite is composed of nitro-glycerine, which may exude, we are afraid of it.

2116. Are you not of opinion that the Nitro-glycerine Act has to a great extent tended to increase that fear throughout the country?—I do not think it has influenced us at all. I cannot speak for others.

2117. The Committee have been informed that there is a great quantity of dynamite being made and used abroad; are you aware of that?—Yes.

2118. Have you ever heard of any accident occurring on foreign railways from the conveyance of dynamite?—I think not.

2119. Has your company taken any means of ascertaining under what conditions foreign railways carry dynamite?—Yes, we are in possession of all those particulars. They were given to us by Mr. Downie some time since.

2120. That information was duly considered by your directors, I suppose, and it was ruled that you would not carry dynamite under any conditions at all?—Yes.

2121. You mentioned another case where you thought an explosion might happen in the event of a truck of iron being in the same train as a truck of dynamite, and you stated that the protruding iron running into a truck of dynamite might cause an explosion?—Yes.

2122. Is your idea based on any accident that has actually occurred?—No; except to the extent that I have known cases where we have had one truck loaded with iron, and that iron has run into the next truck and smashed it in.

2123. But you have had no experience with regard to dynamite igniting under such conditions?—No; not the least.

2124. In fact you do not know of any such experiment as an iron bar being thrust into a packet of dynamite?—No.

2125. But from what you saw yourself, you think that it would cause an explosion?—Yes; that is my opinion.

2126. You have read the conditions under which other companies carry dynamite, and you stated



Mr. Vivian—continued.

stated that the limit for each train is two tons?—Yes.

2127. Is that supposed to be the limit of quantity under which no serious accident could take place?—I need not say that if two tons exploded, the result would be very serious, but it was felt by the managers who discussed the question, that it was not advisable to have very large quantities in one train, and that they had better reduce the risk to a minimum; but if two tons exploded, I should expect that the result would be quite as serious as if there were ten tons.

2128. The two tons then are arbitrary figures based on no particular experience?—Just so.

2129. Without a detonator being present, would you suppose that an explosion would take place from concussion in a railway accident?—Yes.

2130. Simply by a dead blow?—Yes; and the heat caused by the friction.

2131. That is to say, the heat caused by the concussion would, you think, be sufficient to ignite the dynamite?—That is my opinion.

Mr. Whitwell.

2132. I gather from your evidence, that your company and the other companies refuse to carry dynamite principally from your want of full and satisfactory knowledge of its qualities?—Yes.

2133. You consider that it is a more dangerous explosive than gunpowder?—Yes.

2134. In speaking of possible explosions that may occur, you take a wide range of contingencies which you can hardly define?—Yes.

2135. I suppose you have seen the trucks after an accident?—Yes.

2136. Where the packages have been torn asunder, and even the waggons broken into splinters?—Yes.

2137. You think that the dynamite box which we have just seen here is not so powerful as to resist the action of such an accident?—No; it would be crushed into matchwood in a moment.

2138. You think that all that is so serious that you would rather be without it?—Yes.

2139. The railway companies that do carry dynamite, charge very prohibitory rates, do they not?—Yes.

2140. What is the rate of carriage per ton per mile?—It is the highest rate on the railways, and that rate is double; take London to Liverpool, the fifth class rate is 70 s. a ton, so that if a ton of dynamite was conveyed from London to Liverpool, it would be 7 l. per ton.

2141. What is the fifth class rate per ton per mile?—It is generally about 3 d., with the terminals added.

2142. And also the station to station rate?—The fifth class rate would include terminal service, including cartage, at each end, but with dynamite, and the double fifth class rate, those expensive services are not performed.

2143. Do the railway companies find the trucks?—Not in all cases.

2144. Is it generally carried in iron trucks?—Yes, gunpowder is.

2145. It is treated as gunpowder?—Yes.

2146. You were asked whether the London and North Western made any alteration in their mode of carrying gunpowder after the dreadful accident at Clifton?—No.

2147. The company thought it did not arise from the fault or character of the gunpowder, but from some strange accumulation of circumstances?—

Mr. Whitwell—continued.

—Yes, a combination of circumstances that might perhaps never arise again.

2148. In carrying gunpowder, have you any system of marshalling the trains; do you put the gunpowder van in any particular part of the train?—No.

2149. You carry the gunpowder indiscriminately with other goods?—Yes.

2150. Do you put any limit in a goods train with reference to the number of gunpowder trucks that the guard may receive?—No.

2151. He may have a whole train made up of gunpowder trucks, I suppose?—Yes.

2152. You never impose any limits?—No.

2153. You see no advantage in it, do you?—No.

2154. You take every precaution in loading and discharging, and then you leave the thing to the ordinary chances of traffic?—Yes; the sooner we get it out of our possession the better; I say it is far better to take it at once to its destination, rather than keep it waiting at the station for another train.

2155. If you were to keep it waiting in order to make up a gunpowder train those delays would incur very considerable risk, would they not?—Yes, great risk. But gunpowder is never sent in such large quantities as to warrant our sending either a full train, or any great number of waggons in one train.

2156. Now, with reference to the rate which the companies that do carry dynamite charge; what do you charge generally for gunpowder in transit?—It depends on how it is loaded; if the gunpowder is loaded in metallic cylinders, which is the best mode, and one adopted by the Government, we charge it the same as ordinary heavy goods, that is the third-class rate; but if it is in kegs or barrels, that we consider a risky mode, and we charge the fifth-class rate, with 50 per cent. added.

2157. So that it is three-fourths of what is charged for dynamite?—Yes.

2158. How many, should you say, of those great manufacturers find their own trucks?—The company find trucks in some cases.

2159. Do they charge for the trucks?—No separate charge is made.

2160. Have you known any danger to arise from imperfect gunpowder barrels?—No; all the barrels that I have seen, and I have seen a great number of them, are very well made.

2161. I suppose that you convey over your line at least as large a weight of gunpowder as that which is carried over any other line?—Yes; I think so.

2162. Has any accident occurred at Garston?—No.

2163. Do you know what quantity of gunpowder has been shipped at Garston in the course of a year?—No.

2164. It is a very large amount, I believe?—Yes.

2165. You could not, perhaps, even tell the Committee within 100 tons?—Making a rough guess, I should say it is perhaps 2,000 tons a year; Mr. Keighley informs me that his own firm shipped 600 tons or 700 tons a year, and that some firms shipped much more.

2166. And yet that enormous amount of traffic in gunpowder has taken place without any danger?—Yes.

2167. And of course with ordinary care and management?—Yes.

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2168. Do

Mr. Kay.

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Mr. Kay.

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Mr. Whitwell—continued.

2168. Do you know anything of the magazine on the Mersey yourself?—I know that when the gunpowder is unloaded from the truck at Garston it is put at once into the boat and taken to the magazine; the powder is taken out directly and taken to the magazine, but I have never been on board the magazine.

2169. You never heard any report of danger in loading or unloading, or in the use of the magazine?—No.

Mr. Whitelaw.

2170. With reference to the fifth-class rate which you have spoken of, is that the maximum in the Act of Parliament?—It is the highest rate we have.

2171. In fact it is the highest that the Act of Parliament allows you?—Yes.

2172. Then how is it that you manage to charge 50 per cent. more for powder; in certain cases?—Yes, but we prefer not to carry it at all; we do not carry the article for the purpose of making a profit out of it, and we think that the rates we charge scarcely compensate us for the risk.

2173. But still it is a rate which is not legal?—It is outside our Parliamentary classification, and carried only by agreement at special rates and conditions, as provided by the Company's Act of Parliament.

2174. Of course the double fifth rate, under which the companies carry dynamite, is also an illegal rate?—That is in the same position as gunpowder.

2175. Can you tell the Committee how you came to believe in dynamite being dangerous at all, you having seen those experiments made?—Simply because of the nitro-glycerine contained in it.

2176. I suppose it was the Nitro-glycerine Act that suggested all this to you?—No, it was not.

Sir H. Selwin-Ibbetson.

2177. Do you recollect a meeting of the goods managers at the railway clearing house, in March 1872, at which they came to an agreement which was entered in the minutes, that a railway train might not properly carry more than 10 tons of gunpowder in two trucks, to be placed at different parts of the train, because the Government

Sir H. Selwin-Ibbetson—continued.

inspector pointed out that to carry a large number of gunpowder trucks would be dangerous to the public safety?—I do not remember that meeting.

2178. I understand you to say that notwithstanding accidents having occurred, there is no restriction on the carriage of gunpowder trucks at this moment?—None.

2179. Do you not consider that that resolution binds the companies at all?—No.

2180. Do you not consider it very advisable that every resolution of that description should be enforced?—No; I do not think it advisable that such a resolution should be enforced, unless you could prevent the gunpowder coming to the stations; if it is once brought to the station, the sooner it gets to its destination the better.

2181. There is one other question I wish to ask you with reference to the conveyance of gunpowder in cartridges; at present, are there any companies that continue the prohibition against that?—None.

2182. They all carry them?—Yes.

2183. But with very severe restrictions?—I have read the restrictions to the Committee.

2184. They are restricted to be carried by certain trains in closed boxes of certain thicknesses, are they not?—No, not by certain trains on our line; they may go by any goods train.

2185. Is that so on all railways; are there not certain railways which limit the conveyance of cartridges to certain days of the week?—Yes, fixed days to be arranged by those companies; but we ourselves take them on any day.

2186. Do you think that gunpowder in cartridges is sufficiently dangerous for you to prohibit the free circulation of it?—I think there is not much danger.

2187. With proper bye-laws you think that it might be freely carried?—Yes.

2188. I suppose you would see no objection to the bye-laws with respect to explosives on railways being revised by a competent authority?—No; we should be very glad to carry out any regulations for giving additional safety, which Parliament may consider necessary. We should also be glad, if those regulations are not attended to by the public, if you gave us the means of recovering penalties in case of failure to observe them.

*Tuesday, 2nd June 1874.*

## MEMBERS PRESENT :

Mr. Dillwyn.  
Mr. Knowles.  
Mr. Laird.  
Mr. M'Lagan.  
Colonel North.

Sir H. Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Whitelaw.  
Mr. Whitwell.

VICE ADMIRAL THE RIGHT. HON. SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Mr. CHARLES THOMAS BROCK, called in; and Examined.

*Chairman.*

2189. I BELIEVE that you are a manufacturer of fireworks?—I am.

2190. Do you manufacture fireworks of all sorts; the smaller descriptions, as well as fireworks for large displays?—Yes, I make all kinds.

2191. What number of persons do you employ in the busy time of the year?—About 70.

2192. You are, I suppose, familiar with the existing Gunpowder Act?—I am.

2193. Do you consider that the distances assigned in that Act as the distances from dwelling houses, &c., at which fireworks may not be manufactured, are satisfactory?—I consider that the distance may be reduced with safety.

2194. Do you not consider that the distances should bear some reference to the quantities and to the local circumstances?—I do.

2195. In your own case you, of course, require to have on your premises a much larger quantity of explosive materials and manufactured and semi-manufactured fireworks than a person who only makes squibs and crackers, and such small goods?—I am obliged, as a large manufacturer, to have more material generally, but the proportion of gunpowder to other chemicals would be considerably less in my case than in that of any one making squibs and crackers only.

2196. But, according to the Act, the distances to be observed would, in both cases, be the same, would they not?—Yes.

2197. You are aware that, by Section 6 of the Gunpowder Act, no distinction is drawn between explosive composition in a loose form and the same when made up into fireworks. The words are, "Whether loose or made up." Will you state whether, in your opinion, the danger is the same with manufactured fireworks as with loose composition?—I look upon manufactured fireworks simply as so much very combustible material, so that, to my mind, a small quantity of loose composition is equal in danger to an almost unlimited quantity of manufactured fireworks.

2198. Then in your opinion, a distinction ought to be drawn between loose composition and made-up composition?—Yes.

2199. And the Act is defective, then, in drawing no such distinction?—Yes, I think so.

2200. It appears that the 6th Section of the Gunpowder Act, allows 50 lbs. of gunpowder to be in a cartridge-filling shed, but only 30 lbs. of ordinary firework composition to be in a firework-  
0.84.

*Chairman—continued.*

filling shed; is it not a fact that the danger of communicated explosion from one shed to the other is considerably less with firework composition than with gunpowder?—Yes, decidedly so. But the Act is vague, inasmuch, as after limiting the quantity of fireworks, loose or made up, to 30 lbs., it goes on to say, "or what is equivalent as regards explosive power to 30 lbs. of gunpowder, which is a very different thing to 30 lbs. of firework composition.

2201. That being so, the quantities assigned in the Act for gunpowder and firework composition, ought, you think, rather to be reversed?—Yes, I think so.

2202. Do you consider that it is necessary to maintain a distance of 20 yards between firework sheds, containing 30 lbs. only of firework composition?—No.

2203. How much do you think the distance might be safely reduced, supposing a screen were erected between the sheds?—I should say by one-half.

2204. With regard to the statutory restriction of composition, which is more easily ignited by friction than ordinary gunpowder, to 10 lbs., and the increase of distance between the sheds to 30 yards, is this provision, in your opinion, founded on any sound principle?—No; all compositions used in firework making, which are most easily ignited by friction, require less friction and rough handling in their preparation and working than other compositions. They are never treated in a way to render them explosive. These compositions may be defined as those in which chlorate of potash enters as opposed to those containing nitrate of potash. I think these compositions may, so long as they are dealt with in a special shed, be treated with those having the least restrictions.

2205. As a matter of fact, I presume that it by no means necessarily follows that because a composition is more sensitive to ignition by friction, the effects of its explosion would be felt to a greater distance?—Certainly not.

2206. For example, I suppose that if some inert gritty substance were added to ordinary gunpowder, it would become more sensitive to explosion by friction, but it would not, I presume, become more powerful?—No, just so.

2207. The Act appears to fix the distance of a firework factory magazine from the working buildings at 50 yards in all cases; I suppose that  
there

Mr. Brock.

2 June 1874.

Mr. Brock.

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Chairman—continued.

there is a great difference in the quantities kept in their magazines by different makers?—Yes; the quantity of fireworks kept would of course depend upon the extent of the business done, and the quantity of gunpowder stored would depend upon this as well, but also upon the manufacturer's facilities for obtaining it.

2208. What is about the largest amount, and what is the smallest amount of explosive material which firework makers on a large and a small scale would be likely to have in their magazines?—I am obliged to keep a stock of about 30 tons of fireworks; I should like to keep this stock on my premises in suitable buildings at safe distances; at present I keep it in a powder lighter on the Thames, near Barking. The stock kept by other makers would vary from a few tons to a few pounds.

2209. In all these cases the distances would be equally 50 yards?—Yes.

2210. And I believe that there is no dispensing power vested in the licensing authorities, or Secretary of State, is there?—Not that I am aware of.

2211. Is not the operation of making "coloured fires" in some cases attended with danger?—Yes.

2212. Have you known fires and accidents from coloured fires?—I have known many.

2213. Is the operation of making coloured fires required by the Act to be carried on in a shed apart?—No, but I have always had this work carried on in a shed specially devoted to it.

2214. Is the risk which attends the making and keeping of coloured fires (when those fires are made of ingredients which are liable to spontaneous ignition) recognised or provided for in the Act?—No, but the shed referred to in Clause 6 of the Act may probably mean the coloured fire shed; firework makers will always make coloured fires of ingredients liable, under certain conditions, to spontaneous ignition, and the matter cannot be too strictly dealt with.

2215. But it is, I understand, a risk which is well known to all firework makers?—Yes, all makers of any experience.

2216. Therefore, I presume, we may take it, that in your opinion, the Act is defective in this respect?—Yes.

2217. It has been represented to the Committee that the manufacture of squibs and crackers and fireworks of that class is carried on to a large extent illegally, and without a license, in dwelling-houses and other unlawful places; is that so?—It is so.

2218. Is it the case that, as has been represented, the greater part of the trade, in what are called the 5th of November fireworks, is so carried on?—It is not so now, so far as London is concerned; but this illegal manufacture is, doubtless, still carried on to a very great extent.

2219. Have you any idea of the age of the persons employed by the people carrying on this trade?—They employ very small children.

2220. Have there been many accidents from this cause within your knowledge?—Yes.

2221. Is it, in your opinion, desirable that persons should manufacture fireworks without a license, in dwelling-houses, in the manner referred to?—No, I think that steps should be taken to prevent its continuance.

2222. Can you suggest to the Committee how this illegal and dangerous firework trade can best

Chairman—continued.

be put down?—There will always be a great difficulty in dealing with this class, but I believe that by giving the licensed manufacturers the power to manufacture, on a sufficiently large scale, without infringing the law, the difficulty will be, to a great extent, obviated. Instead of employing people out of doors the manufacturer will be able to have them on his own premises.

2223. I suppose that these makers are generally very poor and would be quite unable to comply with the provisions of the Act with regard to obtaining ground 50 yards from any dwelling-houses, and of sufficient extent to erect all the sheds and magazines required by the Act?—They are so poor as to be quite unable to erect a shed at all of any kind.

2224. Any relaxation of these provisions would therefore, I presume, be a relief to these small people, as tending to place the means of manufacturing legally more within their reach?—No; unless you were to allow them to manufacture in their own dwellings, which is very undesirable, you would not help them at all, for the reasons I have just given.

2225. How do these illegal makers dispose of their goods; do they sell retail, on their own accounts, or do they in fact execute the work for the larger makers?—Sometimes they are ordinary sellers of fireworks who buy the principal kinds of fireworks, and make their own squibs and crackers. Sometimes they are makers for one or two large dealers, who care to hold a largish stock until November comes. By purchasing at unusual times, and so keeping the petty illegal maker going, the dealer is able to buy at a cheaper rate. But for the most part these small makers work for larger manufacturers, who are so restricted by the present Act, that they are glad to get the simpler description of goods (of which great numbers are required) made off the premises. Cheaper labour is employed, so that the goods cost him less than if they were made at his factory, and he is relieved of the presence of large quantities of combustible material which would be in danger of seizure, and which would cause him to be fined if discovered.

2226. Will you state if the making of squibs and crackers is attended with less danger than the making of the more important classes of fireworks?—There is very little difference in the danger of making squibs and crackers as compared with other fireworks, and they can all be made with perfect safety under proper conditions. There is considerable danger in squib making as carried on by these petty makers, owing to the nature of the composition, which is nearly all gunpowder, and to the absence of precautions which such people never take. The making of pin wheels which is generally combined with squib and cracker making is also attended with much danger.

2227. There is therefore, you think, no more reason for permitting this manufacture to be carried on in dwelling-houses than there would be in permitting the manufacture of the larger goods to be so carried on?—No.

2228. With regard to the storage of fireworks, do you think that the limit of 10 lbs. which is frequently assigned in a seller's license is sufficient to enable him to carry on his business?—Quite insufficient.

2229. Are the limits imposed by licenses generally

*Chairman*—continued.

rally observed?—No; dealers always order and keep such a stock as they are likely to sell, regardless whether the license is for 7 lbs., or 1 cwt. In the country this is especially so, for owing to the high rate charged for railway carriage, the dealer instead of ordering in two or three batches, orders in the bulk.

2230. In your opinion might those limits be safely extended where a person had a proper place of storage, or where he had a detached shed?—I think they should be extended, and that he should be enabled to do legally the business he at present does illegally, provided he adopts proper means for storing the goods.

2231. Would you approve of a graduated scale of quantities to be kept according to the situation of the place of storage?—Yes.

2232. Can you indicate to the Committee what you would consider a safe and suitable scale?—I should suggest 1 cwt. in the house, provided that the dealer carried on no other business specially dangerous in connection with fireworks (a cigar shop, for instance), and he should be enabled to keep 2 cwt. outside his house. I think also that he should be allowed to keep from 2 cwt. to 5 cwt. in a proper place, well away from a dwelling-house. If such quantities were permitted they would satisfy the necessities of any dealer.

2233. With regard to the carriage of fireworks by railway, do the railway companies afford sufficient facilities for such carriage at reasonable rates?—I do not complain of the excessive rates, but the opportunities for sending the goods away are insufficient.

2234. You allude to the fixed days for receiving and sending fireworks?—Yes.

2235. Has the effect of the railway regulations with regard to the carriage of fireworks been to encourage the surreptitious sending of these goods?—Decidedly so; but recently the regulations have been relaxed; but this relaxation has been variable; upon some of the great lines leading out of London the difficulty of complying with their regulations is now so great as to compel either surreptitious sending, or the abandoning of orders.

2236. But do you believe that such surreptitious sending has been extensively carried on?—I believe that surreptitious sending has been the rule, and declaration of the goods the exception; indeed, I do not believe that any other maker but myself has habitually declared the nature of the goods sent.

2237. Can you give any illustration of the rates charged by the railways for the carriage of parcels of fireworks?—I am not disposed to quarrel with the rates; the hardship consists in the rarity of receiving days and the minimum charges; for instance, on the Great Eastern Railway fireworks are only received once a fortnight, and the London and North Western has no smaller charge than for half a ton of fireworks to Aberdeen.

2238. In your opinion, is the carriage of fireworks attended with any special risk?—No, some danger might exist where the carriers are kept in ignorance of the character of the goods; and this is an argument I have used to induce railway companies to render proper facilities to senders, and so actually reduce their risk.

2239. If a quantity of fireworks were to take fire, would they explode, like gunpowder, for

*Chairman*—continued.

example?—No, they would simply burn fiercely; this has been demonstrated to the representatives of the railway companies by me in a series of experiments suggested by Major Majendie; a box full of fireworks was ignited, and another box similarly packed was placed upon it; the second box actually escaped with a slight scorching of the exterior.

2240. Do you speak of all classes of fireworks?—No, not all classes.

2241. Your answer would only apply to certain classes of fireworks then, would it?—No, it would apply to all classes of fireworks.

2242. You have, I believe, heard the suggestions which Major Majendie has made for the amendment of the law; have you considered the probable effect of the adoption of those suggestions upon the firework trade?—I have; I am sorry not to have been able to obtain a copy of them, in order to give them fuller consideration; but I may say, generally, that the effect of Major Majendie's Act would be to enable the manufacture of fireworks to be carried on legally. Fireworks would be made in fit places and under proper conditions. In case of accidents the damage would be limited. Those who at present manufacture illegally would feel it hard to be compelled to take proper premises, but they would quickly feel the benefit in increased business, and in their power to carry it on without hindrance. I do not approve of the proposed "general manufacturing license;" I consider that it would give an unfair advantage to the small maker over the large manufacturer. I think there should be only one description of manufacturer's license. A man might fail to get a special license, and still get three or four general licenses which would answer the same purpose; all should, in my opinion, be treated alike. Anybody using sheds to the extent required by the proposed general license could not possibly conform to the restrictions of the Act as to stock, &c. If he were in a sufficiently large way of business to require three or four sheds, he would be doing such a business that 5 cwts. of manufactured goods would be absurdly inadequate. The result would be that he would keep stock in his bedroom as he does now, and the general license would simply serve as a cloak to hide his real doings; because a man is in a small way of business there is no reason that he should be permitted to carry on the numerous branches of a dangerous business in one or two sheds, thus increasing the danger tenfold. I cannot, as I make fireworks, make them safely in less than 12 sheds; indeed I consider it necessary to divide the work into 20 distinct divisions, in 20 separate sheds. I should not propose to compel all makers to have 12 sheds, but I do think there should not be two sorts of licenses. The result will be that instead of having extensive premises, as they are now compelled to have, the large manufacturers will simply apply for one or more general licenses; and then instead of lessening the danger, it will have been very considerably increased. The general license would give power to manufacture in a garden attached to the house, and this means that when the inspector visits the place the house becomes the magazine.

*Colonel North.*

2243. Where is your establishment?—At Nunhead, Peckham Rye.

2244. Are

*Mr. Brock.*

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Mr. Broch.

Colonel North—continued.

2 June 1874.

2244. Are there any houses near it?—On one side of the field there are.

2245. At what distance?—We are 50 yards from any house.

2246. You have stated that you would wish to have 30 tons of prepared fireworks in stock?—Yes.

2247. What quantity of coloured fireworks would you wish to have in that proportion of 30 tons?—Not more than half a ton at any time.

2248. That is to say out of the 30 tons?—Yes.

2249. Would you propose to keep them in different parts away from each other?—I should keep the 30 tons in at least six magazines; five tons in each, and 50 yards apart.

2250. Would you propose to keep the coloured fireworks quite separate from the others?—Yes, quite separate.

2251. In conveying them by railway, do you draw the attention of the railway people to the fact that they are coloured lights?—Yes, there are two kinds of fireworks. Railway companies allow us to send what they call non-explosive fireworks by one rate, and the explosive fireworks by another rate; the coloured fires are included under the head of explosive fireworks.

2252. Are you forced by the Act of Parliament to give information, when you send such fireworks, that they are coloured lights?—No.

2253. Then you could legally mix up the two kinds of things without the railway companies being aware of it?—Yes. I know of no clause in the Act of Parliament which compels us to declare coloured fireworks.

Mr. M'Lagan.

2254. You have said that the materials of which coloured fireworks are composed are subject to spontaneous ignition?—Yes, some of them.

2255. Will you be kind enough to mention the substances which you think are subject to that?—Chlorate of potash, and most of the sulphides. Chlorate of potash, with sulphur, and nitrate of strontia, is liable to spontaneous ignition.

2256. That is to say, without any fire being brought to them?—Yes, by getting damp and drying again. I think if they are kept dry they are safe enough.

2257. Then it must be very dangerous, must it not, at all times to carry those coloured fireworks?—Some coloured ones; but not all.

2258. But chlorate of potash and nitrate of strontia must be always very dangerous materials to carry, must they not?—Yes.

2259. And they might explode at any time on the journey, might they not?—Not spontaneously, except those with nitrate of strontia in them.

2260. You limit it to that one particular ingredient, do you?—Not altogether; there are other chemicals which can be used for coloured fireworks, but they are not generally known, and they are not likely to be used.

2261. Is manganese ever used for coloured fireworks?—No.

2262. Is iron?—Iron is simply used for corrusions.

2263. You stated that young children are employed in making fireworks in unlicensed houses, and at home?—Yes, a man and his wife will em-

Mr. M'Lagan—continued.

ploy the whole of his family in the work, and the youngest may be two or three years old.

2264. I suppose those children would be mainly employed in making up the paper to enclose the fireworks?—No; in making the crackers and squibs there may be 12 or 14 processes, and the children can help in nearly all those processes.

2265. Then supposing a stop was put to the manufacture of fireworks in this unlicensed manner, would there be many of those people thrown out of employment?—Not very many; but even if there were that would be quite right, for they are very badly made; they are very cheap, but of a very slovenly and dirty kind.

2266. Do licensed manufacturers ever contract with such persons for making fireworks, do you think?—Yes, those small people manufacture the goods cheaply, and that is a sufficient inducement to some licensed manufacturers.

2267. Suppose a regulation of this kind were introduced, namely, that only one day's supply of materials for making fireworks should be given to such families, and that they should be removed at night, how would that work?—That could not easily be done, because he cannot make his goods off-hand in a day. There is one process begun on Monday, and he would get them done by the end of the week, perhaps.

2268. Then, in fact, the house in which the manufacture was going on will be a source of danger to the neighbourhood for the whole week?—Yes, but it is not a very great affair; you cannot say that it is a danger to the neighbourhood, because the quantity of material supplied to him would be too small to be any danger, except to those immediately concerned.

2269. But have we not heard of explosions in such houses, that have done much damage to the neighbouring houses?—Yes; the last one which I suppose you refer to was Mr. Fenwick's; he was a firework manufacturer proper.

2270. Was he licensed?—No, he was not licensed; he was in a reduced state, and he made up what orders he got as well as he could in the house where he was living.

2271. But would you approve of doing away with the system of manufacturing fireworks at home entirely?—Yes, I would do away with it entirely.

Mr. Whitwell.

2272. You spoke of your works being situated in a field?—Yes.

2273. And you said that there were buildings on one side of that field?—Yes.

2274. Those buildings are 50 yards from you, are they?—Yes.

2275. How far on the other side are the buildings from you?—On one side is my house and garden within 50 yards, or beyond 50 yards; on the other side is a brick-field, and the remaining side is a road.

2276. How far from the brick-field are you?—Perhaps 30 yards.

2277. You are within the 50 yards of the brick-field, then?—Yes, within the 50 yards.

2278. And the road along which passengers go, how far are you from that?—Fifty yards from any shed used for the manufacture of fireworks, but we have a shed within 30 feet of the fence of the road.

2279. Are

Mr. *Whitwell*—continued.

2279. Are any persons employed in the brick-yard?—No, not now.

2280. There have been, I suppose?—Yes.

2281. Did any one inspect the place when you obtained your license?—Yes.

2282. Who?—The magistrates.

2283. Did they give you a plan of the ground, or did you have a plan attached to the license?—No.

2284. How does the license describe the ground?—I forget the exact terms, but it is a field situated on the side of Evelina-road, and so on.

2285. Have any buildings come nearer to you than there were existing when you obtained your license?—Yes, there has been a lot of houses built.

2286. Within what distance?—Not within 100 yards.

2287. Are your neighbours afraid of you?—Not at all.

2288. Have you had no explosion?—I had one accident; it was from the spontaneous ignition of some red fire, when three sheds were burnt down.

2289. But no explosion?—No.

2290. You said that you would like to keep 30 tons of fireworks on your premises; to have six magazines of five tons each, did you not, each being 50 yards apart?—Yes.

2291. But how could you do that on your own ground now?—I have not the area.

2292. You would require a larger area?—Yes.

2293. You keep your depôt in a barge on the River Thames?—Yes.

2294. What quantity do you keep there?—There may be 20 or 25 tons there at present.

2295. Nearer November you have a larger quantity in stock, I suppose?—No, that would be about the largest stock.

2296. What is the season of the year when your fireworks are most in request?—With me the demand commences now, and in October we shall have got rid of the bulk of them.

2297. What is the largest quantity that you keep on your works for the needs of your trade?—We are able to have two deliveries a week; so that we keep only just sufficient to supply the general orders of the day.

2298. If you were going to send fireworks off next week, would you take the trouble of sending them down to the barge on the river, rather than keep them on your premises before sending them on to the railway?—No, we should arrange to keep as little on the premises as possible, but we should manage differently from that.

2299. But sometimes, I suppose, you are obliged to keep a larger stock on your premises, and you do not take the trouble to send it to the barge before you send it to the railway, do you?—We make our stock during the winter chiefly.

2300. Are you making any now?—There are certain times at which we are forced to make them as the orders come in; all goods for display, or the greater proportion of the goods for display, are made for the occasion, within two or three days.

2301. Is that so with regard to the fireworks for the theatres?—I do not make fireworks for theatres.

2302. Is that a special business?—It would not suit us.

0.84.

Mr. *Whitwell*—continued.

2303. But is it a special business?—Yes, there are two or three people who turn their attention especially to it.

2304. Now how is it that you propose to reduce the distance to 20 yards when you are anxious that a magazine should be 50 yards from another magazine?—That would apply to some of the working sheds; it is unnecessary to have them all 50 yards from any building, because the quantity of composition in some of the sheds is limited.

2305. You have now 12 sheds, and those 12 sheds are divided into 20 divisions, you say, I think?—I have 22 sheds.

2306. How many yards apart from each other are those sheds?—I think that they are 30 yards apart; some of them may be 20 yards.

2307. How near to each other were they when those three sheds exploded?—Those were about five yards apart, but there was a quantity of wood-work between the sheds, so that the communication from one shed to the other was not from the burning materials inside the shed, but from the communication made by the lath wood work between the sheds.

2308. Although the distance was only five yards, there was no communication from one shed which had been exploded, to the other?—None at all.

2309. Is there no probability of the communication of an explosion of fireworks beyond a distance of five yards?—No, it is a much more harmless matter than you might suppose.

2310. Then what is the use of proposing this distance of 50 yards?—I should say that the distance should be lessened.

2311. You would propose to reduce it, perhaps, to 20 yards if there were some screen, would you?—Yes.

2312. But why fix the distance at 20 yards if you cannot explode from one shed to another shed, which is only five yards?—I do not say you cannot do it.

2313. Do you know of any case where a shed has exploded another shed at a greater distance than 20 yards?—No.

2314. Or at a greater distance than 15 yards?—No, I know of no such explosions.

2315. You propose to reduce the distance to 20 yards, and yet you say there is no danger beyond five yards?—I would propose to reduce it to 10 yards with a screen between the sheds.

2316. You state deliberately to the Committee that the sheds may safely be within 10 yards of each other, provided there is a screen between them?—Yes.

2317. You referred to the regulation limiting the quantity of explosive material in one shed to a quantity equivalent to 30 lbs. of gunpowder?—Yes.

2318. How could you compare a quantity of fireworks to 30 lbs. of gunpowder?—I must say that I cannot do anything of the kind.

2319. Is there no rule of arithmetic, or theory, by which that can be done?—I am not aware of any.

2320. You think that in any Act of Parliament such a mode of dealing with fireworks is worthless?—Yes.

2321. You think that an Act of Parliament should specify the exact quantity of fireworks, and not its equivalent in gunpowder?—That would be difficult, also, because many tons of  
some

Mr. *Brock*.

2 June 1874.

Mr. Brock.

2 June 1874.

Mr. Whitwell—continued.

some composition would be harmless, while a smaller quantity of others would be dangerous.

2322. But taking the average, you do not always limit one shed to a particular species of fireworks, do you?—Something must be left to the discretion of the manufacturer, no doubt.

2323. You said that the introduction of nitrate of strontia into fireworks was the principal cause of spontaneous combustion?—Yes.

2324. What quantity of nitrate of strontia may you use in the course of 12 months?—I think I used three tons last year.

2325. That was mixed into what amount of fireworks?—That would represent about 80 per cent. of the composition.

2326. So that in fact you would only make four tons of fireworks, in which nitrate of strontia was introduced?—Yes.

2327. That quantity would be especially explosive, would it?—No, there are conditions by which it can be made not liable to spontaneous combustion; I make nitrate of strontia into coloured fireworks in a way that I consider perfectly safe.

2328. In fact you think the preparation of fireworks, when nitrate of strontia is used, is not more dangerous than when you use the chlorates, do you?—We must use chlorate always with nitrate of strontia, but you are not always forced to use sulphur or the sulphides; it is when sulphur or the sulphides are used with the nitrate of strontia and the chlorates that the danger commences.

2329. Can you see your way in any future Act of Parliament to the possibility of introducing some special regulations with reference to the management and use of nitrate of strontia with those other ingredients that make it so explosive?—I cannot suggest such a thing off-hand, but I consider that the subject should be treated separately.

2330. If there was a separate portion of the manufactory appropriated to that purpose under special regulations, you think that would render the work little dangerous, if at all so?—Yes.

2331. That is what your evidence comes to, is it?—Yes.

2332. Now, with regard to the illegal manufacturers of fireworks in a small way; I suppose that you and all other large manufacturers when you are in great want of fireworks for a large demand get them where you can?—No, I have not gone into the November firework trade until within the last two or three years, when I have made such goods on our own premises.

2333. Are you not forced to buy some of them sometimes?—I buy crackers and pin wheels.

2334. I suppose you buy them where you get them the best and cheapest?—No, we employ our men only; we employ them on our own premises, letting them a shed.

2335. You supply the workman with the material, and he supplies you with the labour?—Yes.

2336. Is not that the case with many small houses also?—That would be the case generally, I suppose; but when I say that I supply material and they supply the labour on my premises, I mean that I let them a shed for the purpose.

2337. Do they employ children on your premises?—Yes; but not younger than 12 or 14 years of age.

Mr. Whitwell—continued.

2338. You employ some children, do you?—Yes, girls.

2339. Merely girls and boys, and they are employed in mixing as well as filling, I suppose?—No.

2340. Are children employed in mixing in the illegal firework places?—No, I think not.

2341. You think that the mixing would generally be done by adults, do you?—Yes; the way in which the mixing is done is this; a man wants a lot of pin wheel composition, we will say; he will go to the oil shop for just the quantity he wants; it is all placed in one bag, and when he gets it home he mixes it together as he best can, and then it is used; he will not buy it until he wants it.

2342. The children on your premises are not employed in the mixing?—No.

2343. Are they engaged in filling?—Yes, they are engaged in some part of the filling.

2344. Are you under the Workshops Regulations Act?—Yes, we have a notice posted upon our sheds.

2345. What is the youngest age at which you take on children?—Fourteen.

2346. Do you employ girls of that age as well as boys?—Yes.

2347. I suppose that the principal part of your labourers are girls and boys?—Not principally.

2348. Is it one-half or less?—Yes, it is probably one half.

2349. Do you impose any restriction on their dress or shoes, or anything else indicating that there is danger?—In the danger sheds and all those sheds that have composition in them, we have floors lined with linoleum, and the girls there are dressed in blue serge dresses which we supply them, and the men have shoes found them and blue guernseys.

2350. That is the only precaution which you take?—Yes.

2351. Of course the shoes you find them are made with leather without any metal in them?—Yes.

2352. They change their dress when they enter the works, and they also change their dress when they leave the works, I suppose?—Yes.

2353. Have you any restrictions with regard to smoking?—Yes, we have a set of rules which are posted up in each shed; the restrictions forbid smoking, carrying fuzees, lights, or pipes.

2354. Have you had several minor accidents from the carelessness of the employés?—Never.

2355. I do not mean actual explosions in the sheds, but burns, and things of that sort?—On one occasion there was some composition used for a pretty little firework which I had invented; a pinwheel which had various corruscations with metals. That was filled in long thin pipes as in ordinary pin wheels; the composition not being quite dry was very difficult to run down; and the man got a piece of zinc made hot with boiling water and put it into the jar containing the composition, and I rather think that the zinc knocking against the jar might have caused a spark.

2356. You think it did not ignite by the heat imparted to it by the heated zinc?—No.

2357. It would not explode without a spark, would it?—No, I am quite sure of that.

2358. You propose to allow the dealer to have as much as 1 cwt. in his house?—Yes.

2359. Does that mean whenever he likes to keep



Mr. *Whitwell*—continued.

keep it in the house?—No, I think it should be under proper conditions.

2360. What are those proper conditions, in your opinion?—If he keeps them in ordinary boxes, that would be enough.

2361. How can you control it by Act of Parliament, so that he should only keep 1 cwt. under certain conditions?—Of course the seller must put up with a certain amount of risk; he ought to know the risk, and take proper precautions.

2362. Then take the case of 2 cwt. outside the house, in a place which might be close under a neighbour's house. In large towns the back premises are apt to be very small, as we know?—Yes.

2363. And therefore the man might endanger his neighbour, might he not?—Yes; he ought not to have 2 cwt. outside the house without proper conditions.

2364. You would have the place inspected by some official, I suppose?—Yes.

2365. All this would apply to quantities from 2 to 5 cwt., would it?—Yes.

2366. Do you think that any license should specify the place where, and the conditions under which the stock was kept?—Yes.

2367. Is 5 cwt. the maximum which any dealer with whom you do business would wish to keep?—Yes.

Mr. *Stevenson*.

2368. I suppose the fireworks chiefly made in unlicensed premises, are squibs and crackers, and things of that class?—Yes, and pin-wheels.

2369. They are the simpler class of fireworks?—Yes.

2370. Have you any idea of the annual value of such fireworks that are manufactured and sold?—No.

2371. Do you know how many small unlicensed makers there may be?—No, I think that part of the business is chiefly carried on in Yorkshire and the northern counties; they are made, perhaps, by miners' children.

2372. Is that for the London market?—No, for the Leeds and Manchester, and Liverpool people, and the Scotch towns.

2373. Is there no such trade carried on in London, do you think?—Not to such a great extent.

2374. Then how are they enabled to undersell the licensed manufacturer?—By making them so very cheap.

2375. Why are they made so cheaply?—That trade originated in London to a great extent in this way; there was a man in the East End of London who found it profitable to sell fireworks rather than make them, and he would take any description of fireworks from any one, in any quantity, all the year round, so that a lot of little makers got into the trade, such as weavers in Bethnal-green, and turned out a large quantity of those goods; this man would have many tons on his premises, and he would have customers all over the country; I should say that he originated the trade in these badly-made fireworks.

2376. Is that trade still carried on in this way?—No, not in London; I think that Major Majendie has quite upset it; the man got frightened, and was forced to give up business.

2377. That is to say, for fear of a prosecution?—Yes.

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Mr. *Stevenson*—continued.

2378. The existing law then is sufficient, is it not, to put a check on those unlicensed makers of fireworks?—No, not quite so, because there is no power of following them up or finding them out.

2379. Is it possible in every case to find out a manufacture which can be carried on in a man's own house by his own children, if it can be done to advantage?—It is not possible at present, but it might be made possible, in my opinion.

2380. Have the police now any power of interference?—I think not.

2381. How are those unlicensed firework-makers enabled to work cheaper than you are?—If they work in a garret or small room, it would be much cheaper than working in a shed, on ground which had to be rented for the express purpose; it is very hard to get ground; even outside London it is with great difficulty that you can do it.

2382. But if it is possible to make those squibs in private houses at a profit, will it not always be carried on, do you think?—I think it might be prevented by some law; the makers of such goods in that way should be visited with some punishment.

2383. On what public ground would you propose that such a law should be passed?—Because it is very dangerous, and there have been many accidents from that class of people making the goods in that way, and they make them very carelessly; they work in the same room that they are living in, with a fire or by candle light or by gas. The fireworks are made in a very dirty slovenly way.

2384. Do you think that it is the province of Parliament to interfere, to secure a supply of good fireworks?—No, but I say that where they are made badly, they are made carelessly, and therefore dangerously.

2385. From the point of view of the public safety, do you think this manufacture of fireworks should be stopped in private houses?—Yes.

2386. Have many accidents arisen in those unlicensed private houses?—Yes many.

2387. Do you know of any people who have been killed in that way?—Yes, killed, maimed, or blinded.

2388. What is the last case that you can refer to?—In the case of the explosion at Mr. Fenwick's house, four or five people were killed.

2389. Was it a small house?—Yes, it was a small house in a crowded thoroughfare.

2390. Was he licensed?—No.

2391. He had been a licensed manufacturer, had he not?—No.

2392. Have you known of any one being killed from people employing their own families in their own houses in that trade?—Yes.

2393. In what case was that?—A man of the name of Daniels, in Baker's-row, Whitechapel, two Novembers ago, was burnt.

2394. Was that in a small private house?—Yes, a small private house in a crowded neighbourhood.

2395. Where do these unlicensed makers obtain supplies of their materials, such as gunpowder and the other ingredients?—Certain oil shops are known to serve such goods.

2396. That is not an illegal sale, is it?—No.

2397. Do they mix the materials themselves?—Yes.

2398. Where do they make the cases into which

Mr. *Brock*.

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*Mr. Brock.*

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*Mr. Stevenson—continued.*

which the materials are put?—They make the cases in their own houses.

2399. I suppose there is no harm in their making the cases in their own houses?—None whatever.

2400. What proportion of the labour is the making of the cases as compared with the filling?—The making of the cases and the finishing of the goods would represent about two-thirds of the labour.

2401. The remaining third being the charging or filling?—Yes.

2402. The making of the cases is a great portion of the labour, and there is no harm in it?—No, making the cases would represent a third of the labour, and finishing the goods another third.

2403. So that two-thirds of the labour is of a harmless nature?—If you consider that finishing the fireworks as they are made is harmless.

2404. Have any of the explosive class of fireworks been made in private houses?—Yes.

2405. That is to say, in the same small way that squibs are made in?—Yes.

2406. Can they undersell the regular manufacturer in making that class of goods?—No.

2407. Then why should they make them?—Anybody knowing how to make red fire, if he got an order for it, would make it in his own house.

2408. Could you make it cheaper?—We could, perhaps, but we should not.

2409. Did you ever know of any accident from an explosion of fireworks on a railway in transit?—No.

2410. Are you subject to regulations by law with regard to the mode of carrying on your business now within your works, or is that left to your own discretion?—We are supposed to be under the regulations of the present Act of Parliament.

2411. Do they affect the mode of carrying on your own business within the works?—Only with regard to the distances and quantities.

2412. Would you approve of a law interfering with the carrying on of your work inside of your place?—Yes, if it gives me the advantages which I require.

2413. What advantage would you expect from such a law?—That the sheds may be closer together in some places, and that I may keep a larger stock.

2414. You do not object to the inspector having the power to enter your works to see that proper precautions are used?—No, not at all.

2415. Before what tribunal would he bring you if he thought you were not using proper precautions?—I do not know, but I should hope he would take me before some one who would know something about it.

2416. You would not like to go before any ill-informed tribunal, therefore I ask, have you

*Mr. Stevenson—continued.*

thought what tribunal would be most suitable?—No, but I have a very strong feeling that the tribunal and the inspectors should know a little more than people generally do know about chemistry and firework-making.

2417. It was suggested that an arbitration might be a suitable mode of deciding whether the inspector's requirements were reasonable or not; would that satisfy you?—Yes, I think by that means we should stand a chance of being more fairly treated, perhaps.

*Mr. Whitelaw.*

2418. Are all the fireworks that you make and dispose of made in your own works?—Yes, almost all of them with the exception of a few crackers and pin-wheels.

2419. I suppose you do not employ those people who make fireworks in their own houses?—I do not.

*Mr. Knowles.*

2420. With reference to the manufacturing sheds, are those sheds in one or two compartments?—No, they are single sheds, very small huts.

2421. How many people are employed in each?—One or two.

2422. Do you think that it would improve the manufacture in private houses if they were compelled to be licensed or even registered?—I do not think that they should be allowed to manufacture in such houses at all.

2423. Have you any printed rules for the guidance of your workpeople?—Yes.

*Chairman.*

2424. Will you kindly put a copy of those rules in for the information of the Committee?—I will do so.

*Sir Henry Schwin Ibbetson.*

2425. Do you know how many people were killed in the Lambeth explosion on the 4th of November last?—I think it was five or six.

2426. The manufacture was being carried on illegally there, was it not?—Yes, and in a very small house.

2427. Of the five or six people who were injured, were some of them persons not engaged in the trade?—Yes.

2428. Lodgers in the house, I believe?—Yes.

2429. Do you suppose that they were aware of that manufacture being carried on in that house?—Yes, I feel sure that they were. People very soon get used to firework-making, and seem quite to disregard the danger.

2430. That you think is a strong argument that something should be done to protect them when they will not protect themselves?—I think so.

Mr. HENRY E. TAYLOR, called in; and Examined.

*Mr. Taylor.**Chairman.*

2431. You are a partner in the firm of John Taylor & Sons, are you not, and manager of mines in Chester and Aberystwith?—I am not a partner, but a son of the senior partner, and the one who has taken this matter now before the

*Chairman—continued.*

House in hand. I manage mines at Chester and Aberystwith.

2432. Have you had practical experience in the use of explosives?—Yes, for the last five or six years, I have taken a great deal of pains to ascertain

*Chairman*—continued.

ascertain the best explosive for mining purposes.

2433. Which of the explosives used for that purpose have you ascertained, in your opinion, to be the best?—The different kinds that I have had brought before me, are ordinary gunpowder of two or three kinds, made by nearly all the makers, dynamite, pudrolythe, gun-cotton, and several of the powders which they call sawdust powders; nitro-glycerine I have not had anything to do with.

2434. Except as a component part of nitro-glycerine and compounds?—Yes. I have had no experience of nitro-glycerine proper, because a friend of mine was killed by it.

2435. I think that first of all you wish to speak with regard to the difficulty in the carriage of these explosives, do you not?—Yes; until lately, and since the British Dynamite Company was established, the things that I have had have been carried surreptitiously, and no one can have known what they were; with reference to dynamite, everybody until quite lately seems to have pounced on the difficulty of carrying it; it enhances the price, and really in England is hardly yet in common use; it is not in common use in fact; to instance a case, I bought some dynamite in Antwerp, and I exported it to Bristol, and I thought I had done everything which was required; I declared the dynamite, but the importer had not marked it; a steamer which belonged partly to myself was chartered, without my knowledge, to go into Liverpool; it went into Liverpool, and the authorities boarded her, and found there was dynamite on board, and they threw it overboard as they thought (this was two years ago); but instead of throwing it overboard they threw overboard a lot of cast steel hammers, and the dynamite was landed safely in Liverpool; but the loss of the steel hammers was very costly. I have tried dynamite in every way as well as I could, by giving it rough usage in carriage, but I have never had any accident with it. I think that if Parliament would allow dynamite to be carried under the same regulations as gunpowder, or something like it, no one would be any the worse; there would be no greater danger, and there would be an immense benefit to mine and quarry owners.

2436. Can you speak with regard to the comparative safety in the use of different explosives, such as gunpowder, dynamite, pudrolythe, gun-cotton, and nitro-glycerine?—In the use by the workpeople with gunpowder there is very great danger, and I have had so many killed with powder, that anything that will come in place of it I will adopt; the chief danger is in tamping, that is to say, forcing the powder and the material upon it into position; this is almost always done with an iron or a steel rod; it is not allowed by the Act of Parliament, but it is done every day; I had seven men killed in one year, I believe almost entirely through that cause.

2437. That is to say from using the iron tamping rod illegally?—Yes, from using the iron tamping rod illegally; with dynamite there is no necessity for an iron tamping rod; you need not give it any violent blow, for you do not require to have that solidity that is needed with gunpowder; gunpowder, unless closely confined in the blasting hole, is of very little use, but a lump of clay will do very well with dynamite and a little loose sand or water over it.

*Chairman*—continued.

2438. Can you speak with reference to the safety of dynamite, and the mode of using it at all temperatures?—I cannot say that exactly, because I have not had experience in all temperatures. I never met with any accident. I have had it in very hot places, but never in a place that was hot enough to be dangerous.

2439. But it requires to be warmed, does it not, when it is at a low temperature?—Yes, I have been afraid of accidents with it, but I have never had one. The way in which my people warm it is usually to carry it in their pockets or else, which is as good as anything, to put it in a tin can, and put it for a short time in hot manure (there are generally horses kept about a mine), which has a slow way of warming the dynamite which has a wonderful effect upon it. Some men at a quarry in North Wales heated it in another way, but I do not know how they did it as they were both killed. I believe they put it on the fire in a saucepan; the saucepan was found up the chimney, so that I presume that that was what they must have been doing.

2440. Now, with regard to pudrolythe, what evidence can you give the Committee?—The same effects attach to pudrolythe almost as to dynamite. It was invented by a Belgian, and has only lately been introduced; in fact there is no licensed manufacturer as yet, but, it is the safest material that I ever came across; it will not explode under any condition except when it is very closely confined; it will not explode if put on an anvil and hammered with steel or iron. Parties connected with it have burnt a 50 lbs. case of it in a fire, while the Duke of Sutherland was having his lunch close by. That has been done over and over again, and in the process of tamping, if sparks should be caused, the pudrolythe will not go off, because the air is not excluded from it; it is not nearly so strong as dynamite, and perhaps not so strong as gun-cotton, but it is very safe and much cheaper. With gun-cotton I never had an accident, so that I do not know that it is dangerous, but I have given up the use of it because it could not be depended upon. I have heard others say it is dangerous, but it is so treacherous as to quality that I do not care to use it. I have had no personal experience of nitro-glycerine in a liquid state.

2441. Now, with reference to the use of cartridges in mines; what have you to say upon that point?—I think that if a good cartridge for gunpowder were invented, or made, we should have many fewer accidents than we do at present; I almost think, so far as my own mines go, if I had got a good cartridge I would not let powder be used except in cartridges; I think Parliament could safely say that gunpowder with dynamite should not be used except in cartridges, and it would be cheaper for the mine owners if that were so.

2442. Now with regard to the carriage of explosives, have you any remarks to make to the Committee on that point?—With reference to the carriage by railway, I do not think that anyone can at present much complain as to the carriage of gunpowder in large quantities. As a mine owner, I do not know much about it in small quantities, for we are allowed by the law now to carry two tons at a time, which is reasonable; however, I should like to see other explosives carried in a similar way, and that the manufacturer should be allowed to send dynamite, or compounds

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pounds of nitro-glycerine, to their destinations something the same as gunpowder is. Some of the railways at present refuse to carry it altogether; we have very great difficulty sometimes. The people in office get hold of the Act of Parliament, and prevent us from getting it to our magazines; it really is so safe that I should think it might be carried just the same as gunpowder is.

2443. With reference to the storage of explosives in mines for mining purposes, what have you to state to the Committee?—There is no doubt that mine magazines and colliery magazines, as a rule, and especially quarry magazines, are not all what they ought to be; I would suggest a magazine similar to that I have heard Major Majendie describe, though I have not done it until lately, and very few people have made proper magazines at all. I was at a quarry lately, when I found that the gunpowder magazine was a portion of a long building with the offices in the middle, and the storehouse at one end and the smiths' shop at the other, divided by wooden partitions, and the gunpowder was kept there; there was half a ton of it; people really do not know what the law is. If some special magazine were adopted, and some very simple rules, we should get every one to attend to them, I hope; with regard to the quantity, there is a great difference of opinion among the miners. I think the present rules with regard to powder are very fair. I am allowed to store two tons of gunpowder in a properly licensed magazine. I think that that is a very good amount. Then, with respect to dynamite, and other explosives, those quantities want arranging, I think, because as it is now, we hardly know what we may have. I bought a ton of dynamite the other day, and I was told that I could not put it anywhere. I obtained a license from the Home Secretary, but I do not think it clearly says what the quantity should be, and it should be defined.

2444. Now, with reference to the packages in which dynamite should be sent, and the size and description of those packages, what is your opinion?—I think that the package is a very important question with regard to dynamite. So far as I am able to see, dynamite is perfectly safe as long as it is used fresh and has not had a chance of being exposed to the air so that it might exude, or get damp. It would be no hardship to anyone, except perhaps to the maker, to have the packages limited as to size. With respect to gunpowder, at present 100 lbs. is the largest which is used in practice, and I think, as dynamite claims to be four or five times the power of gunpowder, it ought to be packed a fourth or fifth of the size, and that a package, when once opened, should be taken out of the magazine and never returned. Supposing the package were limited to 25 lbs., it would be a very small mine where it could not be distributed altogether away from the magazine; the packages should, I think, be limited to 25 lbs., or at the outside 50 lbs., and should never be allowed to be closed up after being once opened.

2445. In what sized packages did you receive the ton of dynamite which you received the other day?—Chiefly in 50 lb. packages, but I believe that they are made in 100 lb. packages; that is a question of convenience now.

2446. When you receive your explosives do you have them chemically examined?—No.

Chairman—continued.

2447. It is of great consequence, is it not, that there should be a strict adherence to the specification as to the component parts of these explosives?—From my experience of gun-cotton, I should say that it was very important, and, from what I know of dynamite accidents in other places, I should say that it was also important. I would suggest some system such as they have in France, by law, for artificial manures. There is a very heavy penalty for anyone who does not adhere to the specification. I do not see why that should not apply to nitro-glycerine compounds here, so that if we suspected anything we could send a sample out of our magazines to an eminent chemist and see whether it was equal to the specification. Gun-cotton, either from careless making or from departing from the proper component parts, is so uncertain that two shots out of three will hardly have any power at all in some cases.

2448. Will you be kind enough to explain the form and nature of the mine and quarry magazines which you would propose to adopt, and state your views with regard to the storage, separately or together, of the different kinds of explosives which it is necessary to use in such places?—I should propose that all quarry or mine magazines should be made either of stone or brick, and should be lined inside with planking, and that the planks should be closely jointed so that no powder or explosive compounds could get through the cracks. I may say that explosions have occurred through that. I do not see myself why dynamite or nitro-glycerine compounds should not be stored in the same magazine at the mine with gunpowder. I think if we are obliged, as we are now to establish separate magazines everywhere for dynamite, we shall have great difficulty in getting them. In collieries it is very difficult even now to get a good site for a magazine, and if we are to have two magazines, one for dynamite and one for gunpowder, it would very much tend to stop the use of one or other of those explosives. I cannot see that there is any greater danger in putting the two things together than in putting them 200 yards or 300 yards apart.

2449. I gather that you think there are some purposes for which gunpowder would be more efficacious than dynamite, and some purposes for which dynamite would be more efficacious than gunpowder?—Yes; I have never found an instance where a man will do the whole of his work with one of them only. Dynamite is still so expensive that I should say it would be some time before it is used altogether, and, therefore, the two explosives are required almost everywhere.

2450. I suppose you would desire that the magazines of mines and quarries should be under careful inspection?—Yes; I should wish it. I should feel much more comfortable if they were regularly inspected, but I do not think it is necessary to appoint a special set of inspectors for mine magazines. I do not mean large magazines where they store 30 tons or 40 tons of powder, but if a simple rule was laid down for the construction and conduct of magazines, then inspection of magazines might be very well done by the inspectors of mines. I believe that they inspect every place in their district as soon as they can. The process of inspecting the magazine at the same time as they inspected the mine would be a matter

*Chairman*—continued.

matter of 10 minutes or a quarter of an hour. If the inspector came on purpose he would come very long distances, and he would have hardly any work to do when he got there.

2451. With regard to the distance which buildings should be from the magazines, and with reference to the erection of buildings after magazines had been established, what have you to suggest?—I would draw attention to this point: I have been put in rather a serious position once or twice; we are forced to build our magazines at a stated distance from the houses, and so on, but there is no law (that is acted upon, at all events) to prevent people coming and building as near as they can to the magazine. In case of a serious explosion, when everybody connected with the case might have disappeared, it would be very difficult to say which of them was first. Close to one of my mines there is a magazine belonging to a large powder manufactory where there are often stored 30 or 40 tons of powder, and there is a turnpike road not very far off, but within a stone's-throw, and within the last two or three years a church has been built. The question is who is to move. I am not an interested party there, but if the powder magazine blows up there is nothing in the law to say who is responsible, as far as I understand it. Several complaints have been made to the magistrates but nothing has been done. If people have got a bit of land near by, they say, "I am not afraid of the magazine;" and they come and build their houses close to it.

2452. Is it your opinion that, in law, there should be a definite area fixed wherever a magazine is established?—Yes, I think so, or else the parties who build within the area should compensate the owners of the magazine in some way; it seems very hard that we should be obliged to go moving about for everybody who comes and builds within the area.

2453. That would rather raise the price of the land on which the magazines were proposed to be erected, would it not?—Yes, near populous towns it would be a different thing, but land around mines and quarries is of very small value, and a powder magazine is generally put or built where no one could build a house; but in collieries it would be an awkward question.

2454. Now with regard to the quantity of any explosive substance which ought to be delivered to a workman: do you make any rules for the men whom you employ?—We have rules of our own, but it is most difficult to make the men adhere to even the ordinary mine rules; they come one day and are gone the next; they do not care much about the rules, especially rules in detail, but if there is a law by which they are liable to be fined or imprisoned, they have a great deal more respect for it. It struck me that in passing a new Act of Parliament, there should be some limit to the quantities to be delivered to the men. The workmen sometimes live a long way from the magazine and yet close to the mine, and they are in the habit, if they are allowed to do so, of taking the very largest quantity they can get to their own house, and keeping it perhaps under their beds. I have known 25 lbs. of common gunpowder to be stored under a bed. If there was a law that there should be a man who was responsible in the magazine, if he delivered to a workman more than a certain quantity, he should be the responsible

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*Chairman*—continued.

party, and not the workman; that might be a good thing.

2455. Now, with regard to the other safeguards in mines, such as forbidding the use of iron or steel tools, and other dangerous substances in magazines, or in connection with explosives in any way; what have you to suggest?—There is in the Mines Regulation Act (which I suppose applies more particularly to this point) a rule that iron and steel bars and prickers are not to be used, but I do not think that there is any regulation that the men are not to use steel chisels, or any thing they please to open powder cases; if there is such a rule, it is broken every day. I think there ought to be a rule of that kind, and also, if this Act of Parliament can in any way interfere (dynamite now being brought before the public), more than the Mines Regulation Act does to prevent the use of iron bars and prickers, it would be a very good thing. The pricker or borer is used for taking out a charge if it misses shot; that is altogether against the law, but it is done, and ought to be prevented.

2456. Have you any suggestion to make to the Committee with reference to the rules for the regulation of mine or quarry magazines?—Chiefly to have them as simple as possible; they are very important, but if they are as long as those sent to me by the Home Secretary for my dynamite magazine, I am quite sure the men who work and have charge of the magazines would never read them, and if they did read them, they would not understand them. It would be well if we had fuller rules for the managers and for men of more intelligence; but I should like to have some simple plain rules to put up in the magazines, which a common workman would understand, and would know that if he broke those rules he might be prosecuted by the inspector or some one else, and that he would be under severe penalties if he infringed the rules. I mean rules such as these; that no more than a certain quantity is to be stored in any one magazine; say two tons of powder, and half a ton of dynamite (of course the quantities would be modified in different places). That a person should be appointed as the sole deliverer of these explosives. That that person should be supplied with special safety shoes, which he should always wear when he goes in; that the magazine should have a good lock on the door, and be always kept locked; that it should be lined with boards or any other safe lining, closely jointed, and always kept clean (cleanliness is a very important point); no naked lights should be used, and if possible no deliveries should be made except by daylight; the percussion caps and detonators, which are required for dynamite fuzes, &c., should not be kept in the magazine; they are themselves of very little danger, and they might be kept almost anywhere away from fire, but in a magazine, if they are allowed to drop, they might explode and be exceedingly dangerous. I think that a few simple rules we could get men to attend to, but if we have those long ones, it is like the Coal Mines Regulation Act. Only the other day I was reading the rules relating to the use of gunpowder to the overlooker of a colliery. I asked if he had seen that before, and he said, No, he had never read them. I asked him the reason, and he said, "They are so long."

2457. Have you anything further to state to the

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the Committee?—Yes, I have collected several reports in writing with regard to the value of dynamite as against gunpowder. These reports are from my own miners, and other miners whom I have asked questions upon the subject.

2458. I suppose you concur in the results?—Yes, I concur in them so far that I find myself that those are not so good as my own experience, but I put that down to carelessness and want of knowledge of the new explosives; but the report, which I have here, and will hand in (*vide Appendix*), was made by an English engineer managing a mine in Prussia. His name is Mr. Darlington, and his present address is 2, Coleman-street Buildings. He uses Nobel's dynamite. He makes the relative cost of dynamite to gunpowder exactly one half; my own experience shows that that is, I may say, almost a moderate estimate; but the great value of dynamite to the miner is that we can do the work quicker than with gunpowder. There is another very important thing connected with mining, though it has nothing to do with this inquiry (I wish it had), that very good ventilation is required when nitro-glycerine compounds are used. They give off fumes which subject the men to very severe headaches.

Colonel North.

2459. Did I understand you to say that you brought your dynamite in a ship of your own from abroad?—No, it was brought from abroad, and transferred to my vessel at Bristol; it might have come to Aberystwith, but the vessel went round to Liverpool.

2460. Was the captain aware that there was dynamite on board?—Yes; but he was ignorant of the law.

2461. How was it packed; was it packed in the magazine of the ship?—No, it was in ordinary cases with the rest of the cargo.

2462. Who inspected the ship?—I do not know; but the authorities at Liverpool, I understand, have supreme power, and all vessels are boarded by the Custom House authorities.

2463. But how came they to take the steel hammers instead of the dynamite?—The dynamite was not marked as it should be; they simply knew that dynamite was on board.

2464. And they might, in fact, have thrown anything whatever overboard?—Yes, but I suppose the cases of the hammers resembled what they thought the dynamite might be packed in.

2465. You said that you bought a ton the other day; was that what came in your ship?—No, that was years ago when dynamite was hardly known in this country.

2466. Then there was no objection to your having that quantity, was there?—There was a law, until lately, that these nitro-glycerine explosives were only to be conveyed under severe restrictions, and it was under that law that it was intended to be thrown overboard.

2467. You think that there is no danger in the transmission of dynamite?—None whatever, if it is properly packed; but I should like to see air-tight cases.

2468. Take pudrolythe for example, how is that exploded; is it done with a cap?—No; almost every explosive will have more power with a cap, but pudrolythe does not require it; all that it requires is, that the air should be strictly

Colonel North—continued.

excluded from it; if there is a crack in the ground or the hole it loses its power.

2469. How do you explode it?—By confining it strictly from the air, and by tamping with a common fuse like gunpowder.

2470. Now with regard to buildings, you think that if people choose to come and build near, you think that the whole responsibility should rest on those who so choose to build?—I think that they ought either to give us another site or that they ought not to come there at all.

2471. Suppose a man builds a house near you, and there is an explosion, are you held responsible for it?—I am afraid that we are.

2472. You think that when an establishment is once placed in a certain locality, those who choose to come within a certain radius of the building ought to be responsible for anything that occurs?—Yes, they ought to be responsible for anything that occurs; or else they should compensate us for removing.

2473. But you might keep moving for ever, in that case, might you not?—We should not mind doing it, if we were paid for it.

2474. You said that if certain cartridges were invented for powder they would be very much used but they have not the same power as dynamite, have they?—No; but I think that gunpowder, if properly confined in a good cartridge, would be a great deal more powerful than it is now.

2475. But not equal to dynamite, I suppose?—No, but I believe that Messrs. Curtis are bringing out a very much stronger powder; and with a better cartridge, gunpowder would compete with dynamite more than it does now, because dynamite is expensive.

2476. Do you think that if our railways were obliged to carry dynamite, it would diminish the price very much?—Yes.

Mr. Laird.

2477. With regard to this Liverpool case, you said that the captain was aware that the dynamite was on board?—I think he was; but he did not know that it was illegal.

2478. Did he know the cases it was in?—Captains, as you know, always leave the stowage of the cargo to the subordinates; I dare say he did not know; in fact, I do not know that any one found it out until they got into port.

2479. But if he had known which case it was in, he could himself have deceived the officers, could he not?—Yes, but it would not have been his object to do it, because the hammers were worth more than the dynamite.

2480. If you compelled magazines to be a certain distance from buildings, would not it be better to buy sufficient land at once, than have disputes afterwards?—Yes, a great deal better; we always do it where we can, but it is often difficult to buy land near the works, especially in collieries.

2481. The great difficulty is that so many small houses are built round about, is it not?—Yes.

2482. But it must come to that in the end, that you must either buy the houses or buy a great deal of land around?—Yes; I think it is absolutely necessary that there should be some regulation with regard to that, because the case which Major Majendie quoted would not have happened if the magazine had been in an exposed place and with

Mr. Laird—continued.

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Mr. McLagan.

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2488. Almost every witness who has come before us has said that there is a great risk of nitro-glycerine exuding from dynamite, and making it very dangerous to carry; are you aware of that?—I have always followed the rule of using it quickly, and I have not come across a case of exudation.

2489. Do you take any precaution (before removing it from the manufactory to your own place) to ascertain the quality of it?—No, I think the manufacturers ought to be bound by law to deliver all the explosive compounds according to specification, and if we detect anything wrong on referring it to an eminent chemist, the persons supplying it should be liable to a heavy penalty.

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Mr. McLagan—continued.

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2494. The purchaser and seller must look after themselves; but in a dangerous article like dynamite it is necessary to have an inspection to protect the public, is it not?—Yes; but not such an inspection as would involve seeing that every consignment was of good material, because that always levels itself. If we found a man sent a bad article we should go somewhere else.

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2499. Do you find it in mining operations quite as effective as dynamite?—In some cases we do; in limestone and coal it is as good as gunpowder, and better than dynamite. In mines it is as good as powder where the rock is very firm like granite, but it is not so good in jointy places; where the air can get to it, it fails.

2500. Do you complain of the want of facilities for the carriage of this explosive material, at present?—I am told that there is not so much difficulty at present, but there is only one place where you can get it, and it is very dear.

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Mr. Taylor.

Chairman—continued.

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the Committee?—Yes, I have collected several reports in writing with regard to the value of dynamite as against gunpowder. These reports are from my own miners, and other miners whom I have asked questions upon the subject.

2458. I suppose you concur in the results?—Yes, I concur in them so far that I find myself that those are not so good as my own experience, but I put that down to carelessness and want of knowledge of the new explosives; but the report, which I have here, and will hand in (*vide Appendix*), was made by an English engineer managing a mine in Prussia. His name is Mr. Darlington, and his present address is 2, Coleman-street Buildings. He uses Nobel's dynamite. He makes the relative cost of dynamite to gunpowder exactly one half; my own experience shows that that is, I may say, almost a moderate estimate; but the great value of dynamite to the miner is that we can do the work quicker than with gunpowder. There is another very important thing connected with mining, though it has nothing to do with this inquiry (I wish it had), that very good ventilation is required when nitro-glycerine compounds are used. They give off fumes which subject the men to very severe headaches.

Colonel North.

2459. Did I understand you to say that you brought your dynamite in a ship of your own from abroad?—No, it was brought from abroad, and transferred to my vessel at Bristol; it might have come to Aberystwith, but the vessel went round to Liverpool.

2460. Was the captain aware that there was dynamite on board?—Yes; but he was ignorant of the law.

2461. How was it packed; was it packed in the magazine of the ship?—No, it was in ordinary cases with the rest of the cargo.

2462. Who inspected the ship?—I do not know; but the authorities at Liverpool, I understand, have supreme power, and all vessels are boarded by the Custom House authorities.

2463. But how came they to take the steel hammers instead of the dynamite?—The dynamite was not marked as it should be; they simply knew that dynamite was on board.

2464. And they might, in fact, have thrown anything whatever overboard?—Yes, but I suppose the cases of the hammers resembled what they thought the dynamite might be packed in.

2465. You said that you bought a ton the other day; was that what came in your ship?—No, that was years ago when dynamite was hardly known in this country.

2466. Then there was no objection to your having that quantity, was there?—There was a law, until lately, that these nitro-glycerine explosives were only to be conveyed under severe restrictions, and it was under that law that it was intended to be thrown overboard.

2467. You think that there is no danger in the transmission of dynamite?—None whatever, if it is properly packed; but I should like to see air-tight cases.

2468. Take pudrolythe for example, how is that exploded; is it done with a cap?—No; almost every explosive will have more power with a cap, but pudrolythe does not require it; all that it requires is, that the air should be strictly

Colonel North—continued.

excluded from it; if there is a crack in the ground or the hole it loses its power.

2469. How do you explode it?—By confining it strictly from the air, and by tamping with a common fuse like gunpowder.

2470. Now with regard to buildings, you think that if people choose to come and build near, you think that the whole responsibility should rest on those who so choose to build?—I think that they ought either to give us another site or that they ought not to come there at all.

2471. Suppose a man builds a house near you, and there is an explosion, are you held responsible for it?—I am afraid that we are.

2472. You think that when an establishment is once placed in a certain locality, those who choose to come within a certain radius of the building ought to be responsible for anything that occurs?—Yes, they ought to be responsible for anything that occurs; or else they should compensate us for removing.

2473. But you might keep moving for ever, in that case, might you not?—We should not mind doing it, if we were paid for it.

2474. You said that if certain cartridges were invented for powder they would be very much used but they have not the same power as dynamite, have they?—No; but I think that gunpowder, if properly confined in a good cartridge, would be a great deal more powerful than it is now.

2475. But not equal to dynamite, I suppose?—No, but I believe that Messrs. Curtis are bringing out a very much stronger powder; and with a better cartridge, gunpowder would compete with dynamite more than it does now, because dynamite is expensive.

2476. Do you think that if our railways were obliged to carry dynamite, it would diminish the price very much?—Yes.

Mr. Laird.

2477. With regard to this Liverpool case, you said that the captain was aware that the dynamite was on board?—I think he was; but he did not know that it was illegal.

2478. Did he know the cases it was in?—Captains, as you know, always leave the stowage of the cargo to the subordinates; I dare say he did not know; in fact, I do not know that any one found it out until they got into port.

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Mr. M'Lagan—continued.

Mr. Taylor.

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2505. Take the Abergele accident where casks

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Mr. M'Lagan—continued.

2 June 1874.

of petroleum were broken, and it flowed down on the ground and was set fire to by cinders from the engine; suppose it had been whisky or brandy, would not the same thing have occurred?—No, I think not; because whisky or brandy would be so soon soaked up; at Abergele this stuff ran along the line as if it was running over glass; the spirits would have been very bad no doubt if it had run over the line, but the people would have been able to get away.

2506. There would be an explosion, however, in a case of that kind when the air became impregnated with vapours from such spirituous liquors, as much as from gunpowder, would there not?—I think not so much; I should fancy that they would so quickly mix with the air that it would not be so serious at all events; gunpowder is so very quick in exploding.

2507. Are you aware whether the railway companies have any particular rules about carrying spirits?—I believe that they charge rather dear for them.

2508. Would you not say that there is considerable risk in carrying spirits as well as carrying those explosives?—Yes, as a railway man, I would sooner carry dynamite than I would carry spirituous liquors.

2509. That is because you think dynamite would not explode, is it?—I think it would not explode, but it remains to be proved whether if several tons were put together they will explode, but small quantities will not explode.

Mr. Whitwell.

2510. Your answer to one of the honourable Members just now implied, I think, that gunpowder is a very dangerous article to be carried by railway?—I did not quite mean to say that; I think it is very dangerous in case there is any fire.

2511. Have you known any explosion of gunpowder in transit on any railway within your own experience?—No, I never have.

2512. Have you never had an explosion of dynamite in transit by railway?—No.

2513. But you know that dynamite will explode?—Yes.

2514. And if it was exploded under certain circumstances, on the railway, the explosion would be as great and as dangerous as that of gunpowder, would it not?—If it did explode it would be a great deal worse.

2515. You said that you could only get dynamite from one establishment in the country, I think?—Yes, I only know of one in this country.

2516. Do you know whether the quality of that dynamite is exactly the same as what you obtain abroad?—It is better.

2517. I suppose you do not wish for other dynamite establishments to be erected in England?—Yes, I do; I want to see some competition, because it is so dear.

2518. You think that if the railways would carry dynamite there would probably be some competition?—It depends on what could else be invented. I understand that this is under a patent now.

2519. I suppose you know that anyone can carry dynamite about who has a license for taking it?—Not in a railway train, I suppose.

2520. You do not know that two railway companies have got licenses already to convey dynamite?—Yes, I know that.

Mr. Whitwell—continued.

2521. Any other railway company that takes out a license may convey dynamite?—I suppose they can, but they do refuse to take it.

2522. They refuse to take it, because they consider it dangerous, I presume?—Yes.

2523. You would not ask Parliament to compel railway companies to take dynamite, would you?—Yes, I think I would; they are public carriers and they have got a monopoly over particular districts, and yet they will not carry it when Parliament says it is safe under certain conditions.

2524. Then if a railway were compelled to take dynamite against its will, and an explosion were to take place, to whom must the railway company look for compensation?—I am afraid that they would not have anyone to look to, and they must get another Act of Parliament passed for that purpose; but if dynamite is passed as safe along with gunpowder, the railway company ought to be made to carry it at certain rates, as they are made to carry coal.

2525. How many years experience have you had with dynamite?—The first time I used it would be about four years ago.

2526. For how many years have you or your predecessors used gunpowder; would you say 100 years?—Yes, I suppose that my grandfather used it nearly 100 years ago.

2527. Consequently the experience with regard to gunpowder is sufficiently long to satisfy us of its safety; but an article which has scarcely been carried by the railways at all, ought certainly to be proved to be harmless before it is carried, ought it not?—Yes; but I thought we had got as far as that with regard to dynamite.

2528. Are you aware that dynamite struck between two metal substances explodes?—Yes.

2529. In the case of a concussion on a railway, is it not probable that two pieces of metal might be brought into contact?—Yes, but that would explode gunpowder in the same way.

2530. Yes, if you get a spark; but is not the explosive quality of dynamite much greater than that of powder by mere contact between two materials?—Yes, no doubt it is four or five times as great.

2531. Are there not other incidents connected with dynamite that make it necessary to take peculiar care, such as uncertainty of temperature?—Yes, that I believe to be the fact.

2532. You say that you have most carefully used it immediately after it was put into your hands, lest any exudation should take place?—I have told my men to be careful, but what they actually do I do not know.

2533. But you understand that if it is kept a considerable time exudation may take place?—Yes, if it is in a moist atmosphere.

2534. Do you not know that dynamite is nothing but a certain preparation of nitro-glycerine?—Yes.

2535. If the nitro-glycerine should exude, is there a more dangerous article in the world than nitro-glycerine?—No.

2536. If it were to exude in transit, the danger would be far greater than that of carrying gunpowder, would it not?—Yes, far greater.

2537. You said that you think gunpowder is dangerous, because some of your men were killed; have no men been killed by dynamite?—Not in that way; I spoke of men being killed, as nearly all miners are killed, through not following

Mr. *Whitwell*—continued.

lowing out the instructions for tamping or boring out.

2538. Should you be surprised to hear that within the last 10 days two men were seriously hurt or killed by the leaving a little dynamite in the hole, and tamping with an iron rod in the same way as this illegal tamping with gunpowder goes on?—I have not heard that, but I can quite understand it if a man will use an iron bar.

2539. I believe you have stated that your experience of dynamite has been considerable?—As far as I could get it.

2540. How many tons of dynamite have you used?—I should think I have used rather over two tons.

2541. You spoke about serving out gunpowder to miners; I suppose you, in your works, have clerks who give out the gunpowder, and charge the miners with it?—Yes; we have storekeepers who serve the gunpowder out.

2542. Is it not the case with all the mine-owners that the clerk debits the miner with the amount of gunpowder that he consumes?—Yes.

2543. Consequently, the gunpowder is given out by the clerk?—Yes.

2544. And dynamite would be given out in the same way, I suppose?—Yes.

2545. Do not the miners still take gunpowder in barrels, and dynamite in their pockets, into the mines, and use it occasionally, as they want it?—Yes.

2546. Would not the miners be very much disappointed if they were limited to either?—I would not limit them.

2547. I was told the other day by a large mine-owner that the miners took a certain portion of dynamite, and a certain portion of gunpowder, both being served out of the same store by the same man, is that generally so?—Not with me; because the Act of Parliament says that you must not do it, but I should like to do it.

2548. You have stated that you think there is no additional risk in having the two things in one store?—Just so, if you do not leave the lids of the cases off.

2549. Is there not more risk in having two tons of gunpowder and 5 cwt. of dynamite than in having 4 tons of dynamite?—No, I think not.

2550. Referring to pudrolyth, you said you would not propose that the law should refer to that because we know nothing about it?—No, I should not; but I think there should be some clause in the proposed new Act which would cover all these explosives, because, as an honourable Member of this Committee said the other day, it is only within the last few years that these things have been known at all, and there have been so many of them brought out that I think any law passed now ought to be so framed as to cover all the new compounds.

2551. Would it not be better to deal with what we do know, and run the risk of having to amend our law, than to run the risk of dealing with articles like this, and perhaps go beyond our knowledge?—It is done now in some way; the Home Office has power to grant licenses; there is a company manufacturing some new powder, near Oswestry, I believe.

2552. Would you propose to mention pudrolyth in the new Act?—No, I would put it with everything else.

2553. With other explosive substances in a general category?—Yes.

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Mr. *Whitwell*—continued.

2554. Is pudrolyth used with tin cases?—Not to my knowledge.

2555. But you say that it explodes best when the air is excluded?—Yes.

2556. But you have not known it received in tin cases, have you?—No; but I propose that it should be so used in blasting.

2557. You propose, do you not, that a chemical analyst should be employed to test the quality of dynamite?—Yes, or any other nitro-glycerine explosive.

2558. On whom, in your opinion, should devolve the expense of such a test?—I think it ought to be as it is in France, that when a manufacturer is proved to be wrong he should pay for it.

2559. And that the fee should be paid by the user if it is found that the article is pure?—Yes.

2560. Seeing now that chemical analysts are appointed generally throughout the country, would not such men be sufficient for this purpose, or would you have men specially appointed by the Government?—I would say let the Home Secretary name some eminent men who would be trusted, and it would not happen very often.

2561. Now, with regard to explosive magazines, you propose that mine magazines should be built according to certain regulations?—Yes.

2262. And that the quantity of explosive material should be limited?—Yes.

2563. But that must vary very much with the demand for the explosive material from that magazine, must it not?—I generally find that the supply and demand level themselves; if there is a large demand, as for instance, at the Festiniog slate quarries there is always a large magazine close by somewhere under Government license, and, therefore, it is not necessary in each particular quarry or mine to keep a large quantity.

2564. Are there not some quarries situated almost by themselves where a large consumption takes place?—Yes; but that is an exceptional case if there is no magazine; I would always give people power in such cases to store for themselves.

2565. You distinguish between a miner's magazine and a dealer's magazine, or a manufacturer's magazine?—Yes, I separate them entirely.

2566. You would let the large manufacturer have a magazine on a large scale, who supplied you with the article?—Yes.

2567. And you would let the miner have his own magazine according to his wants?—Yes.

2568. But you propose that there should be some compensation in case of houses being brought into the neighbourhood of the magazine, but how could you regulate that?—If you work under a man's house you must build him a new house or pay him.

2569. Would you propose that when a magazine is put down in a particular locality a certain area, call it danger area, around it, should be tabooed from any building being placed upon it?—Yes.

2570. And that the area should be fixed when the magazine is built, according to the quantity of explosive material to be put in the magazine?—Yes.

2571. And that that limit should not be passed by anyone?—Yes, except at his own risk, or on his paying for the removal.

2572. That

Mr. *Taylor*.

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Mr. Taylor.

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Mr. Whitwell—continued.

2572. That would be a contract between the buyer and the seller, would it not?—Yes, otherwise there is no use in making a limit.

2573. Would you propose to pass a law, that anyone who came and built within the limit, should not obtain compensation for any damage which he suffered by an explosion?—Yes, otherwise the magazine owner has no protection.

2574. Are you aware of any neighbours being damaged by any explosion of any magazine of your own?—No, I never heard of a mine magazine exploding.

2575. Are we not then discussing that which to your own knowledge has never occurred?—It never did occur within my knowledge.

Mr. Whitelaw.

2576. You propose to keep dynamite and gunpowder together in the same mine magazine?—Yes.

2577. But you would not propose to keep the detonators in the same magazine, would you?—No, I would not.

2578. Where would you keep the detonators?—In the ordinary store room of the mine or quarry; there is no more danger in it than there is in the case of every sportsman who keeps his caps in his own sitting room; the explosion of them would not do any great injury.

2579. Did you read the account of the explosion of dynamite near Durham the other day?—Yes.

2580. Did not that arise because the detonators were in a place where they should not have been?—Reading the report in the "Times," I was not able to make it out, but I should think that it occurred, as all cases of the kind do occur, through sheer carelessness; I think that the detonators had no business to be so near the dynamite as they were.

2581. If you kept the gunpowder and the dynamite in the same magazine, you would not have two tons of one and two tons of the other, would you?—No; I propose that it should be two tons of gunpowder, and half-a-ton of dynamite; two tons is the present limit.

2582. Your answer implies that dynamite, if exposed to the air, is apt to give out nitroglycerine; do you state that of your own knowledge?—I have no experience of that.

2583. With regard to inspection and analysis by a chemist; Major Majendie suggests that there should be power given by Act of Parliament for a Government inspector to come to the works and take samples of the material; is not that enough, do you think?—I think it would be enough, but I did not know of that suggestion.

2584. Would you also desire that you should have the power to require the Government inspector to analyse and make reports?—No, I think that the former suggestion would be sufficient; I should then, as the inspector was passing round, or if I suspected anything, ask him to come and take samples.

2585. There is no hindrance at the present time to your employing a chemist to examine a dynamite supplied to you, is there?—No; but we can recover no penalty from the dealer.

2586. But you would discover whether the dynamite was good or not?—Yes.

2587. Then with regard to the short rules which you spoke of, have you read the short rules

Mr. Whitelaw—continued.

supplied by the British Dynamite Company?—Yes.

2588. Do you consider those rules suitable and sufficient?—They are very good rules for dynamite.

Mr. Knowles.

2589. Are you interested in any coal mining operations in Lancashire?—No; my father is connected with the Wigan Coal and Iron Company.

2590. You said it was usual for workmen to be supplied with powder by the mine owner from the magazine; is that general, do you think, since the passing of the last Mines Act?—Powder is supplied to the workmen by some one appointed by the mine owner. We deliver the explosives by regularly appointed men to the workmen.

2591. Do you think that that is general?—Yes, I do not see any other way of doing it; the workmen divide it among themselves afterwards. I am speaking of lead mines. In collieries I know that they buy it from shopkeepers and all kinds of people, and I do not think that that is a very safe way of doing it.

2592. Would it not be safer if they were to get it from storekeepers appointed under the supervision of some responsible person?—Yes, that would be a great deal more safe. Those shops are very often in the middle of a village, and the powder is given to them with the fuse. I have seen workmen going home with a can of powder, and smoking a pipe at the same time.

2593. You know that by the last Mines Act a collier is not allowed to take more than his day's consumption down in the mines?—Yes, four pounds; but there is no limit to the quantity he can take away and keep in his own house; he can buy 100 pounds if he pleases.

2594. Now, with regard to a man being killed in using loose gunpowder for blasting with iron and steel tamping rods; is that practice general now?—No, I am glad to say it is not now; but at the beginning of last year I issued a peremptory rule that no iron bar should be used in the mines. I thought they had always used tamping rods to a far greater extent than it was necessary, and that a strong oak bar would be quite as good as iron. I delivered two or three oak bars to each set of men in all the mines I have, and I found three months afterwards that the oak bars were all thrown away.

Chairman.

2595. And the steel ones resumed, I suppose?—Yes.

Mr. Knowles.

2596. Would not copper bars do?—I have since sent copper bars, but the men do not like them so much as iron.

Chairman.

2597. Are not the mine owners compelled by the Act of Parliament to see that no steel or iron is used in the mines?—Yes; they are bound to do that, and if any man is found using an iron bar he is to be prosecuted, but we cannot stop it; we do not make the bars, and we do not allow them to be carried into the mines.

2598. Do you get your dynamite in cartridge?—Yes, in cartridge.

2599. That is to say, with a cap in it, and a fuse

Chairman—continued.

fuse to it?—No; the caps and fuse are separate; dynamite is packed in cases, then there are primer cartridges, and the caps and fuse are all separate; we adjust the caps ourselves.

Mr. Knowles.

2600. In the event of the tamping rod cutting the fuse and damaging it, would it not be liable to fire it?—I am afraid that it would. I have no doubt of it.

2601. Would the injury in that case be any less than it would be with gunpowder?—It would be a great deal worse.

2602. Did you ever personally see a hole in a coal mine charged?—Yes.

2603. With loose powder?—I cannot say with loose powder.

2604. But with a cartridge?—Yes, with a cartridge.

2605. Did you ever see the effect of a blown-out shot with cartridge?—I cannot say that I have in a coal mine; my experience is chiefly in lead and copper mines.

2606. Of course under the present Mines Regulation Act a miner is not permitted to take loose powder into the mines; but there is a variety of opinion among practical men about that, the general impression being that loose powder is safer than cartridges; do you think it is so?—I dare say that might be so, but I understand that a man can take four pounds of powder into a mine in a tin case.

2607. In consequence of any irregularity in making a proper blast hole, if you put a cartridge in is it not liable to be stopped before it is close up to the end?—Yes, I think that causes accidents; that is, where boring machines help us.

2608. We know of the effect with a gun or cannon that is not charged to the breach, and the result here would be the same, I suppose?—Yes.

2609. And with regard to drilling out the powder, accidents have occurred from it when the shot has not exploded at first, I believe?—Yes; it is against the law to do so, but it is done every day, I believe; a man works on an average an hour and a half in a mine to bore a hole, and he can drill the powder out in 10 minutes.

2610. If the law is broken every day what is the use of the law?—I think it could be stopped by the inspector exercising his office more severely.

2611. Have you ever seen prickers used?—I saw a man doing it once, and I immediately went away.

2612. How long ago was that?—About three years ago.

2613. Is it not something very novel to see a pricker now?—They are used in some parts of North Wales.

2614. But if the law is broken so often as it has been under this Act there would be very little use in legislating afresh, would there?—Yes; I think the present Mines Act is doing a great deal of good by the inspectors coming round to see the mines.

2615. But if the Act of Parliament makes the owner responsible for not drilling out unexploded shots, how is the inspector to see to that?—By prosecuting the man.

2616. But it is not so, the onus of prosecution is thrown on the owner by the Act of Parliament?—Yes, but it is so difficult to catch them. I have never been able to catch them at it.

0.84.

Mr. Knowles—continued.

2617. But the owner has a staff of officials, has he not?—Yes, they have all got strict orders, but I do not know the facts of my own knowledge, and I cannot help believing that most Welshmen cannot read the rules, and therefore they have their own way in the matter.

2618. Does it require much reading to learn that they are not to drill out an unexploded shot?—No, they have been told over and over again; but they are in the mine, perhaps; no one sees them for hours; they work for eight hours, and the agent could hardly visit them more than once in that time.

Sir Henry Selwin-Ibbetson.

2619. I suppose, with regard to what you said about your license, you had to apply in the usual form for a license to store and keep nitro-glycerine preparations?—Yes, I applied on a printed form.

2620. Was it a form similar to that one (*handing a paper to the Witness*)?—I do not remember this particular form; perhaps I may have done this at the very beginning, but I think I applied on a white paper printed form, merely asking for a license.

2621. Was the license which you applied for for dynamite generally, or a special license?—I think it was a special license for each magazine; I have had several of them built.

2622. Let me call your attention to the second clause of that form of special license which I have handed you; was it filled up with any particular amount in figures?—I am not aware that it was.

2623. Will you supply a copy of your license?—I will; but I have several licenses.

2624. Are they general licenses or special licenses?—I think they are special ones; they are for ordinary mine magazines; I have magazines building now.

2625. In the general license there is a printed amount fixed, is there not, with regard to the quantity?—I do not remember any.

2626. But you cannot be sure whether your licenses are all special under that form, or whether they are general?—I cannot say; but I have made a rule not to store more than half a ton of dynamite at one place; I have never exceeded half a ton, but I do not know for what reason.

2627. But is it the fact that your license does not specify any amount at all?—I cannot recollect.

2628. Of course your attention has been called to the 23rd and 24th Victoria, the Gunpowder Act?—Yes.

2629. Do you remember the 15th section, which enables you to make rules for your servants and workmen for preventing accidents?—Yes, we have rules, but I am sorry to say that the Metalliferous Mines Rules are very antiquated, so far as I am concerned; I have been thinking of revising them on the basis of that Act, but I have not yet had time to do so.

2630. You know that you have power under the 16th section to apprehend your workmen when they transgress such rules?—I give them notice not to do so.

2631. And they are liable to be fined 5*l.*?—Yes, and the rules are posted up.

x 2

2632. Have

Mr. Taylor.

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Mr. Taylor.

Sir Henry Selwin-Ibbetson—continued.

2 June 1874.

2632. Have you ever enforced any of those fines against your workmen for the breach of those rules?—No, I have never been able to catch one.

2633. Suppose you made it a rule to carry out your wish that those iron bars or steel ones were to be excluded from your mine, and that the other modes which you suggested instead of them were to be used in future, could you not apply the penalty under the 16th section, and so enforce their being used?—Yes, no doubt.

2634. Might you not have done it in the instance to which we have referred?—Yes, but I only found it out almost accidentally; the oaken tools were being continually made, and not used.

2635. Do you mean to inform the Committee that your overlookers do not inspect sufficiently to be able to ascertain a breach of the rules?—I have told them over and over again to try and catch the men doing it, but they have not been able to do so; I do not think that it is anything like so bad as it has been, however.

2636. I believe that there are rules of a tolerably simple kind for gunpowder magazines, suggested by the Home Office, which can be applied for and obtained by any mine owner; is not that the fact?—Yes, I have printed rules in each magazine.

2637. Are they in the form of the copies (*handing papers to the Witness*) which I now show you, one for gunpowder and one for dynamite?—No, my rules are enormously long rules.

2638. Were you aware that there were such rules suggested by the Government inspector as those which I put before you?—I believe that these rules have not been yet finished.

2639. Will you look over them and see if they supply the difficulty which you mention with regard to simpler rules being required?—These rules are very much shorter than anything I have seen before, and more likely to be carried out; but the rules which I have now are set out on a kind of parchment, and they are as large as this table. You cannot get ordinary men properly to understand them.

2640. You are aware that under the present law there is no power to require any magazine owner to adopt those or any other rules; it is simply optional, is it not?—I do not know that.

2641. It is the fact that we have no power at the Home Office to enforce these rules, is it not?—As far as I am concerned I wish you had that power.

2642. You would see no objection to power being given to the inspectors to enforce rules of that kind?—As far as I can see here, I should like it.

2643. You think that those rules would be likely to be enforced with regard to your workmen, do you?—Yes, I wish it could be left with the inspector and not with the owner to prosecute the men; it is very awkward in this curious state of the labour market for a mine owner to prosecute any of his men.

2644. Have you used experimentally this new explosive called pudrolyth?—Yes.

2645. Have you used it to any extent?—No, not to any great extent; I have used about a ton of it, perhaps.

Sir Henry Selwin-Ibbetson—continued.

2646. Can you get it in this country?—Yes, some of it is brought over from Belgium.

2647. There is some made in this country, is there not?—Yes.

2648. Where is it manufactured?—It is not manufactured anywhere now in England because they cannot obtain a license.

2649. Have they applied for a license?—They have applied to the magistrates. I am connected with it; small trial quantities have been made, and applications were made at, I think, two places, but a license has not been obtained, and therefore the manufacture is stopped; one was in Shropshire and the other in Wales.

2650. It was manufactured to some extent at those two places, was it?—Only small quantities, for the purpose of trial.

2651. It was manufactured without a license?—Yes, like every other new powder, I suppose.

Chairman.

2652. That is to say as an experiment?—Yes, several experiments were tried with it.

Sir Henry Selwin-Ibbetson.

2653. You said that you would like the mine magazines to be under the charge of some responsible man in the mine; is it always the case, do you think, that there is a qualified storekeeper or clerk in those magazines?—Not in very small mines, but in moderate sized mines there is.

2654. Is that the case in the Northumberland mines?—Yes, I should say so.

2655. You are not aware that the magazines are all in charge of men that take it turn about for a month each, being mere common miners, and being ignorant of the explosive nature of the material?—No, I know that kind of thing is done in some places, and I should like to see it put a stop to.

2656. You would have to establish a new class of men, would you not, in such case?—I think in that case the overlooker should do it himself. If there are only six men at work there is almost always a head man who can read and write.

2657. You think that ought to be a part of any new Act of Parliament, do you?—Yes.

Mr. M'Lagan.

2658. I presume that the rules which you have about your works are rules for the general regulation of mines under the Mines Regulation Act?—Yes, but we had special rules with those licenses for dynamite magazines.

2659. I think you mentioned that if dynamite was placed on a piece of iron, and struck by another piece of iron, it would explode?—I have never tried it, but I think it would.

2660. We have it in the evidence of Major Beaumont, where he says, "Now there is a wide difference, of course, between that and such a blow as would arise, under any circumstances, in the case of a railway accident. I am aware that there were some trials made where, I believe, some cases of dynamite were put between the buffers of railway carriages, and the result of that was that the dynamite did not explode?"—Those might be wooden-ended buffers, and if they were I do not think it would explode.

2661. Mr. Downie was asked, at Question No. 1892, "At what temperature does dynamite explode?"

Mr. *McLagan*—continued.

plode?" and he answered, "At about 420 degrees it becomes very sensitive, and liable to explode at that heat, if it gets any knock;" and then at Question 1893, "There would be no danger in conveying it by railway, except it was subjected to a temperature above 400 degrees then?" and he replies, "I see no possible means of getting at that temperature in transporting it;" at Question 1894, he is asked, "You do not fear any explosions resulting from concussions, except at that temperature?" and the reply is, "I do not fear it even at that temperature, because you would then only scatter it about;" but I thought you stated it as your decided opinion that they would explode, and that the risk would be four or five times as great as gunpowder; is that not so?—I did not mean to say that, because I have never tried it; I should be very sorry to try it; what I meant was, that I thought it might explode if it was a case of striking iron against iron, as might occur in a railway accident, because I do not know what is to stop it, but I think it very improbable.

Mr. *Knowles*.

2662. You have stated that if some stronger kind of powder could be invented you thought it would be much better for the purpose of blasting, did you not?—I thought that we had made such great jumps within the last few years that something may be invented which may compete with dynamite, and so reduce the price of it.

2663. Have you any idea what would be the advantage of a stronger powder than even the present blasting powder for mining operations?—I think that is proved by dynamite; I think we can get on now with the work at half the price.

2664. Is not the ordinary sporting powder very much stronger than the ordinary blasting powder?—Yes.

2665. Why not use it then?—Because it is as dear as dynamite.

2666. You think that it is the high price which prohibits the use of it in this way?—Certainly.

2667. Do you think that it would do better for mining operations in consequence of being stronger?—I do not know that it would. In the first place it would have to be very carefully put up in cartridges; ordinary blasting powder is not

Mr. *Knowles*—continued.

strong enough for some work; it does not blow out the bottom of the holes, sinking pits, for instance.

2668. Do you think that sporting powder would be better for sinking pits?—No, I never tried it, but Messrs. Curtis & Company have promised to send me samples of stronger powder.

2669. But gunpowder, being a very old thing and a very common thing, how is it that we have not yet got something very much stronger?—We should never bring sporting powder to anything like the strength of dynamite, and we should have it at such a price as would keep it out of the market.

2670. But suppose we had something intermediate, say powder at 6 *d.* or 8 *d.* a pound, and double the strength of the ordinary blasting powder?—If we could get it at 1 *s.* a pound it would be a great benefit if it were two or three times stronger; but for some part of the operations dynamite is too strong, but I believe that No. 2 dynamite is better for some of the work, not being so strong.

Sir *Henry Selwin-Ibbetson*.

2671. Did I understand you to say that you had had rules supplied by the Home Office which you are forced by the Home Office to put up in your mine?—I do not recollect saying that, but I think they were sent to me with a request to put them up.

2672. Were not those conditions the conditions of your license and not rules?—No, I think I had the conditions of license as well.

2673. I am told that on your application you would be furnished with certain conditions, which conditions you would be requested to put up, but that no rules would be supplied because the Home Office have no power of doing it except on application; is not that so?—At all events I have got the rules; but the large printed document to which I have referred was perhaps the conditions under which the license was granted. But I should like to be bound to put up some simple rules.

2674. You would like to make that compulsory by Act of Parliament, would you?—Yes, something of the kind of rules which you have laid before me.

Mr. HENRY KITCHIN, called in; and Examined.

Chairman.

2675. You are Secretary to the Salter and Eskatt Park Mining Company (Limited), I believe, and Agent for the British Dynamite Company?—Yes.

2676. How many years have your mining company used dynamite?—About five years.

2677. Would you have any objection to tell the Committee how you came to interest yourself in dynamite?—About five years ago I found a strange, new explosive was coming secretly into our district, which the miners having once tried were clamorous to get more of, but which could not be easily procured by them. Finding this to be so, my company instituted a few experiments, that is to say, they tried in a general way to test its safety under various conditions; they threw it about in boxes; they put some on the buffers of waggons, which were brought into

Chairman—continued.

violent collision together; they set fire to it, and found that it burnt harmlessly away. A number of tests were gone through, and finding that it stood them all, and nobody else moving in the matter, I then considered it desirable to try to get a supply of this valuable mining explosive, and arranged with a number of companies to make up an order for a quantity, so as to meet the wants of the district. We made up five or six tons, which I arranged to get imported into Whitehaven, nearest to our Cumberland mines. The first consignment was brought openly in this way. After that the miners liked it so much that they naturally came to me to get more, and so it came about that, without intending it in any such way, I had to make a kind of arrangement for supplies of this stuff, and, naturally, when the British Dynamite Company came to make it

Mr. *Taylor*.

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Mr. *Kitchin*.

Mr. Kitchin.

Chairman—continued.

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here, they appointed me their agent, I having a business already made for them in the district.

2678. Whence did you import it from previously, before the British Dynamite Company commenced operations?—From Hamburg direct into Whitehaven.

2679. How much have you imported?—From Hamburg direct I should say we have imported about 40 tons; a little over 30 tons came into Whitehaven; we were forced to import a portion into Newcastle on account of freight to Whitehaven being not easy to get, but the difficulty was such that it had to be carted across the country, about 100 miles, in ordinary carts to our mines, and over a very difficult road, in the winter time. Since that time I have had 90 or 100 tons from the British Dynamite Company, making in all about 130 tons, and the miners would be very sorry to be without it.

2680. Do you consider that the use of dynamite has increased the output of hematite iron ore, and, if so, would you have any objection to tell the Committee in what way it has been done?—I am of opinion that the output of iron ore has been much increased by the use of this explosive, but as to the how, or the why, it is a matter of some difficulty, and not capable of being statistically proved; perhaps I may be allowed to explain it thus: the mining district of Cumberland and Furness, from whence come the best ores for the Bessemer process, now turn out between 2,000,000 and 3,000,000 tons of hematite iron ore per annum, which is got out of the limestone formation, in which great difficulties with water frequently prevail. Shafts are sunk to win this ore often through hard, wet, rocky ground. Before the introduction of dynamite it was found very difficult to sink those shafts, but since the introduction of dynamite they have been sunk very easily; some of our friends think that they could not possibly have sunk the shafts at all if it were not for dynamite; it is rather better in wet ground than dry ground; in wet ground it enables miners to get with ease ore that otherwise could hardly be got at all; my own opinion is that the use of dynamite has increased the productiveness of the district from 25 to 33 per cent. over what it could have been with any other mining explosive.

2681. Have you had many accidents in the handling, transport, or storage of dynamite?—As far as the handling is concerned, until it reaches the miners' hands I have not had a single accident; but there have been accidents arising, I am sorry to say, from carelessness on the part of the miners.

2682. Have you seen any cases of exudation of nitro-glycerine from the dynamite?—I have not; but I have sometimes noticed the cartridges damp or moist, to appearance, more especially those that we have had from Hamburg direct; the miners prefer it moist very much, but I have never seen anything like exudation, in the sense of anything liquid exuding from the cartridges.

2683. You are aware, are you not, that when there is exudation from nitro-glycerine there is considerable danger?—I should think so.

2684. Have you had any experience in the receiving, storing, and forwarding of blasting gunpowder?—Yes, I have; for some years I managed a powder agency in Whitehaven, and was well acquainted with the receiving, storing, and carrying of blasting powder.

Chairman—continued.

2685. Which do you consider the safer explosive to store and to carry, blasting powder or dynamite?—With the experience that I have had of dynamite I should say that dynamite is the safer explosive.

2686. Would you allow dynamite to be stored in mining districts, generally, along with blasting gunpowder in mine magazines?—Yes, but only for the convenience of miners in some cases; in the district over which I have control I have made my friends all conform to the Government regulations in the storing of dynamite, and make their stores 100 yards or more off the powder store; but when dynamite was first getting into more extensive use, it was generally stored along with gunpowder, I believe with the consent of the Government, and no harm came of it, but my own preference is for separate stores.

2687. From all your experience, do you consider dynamite as safe as gunpowder to transport and store?—Yes; I consider that dynamite is as safe as gunpowder to transport and store, speaking from my experience of both.

2688. Would you be in favour of compelling all carriers to grant facilities under proper regulations for the carriage of dynamite at equitable rates?—Yes, under proper regulations I would, for I consider the five years' experience we have now had of dynamite entitles it to be placed on an equal footing at least with gunpowder or any other known mining explosive; at present it labours under what I must call an unfair disadvantage in this respect, which, together with being hampered by the licensing conditions, makes the business very difficult.

2689. Have you any suggestions to offer in regard to dynamite licenses in any proposed new Explosives Act?—I am scarcely prepared with any specific suggestions; but from my reply to the last question, the Committee will gather my opinion is that dynamite (a thing used exclusively for industrial purposes) should now in any proposed new or supplementary Act of Parliament be put in all respects on an equitable footing with gunpowder; the experience we have had justifies us, I think, in asking for this, but how it is to be done I am not just at present prepared to say; practically, as things are now, there is found to be a great hardship in small miners not being able to get even a few pounds' weight of it without having a license. Speaking merely as a dealer in the article, I would say, in all fairness, let gunpowder be levelled up to dynamite, or let the dynamite be levelled down to gunpowder in any legislation that may ensue; the harm from both is practically about the same, as far as our experience goes.

Mr. M'Lagan.

2690. You have had considerable experience with dynamite; is dynamite, in your experience, apt to explode when brought in contact by a blow between two pieces of iron?—Yes, I should say that it is.

2691. That is to say, pure dynamite?—Yes, we have tried it all sorts of ways; between wood and iron, wood and stone, and so on, and it does not explode; but when it is brought in violent contact between iron and iron it does explode.

2692. Was it a great explosion which took place when you tried it between iron and iron?—No.

2693. What was the temperature at which it exploded



Mr. *M'Lagan*—continued.

exploded?—Just the ordinary temperature at which the cartridge is taken out by the miners.

2694. You think that more facilities should be offered to you by the railway companies?—Yes, that is one of the great drawbacks; in my district we have railway access, but in others they have none. I believe it is a great hardship to those who wish to use it; many would use it but for their inability to get it; in some cases, I dare say, it has to be taken secretly across the country.

2695. You think that it would be perfectly safe to carry it if proper precautions were taken?—Perfectly safe; the quantity I named just now was carried across the country in carts over very difficult roads.

Mr. *Whitwell*.

2696. Do I understand you to say positively that gunpowder and dynamite should be kept in separate magazines?—My own preference is to keep them in separate magazines, but to meet the exigencies of some mines where the distances are so near I would allow them to be kept under certain conditions together.

2697. But you propose to keep the detonators in separate stores?—Yes, in separate stores; certainly not in the dynamite stores.

2698. At some distance off, I suppose?—Yes.

2699. And also at some distance from the mine?—That would not matter so much; they might be kept in the general stores for that matter.

2700. How much gunpowder might be stored in a magazine, do you think; is two tons the proper quantity?—The general practice in our district is to have two tons at a time.

2701. Is that sufficient, do you think?—Quite sufficient for ordinary purposes; indeed, it is rather more.

2702. How much dynamite do you think it is safe to have in a separate magazine?—Say one ton, or as much less as the district might need.

2703. But one ton is the maximum for a mine magazine, is it?—Yes, one ton is the maximum.

Mr. *Knowles*.

2704. How long is it since you commenced using dynamite?—About five years.

2705. What are the effects of the fumes of it on the workpeople?—In workings such as we have them, the effect on the workmen is not what you might call deleterious; but in every mine there are some badly ventilated workings; in such workings dynamite has produced what is called miners' headache, which goes away after a little time; the miners have found out little remedies for it; in the Furness district they tamp the hole with lime, which makes the explosion innocuous, I am told.

2706. Has blasting powder the same effect?—To some extent, but not quite so much in badly ventilated workings.

2707. Do you use dynamite in blasting at all,

Mr. *Knowles*—continued.

or only in sinking shafts?—Its great value is in sinking shafts through wet ground, but it is very largely used in getting the ore as well; one proprietor in the district has got two one-ton magazines on the same estate, in order not to be out of stock.

2708. What is your opinion with regard to the advantage of storing strong blast powder over dynamite in mines?—I have not so much experience of fine blast powder in mines, except in the sense of its being used with straws instead of fuse; if by strong blast powder you mean powder that approximates to what is called sporting powder, I should think that stronger blast powder would be of more use than the present ordinary blast powder in some mines, but even that would not be near so useful as dynamite.

2709. How do you account for the fact that we have not attempted to use stronger blast powder, if it is better?—I cannot account for it, except that the ordinary powder has served the purpose in dry ground.

2710. Do you not think that strong blasting powder would be too quick for mining operations?—I have no experience of such powder for explosive purposes; with us it has only been used to fire the straws.

Mr. *Stanhope*.

2711. What is the longest time that you have ever kept dynamite in store before using it?—In a district store, which I have in West Cumberland, the stock gets cleared out once a month, or once in six weeks, but before the recent regulations, when it had to be taken direct to the consumers' stores, I believe some of the Hamburg dynamite has been kept in store nearly two years; I saw a cartridge which had been kept for nearly two years, and it looked nearly as well as it did at first.

2712. With no deterioration and no tendency to exude?—None.

2713. Have you found any special danger in dynamite which has been warmed up twice?—No, I cannot say that I have; but I am not a practical miner; such men have the best knowledge on that point.

Mr. *M'Lagan*.

2714. Suppose a railway accident to occur in which there is a case of dynamite, and the dynamite gets between the iron buffers of the trucks; in the dynamite that is struck by those buffers, do you think that there would be an explosion?—Yes.

2715. But would that explosion be communicated to the rest of the dynamite that was not struck?—I think it is probable, but that has not been proved by experiments to my knowledge, and I have no experience to enable me to answer this question conclusively; in the general course of things dynamite has been found equal to any ordinary emergency; it can be thrown about, in any way, in reason.

Mr. *JAMES TOY*, called in; and Examined.

Chairman.

2716. You are a practical miner, are you not?—Yes.

2717. You live at Whitehaven, I believe?—I live 10 miles out of Whitehaven.

2718. You are well acquainted with the process of blasting, are you not?—Yes.

0.84.

Chairman—continued.

2719. Have you had many accidents while blasting in mines with gunpowder or dynamite?—Sometimes with gunpowder, but none with dynamite.

2720. For how many years have you had practical experience in the use of dynamite?—I

Mr. *Kitchin*.

2 June 1874.

Mr. *Toy*.

Mr. Toy.

Chairman—continued.

2 June 1874. have had daily experience of it for about five years.

2721. Have you found blasting with dynamite, especially in badly ventilated workings, injurious to the health of the miners?—In fairly ventilated workings it is not injurious at all to the health of the miners, but in badly ventilated workings it sometimes produces headaches; but to prevent that they charge the bore holes the last thing before leaving off, and after firing them they leave the working till the next day.

2722. If left to their own free choice which explosive do the miners prefer to use?—They prefer to use dynamite in our district; formerly we used about two tons of gunpowder a month, but now we use about 1 cwt. a month.

2723. Dynamite, we understand, freezes in cold weather; what is the usual method in use at the mines for thawing it, when frozen?—The men generally put the charges in their breeches pocket, and by the time that the hole is ready for firing the dynamite is thawed. In frosty weather they use the warm water-pan supplied by the British Dynamite Company.

2724. Have any accidents occurred in the mines with which you are connected by the thawing or tempering of dynamite?—Not any.

2725. Suppose a miner using dynamite for the first time had to thaw it before putting it into the bore holes, could he safely do so by following the printed instructions?—When I first used dynamite I had no other instructions. If the printed instructions are strictly followed, I think an accident cannot occur.

2726. Do you think the men always carry out those instructions?—We have never had an accident yet; it cannot occur if they are properly carried out.

2727. Have you in your practice found dynamite cartridges that have been thawed or tempered exuding nitro-glycerine afterwards?—Not in all my experience of five years.

2728. Have you found damp cartridges unsafe to use, or have you had any accidents whatever, either in the stores or mines, arising from the exudation of nitro-glycerine from dynamite?—I have not found what are called damp cartridges unsafe to use; we rather prefer them soft, and I know of no accident from exudation.

Colonel North.

2729. How is the dynamite carried to you?—I do not know; we just go and get it.

2730. Is it carried in waggons or carts, or how do you get it?—It has been brought in carts from Newcastle; it comes 100 miles in carts, sometimes.

2731. In what quantities do you get it?—The cart generally brings about half a ton.

2732. And no accident of any kind has occurred?—None, that I know of.

Mr. M'Lagan.

2733. Do you find that the air is more polluted by the use of dynamite than of gunpowder?—No.

2734. You think that the dynamite does not pollute the air more than gunpowder?—No.

2735. And there is less danger in the use of dynamite than in that of gunpowder?—A great deal less.

2736. And the work is done at a less cost?—Yes.

Mr. M'Lagan—continued.

2737. There is less danger in the use of it, and less danger in the carriage of it?—Yes.

2738. You never knew of an accident at all occurring among your work in using dynamite?—Never.

2739. But from the use of gunpowder you have?—Yes, from the use of gunpowder I have.

2740. From the carelessness of the men, I suppose?—On one occasion I was re-drilling a hole, and I had left the hole an hour-and-a-half, and when I was re-drilling it the explosion took place.

2741. If you had used a copper wire it would not have happened, would it?—I do not know; it was very hard ground. Dynamite requires very little tamping; you can use water or clay, but with gunpowder you must dry it if it is moist.

2742. But rightly, in using gundowder, you do not require that hard tamping, do you?—Yes, you do with gunpowder; it has a tendency always to throw up; whereas dynamite does the contrary; it has a tendency to throw down; you require a hole to be filled 30 inches with gunpowder, while 22 would do for dynamite, which is eight inches saved. In wet ground it is very disheartening after boring all day to have nothing to show for it, and before you got dynamite you would have to do that. Many times I have worked all day, and never got it dry, and sometimes three or four hours. If you use dynamite you can work with confidence; you can charge five or six holes in a few minutes.

2743. Is your business very much interfered with by the regulations of railway companies, and the regulations of the Government, as to these explosives?—Yes; sometimes our stores get nearly out of dynamite. They keep it for the wettest places; on one occasion we got very short during the time, and the miners bored as many holes as possible, hoping that the dynamite would come every day; they begged me to go and fill a few holes with dynamite.

2744. Why did the dynamite not come?—I suppose the railways would not take it.

2745. Therefore, the railway companies interfere with your occupation, do they?—Yes; it is a great advantage to the miners to have dynamite, because they can do more work, and do it for less money.

Mr. Knowles.

2746. Have you had an explosion by drilling out shot that you have filled in?—Yes; just when I got down where the powder was it exploded.

2747. What was the boring instrument?—A steel drill.

2748. What exploded it, do you think?—Every time you strike the drill it cuts dry; in very hard ground it strikes fire, which ignites the powder.

2749. Did you ever miss a shot for dynamite?—It does not require drilling out; you can tamp it with clay or water, you can pull out the fuse, and put another cartridge in.

2750. But if the fuse runs part of the way, what then?—It always leaves a little substance behind; it is sufficient to pull it out, unless it is loose sand that we stamp it with; but in sinkings we hardly use any at all.

2751. In boring with a copper drill, would you have

Mr. Knowles—continued.

have had that accident which you referred to?—May be not, but I never saw a copper drill.

2752. Do you continue to drill with iron in Cumberland?—Yes, sometimes they do, but I believe it is against the Act of Parliament.

2753. Do not the masters insist on the men having copper drills?—No, not at present; there

Mr. Knowles—continued.

are copper stemmers there, but I have never re-bored since that accident.

Mr. Stanhope.

2754. Have you heard that dynamite which has been thawed several times becomes more dangerous?—No.

2755. You do not find that there is greater danger of exudation in that case?—No.

Mr. Toy.

2 June 1874.

Mr. THOMAS TOLLEY JONES, called in; and Examined.

Chairman.

2756. You are a partner in the firm of Jones, Scott, & Company, are you not?—Yes.

2757. Have you had considerable experience in the use or transport of explosives?—Not in the use of them, but in the sale, transport, and shipment of them.

2758. You have had experience in the export trade to Australia, I believe?—Yes, to Australia, and to various parts of the world.

2759. What are the precautions taken with regard to the shipment of gunpowder?—Gunpowder I do not know so much about; it is shipped in ordinary kegs; the wooden kegs are generally put in a dry part of the ship, covered with tarpaulins, and sometimes separated by bulkheads.

2760. What are the explosives which you have had most experience of?—Dynamite, lithofracteur; more lithofracteur than any other, but guncotton also.

2761. Have you exported much dynamite from this country?—Not a very great quantity: some few hundred cases; but we have shipped thousands of cases of lithofracteur from the Thames.

2762. Have you had experience in getting dynamite from Germany to foreign ports?—Yes, it generally comes from Germany here into the Thames, and is transferred to the port of shipping here on board a lighter, which is moored in a convenient part of the Thames, unless an export ship can be got at once (it is not every ship that will take it), and then it is run up alongside the export ship, and as she leaves the river it is put on board of her, and away she goes to sea.

2763. How is the lithofracteur packed as it comes from Germany?—It is packed in wooden boxes similar to those which I saw Mr. Downing exhibit the other day. The lithofracteur is packed in small boxes (*exhibiting a box*), and covered with black waterproof paper, which is also a non-conductor of heat.

2764. Where is the lithofracteur manufactured of which you speak?—It is manufactured by Messrs. Krebs and Company, of Cologne, about three miles from Cologne; they are the sole manufacturers of it.

2765. Is it a nitro-glycerine compound?—Yes.

2766. How is it conveyed from Cologne to the sea?—After being packed in those boxes they seal them and put them in a case lined with india-rubber, which is perfectly water-tight; they are all proved, and then it is sent by barge to Brielle, near Rotterdam; we send a schooner over generally, and they are transferred there and then, brought down to Thames Haven, and put into a lighter like the dynamite, and there they wait for the export ship.

2767. Do the Belgian and Prussian railways carry them?—The Belgian and German railways do not carry lithofracteur or dynamite, except in war or for their own use.

0.84.

Chairman—continued.

2768. Is lithofracteur used in this country?—Not at present; it would be very largely used if certain restrictions were removed which press heavily upon the trade.

2769. Is it used in the British Colonies?—Yes.

2770. Where do you ship it to?—We ship it to Australia, the East and West Indies, Africa, South America, the various Australian Colonies and New Zealand, and it was also in use by the Dutch in the late war in Sumatra.

2771. What are the restrictions of which you complain which prevents its use in Great Britain?—It is generally the operation of the Nitro-Glycerine Act of 1869, I think.

2772. Which acts more stringently on lithofracteur than on dynamite, you think?—Much more so.

2773. In what shape does it do that?—Several applications have been made for licenses both for export and for the manufacture here, and they have been generally refused by the Home Office.

2774. Is it the opinion of the Home Office that it is more dangerous than dynamite?—It may be so; but I think I could alter that opinion by the evidence I could give with regard to its safety in transport, and use all over the world; in the first place the first shipment of lithofracteur which we sent to Australia we shipped by the "Earl of Dalhousie," on the 30th October 1872, and that ship got to Melbourne on the 30th January 1873; she was 92 days at sea, and went through all the extremes of cold and heat.

2775. What was the amount shipped in that instance?—There were a hundred cases weighing 50 cwt., or 2½ tons; that was an experimental shipment, and before the ship left the Thames we had very great difficulty in getting freight; I went down with the captain of the ship and examined the lithofracteur in the river, and showed him its nature; he expressed surprise that such a harmless material should be worth the freight that we were prepared to pay; I had lit a cartridge on the taffrail of the ship, and it burnt harmlessly away; but on going away from the ship I thought it was only fair to show him the power of the article, so I put one of the detonators into a cartridge which is used for the purpose of exploding them and threw it into the water, and there was very soon a tremendous explosion; he altered his opinion then, but that did not prevent his taking it.

2776. Was this in the docks?—No, it was below Gravesend; he duly arrived in Melbourne, and this is his letter; it is dated the 31st January 1873,—“Dear Sir,—As you are aware, I examined the cases of lithofracteur before they were shipped on board my ship in October last,

Y

and

Mr. Jones.

Mr. Jones.

2 June 1874

Chairman—continued.

and I have again had some of them opened here this day, and I find the cartridges in just the same condition as when I first saw them in England. I do not consider, if proper care is taken, that lithofracteur is a dangerous cargo. I would much rather carry it than ordinary blasting powder, and should you have a shipment when I am again leaving London, I will be glad to treat with you as to freight.—I am, dear Sir, yours truly, *J. Henderson*, Captain of 'Earl Dalhousie.' I recommended my partner when it arrived to take a chemist, one of the best men that he could get at Melbourne, to examine it for our own satisfaction. We began it as quite a new thing for us, and I was anxious to use every possible care not to run into a dangerous trade, and this is the chemist's report, which I will also read to the Committee. "Government Analytical Laboratory, Melbourne, 4th February 1873.—In company with Mr. Scott, of the firm, Jones, Scott, & Co., I, on Friday last, paid a visit to the ship, 'Earl Dalhousie,' now lying in Hobson's Bay, for the purpose of inspecting a shipment of Krebs & Co.'s lithofracteur, just imported, and of reporting upon its condition. Two of the cases, taken at random and opened in the hold of the vessel, had all the appearance of being only just packed, being perfectly dry, and the contents perfectly free from stains of any kind, passing through the tropics not having had the slightest effect upon them; samples removed and examined at my laboratory proved to be in every way unexceptionable, resisting all ordinary methods of exploding them; ignited with a match, or dropped into a bright red fire, the stuff simply burns slowly away; struck with a heavy hammer, on a clean smooth anvil, it explodes with difficulty, and I have not succeeded in exploding it by any other means, even when mixed with other explosives, such as guncotton, and ignited, it refuses to explode. Lithofracteur, such as has been submitted to me, must be very safe to handle and to store, and quite free from the dangers attending the use of ordinary blasting powder. It possesses also the advantage of producing little or no smoke or noxious vapour during the use, a point of considerable importance in underground drives. As a dynamic agent it is said also to possess eight or nine times the power of blasting powder, and of being capable of being used in wet situations, all of which must insure its extensive use in mining.—Signed, *William Johnson*, Government Analytical Chemist." That is the report with regard to one of the first shipments. Now, I have a list of 30 or 40 shipments that went to different parts of the world, and all the reports upon them are of a very satisfactory kind. I have only thought it advisable to bring one other report before the notice of the Committee, which is a report on the last cargo, consisting of 500 cases.

2777. Shipped from what port to what port?—They came first of all from Germany to the River Thames, and they were transhipped there, and left the river on the 17th October last, and they arrived at Sydney on the 25th of January this year, after having been 100 days at sea; this is an extract of a letter from my partner, Mr. Scott, who went round from Melbourne to Sydney, a distance of 700 miles by sea, to meet the ship in order to send it on to Melbourne: "Report upon 500 cases of lithofracteur, shipped from Thames Haven, 17th October 1873, to Sydney, Australia, where it arrived 25th January

Chairman—continued.

1874 (100 days at sea). Extract from letter dated Sydney, New South Wales, 5th February 1874, from R. S. Scott, to Jones, Scott & Co., London: I enclose the memorandum from the captain of the 'Cleta,' who says he would like a full cargo of same goods at same price. Every case is in splendid order, dry and clean as when packed." Then there is Captain Whyter's report attached, which is as follows: "Sydney, 31st January 1874.—In October last I received on board my ship 500 cases, Messrs. Krebs Brothers & Co., lithofracteur, which I have delivered this day in good order and condition in Sydney Harbour, New South Wales. I have not experienced the least inconvenience from it in any way, and would much rather carry it than ordinary gunpowder; at any future time I will be happy to negotiate with you respecting future shipments." I had a telegram from my partner applying to 450 cases which were transhipped to Melbourne, and arrived therein due time "'Cleta' shipment has been transhipped and delivered at Melbourne all right;" this telegram was followed by a letter which I got from my partner, Mr. Scott, on the 14th May last, a fortnight ago: "We have had the 'Cleta' shipment well distributed over Victoria, and there is now a demand in places where we never before sold;" this lot was transhipped no less than eight times, from the time that it left the factory before it reached Melbourne.

2778. Can you give the Committee any information with reference to the mode of manufacturing lithofracteur and its composition?—I have seen it made, and I know that it contains about 55 to 60 per cent. of nitre-glycerine, and the remainder is made up of mineral substances and absorbent earths.

2779. Do you know what those earths and mineral substances are?—I do not know the exact composition.

2780. Nor the process of manufacture, I suppose?—No; but I believe it is similar to the process in the manufacture of dynamite; the nitro-glycerine is first manufactured, and then it is gradually mixed and absorbed by those absorbents.

2781. You have no practical experience in the use of it yourself, have you?—No, but I have seen many experiments made with it, and I have carried out some of them myself.

2782. Have you ever received parcels of it by railway?—No, but we have had it come down the river and then by sea.

Colonel North.

2783. Can you send it by railway in this country?—No.

Mr. M'Lagan.

2784. Is the carriage of lithofracteur absolutely prohibited in this country?—I believe so.

2785. Does not that arise from experiments which were made at Woolwich, about 18 months ago, when it was found very dangerous?—I am not aware of that.

2786. Have you seen the report with reference to the experiments which were made with it at Woolwich?—I have seen some report, but I cannot say whether that is the one.

2787. It was reported upon unfavourably, was it not?—There was an unfavourable report, I believe.

2788. And that is why the carriage of it is prohibited

Mr. *M'Lagan*—continued.

prohibited in this country at present, is it not?—I am not prepared to say.

2789. We have it in the evidence of Dr. Dupré that it is far more complicated in composition than dynamite, and that it contains nitrate of baryta, which makes it more dangerous and far more liable to explosion than dynamite?—From all the reports I have seen it arrives in a better condition than any other explosive that we ship; I believe that it is a very difficult matter to analyse those compounds; I have seen a report which differed very materially from Dr. Dupré's analysis.

2790. Dr. Dupré, on the 11th May, said before the Committee, "I do not think dynamite is quite as dangerous, because the lithofracteur is a much more complex compound, and is much more liable to be affected by variations in temperature or moisture of the atmosphere;" what should you say with regard to that?—My experience is quite the opposite to that; I believe, myself, that it is not so liable to be affected by variations of temperature as dynamite, if our experience in sending it all over the world is to be relied upon; I have shipped both; I am not interested to the extent of one penny in the manufacture of either; I think if they found that lithofracteur arrived in bad condition we should soon have no more orders; but we ship guncotton, lithofracteur, and dynamite to the same markets, and we receive repeated orders for lithofracteur, whereas the other orders have been countermanded.

2791. Would you consider that lithofracteur, which exuded nitro-glycerine freely at a natural temperature, would be safe to carry in a ship?—It all depends on what is meant by exudation; if any nitro-glycerine compound exudes glycerine out of the original packages it would be dangerous; but if by exudation you simply mean that just inside the paper cartridges it becomes moistened by nitro-glycerine, I do not think there is any danger in that.

2792. I believe that the Committee which was appointed to examine into lithofracteur at Woolwich decided to reject it for the simple reason that it exuded nitro-glycerine at a temperature varying from 90 to 100 degrees?—I have a report from an eminent chemist in Melbourne, who tested it after a voyage, and he found that it would stand a temperature of 212 without exuding.

2793. "The test for exudation when exposed to heat resulted in the nitro-glycerine exuding freely, showing thereby that the substance contained a greater quantity of explosive oil than it could contain." That is part of the report in question; have you seen it?—I think not; but I saw an account of some experiments with lithofracteur which I did not consider could be ever borne out in actual experience; the experiments I saw were placing the cartridge in an oven, and I think the dry heat of the oven would have much more effect upon it than the natural atmosphere has. The cartridges were put up-ended in glass beakers, and then placed in the oven. Now, with any substance, the effect of heat would be to unfurl the ends, and the specific gravity of nitro-glycerine being so great, no doubt it would be possible that under those circumstances the nitro-glycerine would exude, but

Mr. *M'Lagan*—continued.

not when the article was packed very close in one of the boxes.

2794. Have you always found lithofracteur of different samples in a uniform condition?—As far as I am a judge, and I have examined a great many of them, I have always found it uniform, and we have always had uniform reports.

2795. One complaint made by the Committee was that they found that the samples differed very much in composition; are you aware of that?—Yes, I mentioned that to Mr. Engels, one of the partners in the factory, and he explained it to me in this way: that they had taken very great pains in making samples of lithofracteur which should stand certain tests which they thought would be applied by the Woolwich Committee, but these tests were varied to a great extent; tests were applied which were never dreamt of, and in that way the samples supplied to the War Office varied, though I believe that the general manufacture was carried on as it originally was; at least, we have had no report of variable results from the Australian mines.

Mr. *Whitwell*.

2796. How much have you exported altogether to Australia?—I think it is something like, in shipments and re-shipments, about 6,000 cases in connection with the Australian trade.

2797. With regard to the re-shipments, what are they; cannot you give me the simple quantity shipped from this country?—3,000 or 4,000 cases, I think.

2798. What weight would that be?—The 4,000 cases would be about 100 tons.

2799. At what price free on board?—The price here is about the same as for dynamite; I think 1 s. 9 d. a pound.

2800. That is the wholesale selling price, is it?—Yes.

2801. Did you insure it to Australia?—We insured it against the ordinary perils of the sea, but every policy contains a clause exempting the insurers against spontaneous combustion.

2802. What freight do you pay?—The freight has been about 10 l. a ton.

2803. Did you pay 10 l. a ton as freight on those articles?—Yes, we have paid 10 l. a ton as freight; we have paid more than 10 l. a ton, and we have paid less than 10 l. a ton.

2804. Will you be kind enough to give me the maximum which you may have paid?—The highest freight we paid was for the first lot, I forget exactly.

2805. Was it not a large sum?—It was about 10 s. a case.

2806. Then what could you contract for, do you think, for a quantity to be exported to Sydney or to Melbourne?—We could now send it for about 4 s. a case.

2807. How much is that per ton?—About 5 l. a ton to 5 l. 10 s. a ton; we pay the freight by measurement, of course.

Mr. *Whitelaw*.

2808. Can you state to the Committee the explosive power of lithofracteur, as compared with that of gunpowder?—I believe that it is six or seven times more powerful than gunpowder.

Mr. *Jones*.

2 June 1874.

Friday, 5th June 1874.

MEMBERS PRESENT:

Mr. Dillwyn.  
Sir John C. D. Hay.  
Mr. Knowles.  
Mr. M'Lagan.  
Colonel North.

Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Vivian.  
Mr. Whitwell.

VICE ADMIRAL THE RIGHT HON. SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

MR. ORLANDO WEBB, called in; and Examined.

*Chairman.*

Mr.  
O. Webb.  
5 June 1874.

2809. You are Director of the Glyn Rhonwy Slate Company?—Yes.

2810. You have had considerable experience in the importing of nitro-glycerine and dynamite, and also in the transport, use, and storage of them?—Yes; as an importer and user in connection with quarries. In 1865, nitro-glycerine was first introduced to my notice at the Glyn Rhonwy quarries by the agent of Mr. Nobel. We used it for some time, and found it a very valuable explosive. I now speak of nitro-glycerine pure and simple, and we conceived that it was very safe to use. We had a supply, and we obtained a further supply from London; that was sent down to Carnarvon by railway, and from Carnarvon station to Llanberis; it came out in a cart without any springs, and with a fast-trotting horse; and it was safely delivered at our works. We used it, and we found that we could get no more, and consequently we sent over to Hamburgh, and a consignment of 10 tons was sent. Messrs. Nobel and Company were under the impression that they had orders on their books for that quantity. They found they had not orders for anything like that amount, and the consequence was that they induced me to become the purchaser of that cargo. That was my commencement as a trader in nitro-glycerine.

2811. Will you be kind enough to state to the Committee how that nitro-glycerine was packed and carried?—It was packed in tin cans, which were enclosed in wooden cases; and between the tin cans and wooden cases, at that time, they inserted a light infusorial earth called Kisselghur. I believe it is the same that they now use for the purpose of making dynamite. Subsequently to that, and down to the last importation that I had, the tin cans were enclosed in wicker-work, which fitted on to the tin cans, and then they had straw placed between the wicker-work and the wooden case, and the wooden case of one-inch deal was fastened down with nails. That was shipped from Hamburgh to Llanberis, that is to say, to Carnarvon, and from Carnarvon it was carried to Llanberis in ordinary carts. We continued to import nitro-glycerine in that way until June 1869, and in June 1869 we imported a cargo. The weather was extremely hot; it was one of the hottest days of that year 1869, namely,

*Chairman—continued.*

the 30th June. We had made arrangements for the carriage of three-quarters of a ton to Llanberis.

2812. What was the capacity of the cans?—They were seven inches square by thirteen inches long, and they were strongly soldered; those tin cans contained 28 lbs. of nitro-glycerine, but they were capable of containing considerably more; they were left only partly filled in order that they might collapse or otherwise, according to circumstances. In June 1869 we had made arrangements for our own carters to go down to fetch this three-quarters of a ton from Carnarvon, but owing to the non-delivery of a letter through the post, it remained on the boats in the straits exposed to the heat of the sun for four or five hours; it was, I think I may say, par-boiled; in that state it was put on the carts to be taken to Llanberis. The carter whom we engaged on that occasion was a stranger; we cautioned him very strongly to be very careful that no case was allowed to fall from the cart; I told him that if a case did fall from the cart it would be death to him. They packed the whole of it, with the exception of a single case, very carefully, but a single case they placed on a board in front of the cart over the horse, and in going down a hill at Cwm-y-glo that case slipped off and fell, and an explosion ensued.

2813. And everybody was killed, I believe?—The carters were killed.

2814. And the horses?—Yes, and the horses; in the whole five persons were killed, I am sorry to say. Now with regard to that accident, I may say that, from the extreme heat the nitro-glycerine had been exposed to for a long time, there is no question that it was extremely sensitive; I felt that at the time, and that made me personally give the instructions which I gave; if those instructions had been carried out, I have no hesitation in saying that the explosion would not have occurred. Some reference has been made before the Committee, I understand, with regard to the leakage of nitro-glycerine. When we first imported it, the tins in which it was packed were made very thin indeed, and when they came to be exposed for a length of time, as it did sometimes occur in those voyages for months, the salt water rusted the tins, and the consequence was that leakage to a very considerable extent took place; and

Chairman—continued.

and I have seen carts coming to our works, when for miles before there had been running streams of nitro-glycerine, but inasmuch as the carts had straw in them between the cases and the cart itself, there was no explosion; nothing of the kind. Nitro-glycerine if exposed to a severe blow from a hammer on an anvil, or between two pieces of iron, will unquestionably explode; but if struck upon wood it will not explode in the ordinary course of things. I think there is a great mistake made with reference to the dangerous character of nitro-glycerine itself; it is not really so dangerous as is generally supposed, for if it can avoid exploding, it will do so; if you bring it to book between iron and iron, or if you explode a percussion cap in it, then it will unquestionably explode; but if it comes in contact with sand or earth, and it has any mode of getting away, it will get away without an explosion; I have tried it over and over again, and when I have spilt it on the ground, I have put my foot on it, and trodden it into the ground in that way.

2815. I suppose you mean that you have done that safely at a certain temperature?—At any temperature; I never knew anything approaching to an explosion; I have been guilty of acts of imprudence; I once took from Llanberis to Cannes in the south of France, 10 lbs. of nitro-glycerine in my pocket; I there fired 8 lbs., and brought back 2 lbs. to Llanberis.

2816. Was that liquid nitro-glycerine?—Yes, liquid nitro-glycerine; I mention that to show that I have extreme confidence in it, after considerable practical experience.

2817. Do you mean to say that you travelled in a railway carriage with other passengers with 10 lbs. of nitro-glycerine in your pocket?—Yes, I was travelling in a railway carriage with other passengers. I daresay, if the truth were known, few persons—I think I may say none in this room—have not travelled in the same carriage with explosive substances. The law, and the arrangements of the railway companies, have helped to bring about this state of things; they will not carry it openly, and therefore it is obliged to be carried secretly. Now, with regard to nitro-glycerine proper: some accidents have taken place which have led me to feel that it is a great deal better to fall back on dynamite, in which I have the greatest confidence, and with which, with ordinary care, no accident can take place. With regard to nitro-glycerine itself, again, there have been mistakes made with reference to the decomposition of it and its spontaneous combustion. There was the case of the "European," which was blown up at Colon; and there was an action tried at Liverpool with reference to that explosion. Scientific evidence was produced to show that the explosion might have arisen after decomposition, and from spontaneous combustion. The evidence given on that trial was conclusive to my mind, from my experience of nitro-glycerine, that it could not have been so; that it must have arisen from a single case having been hoisted carelessly out of the vessel, and from positive concussion. After the trial was over, I stated that opinion to the solicitor for the plaintiff in the cause, and that I placed not the slightest reliance on the scientific evidence that had been given; and the attorney in the cause told me I was quite right, and that the circumstance had arisen from the cause I stated, and not from spontaneous combustion; but inas-

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much as it was utterly impossible to prove it, the witness who had seen it having since died, they had filled up the vacuum by producing scientific evidence to show that it might have taken place from spontaneous combustion. At the time of the passing of the Nitro-glycerine Act, in the year 1869, I had about a ton and a half of nitro-glycerine in my possession.

2818. Was that in the town of Carnarvon?—No, not in the town of Carnarvon; it was in a wonderfully safe place on the Menai Straits near the entrance, on a strip of land there called Abermenai, where there was no house near; so safe was it, indeed, that although the Act of Parliament directed the late Home Secretary to regulate and restrict the storage and carriage of it; he went farther, and prohibited the moving of it; acted against the law, in fact; he would not allow me to remove it for more than two years; eventually he did agree to it, provided Mr. Nobel would come over from the Continent and superintend the carriage of it. Mr. Nobel kindly came, and we put part of it into a van and the other part into an omnibus, and Mr. Nobel rode in the omnibus to Llanberis with it, and it was delivered safely. That nitro-glycerine is now being manufactured into dynamite; I have in my pocket a cartridge of dynamite made within the last few days from that nitro-glycerine (*producing a small packet*). Now, it is the fact that that nitro-glycerine, having been imported in June 1869, is at present in a perfectly good state; I have tested it myself, and the men whom I have brought over from Hanburgh for the purpose of making these cartridges pronounce it to be in excellent condition; this is one of the cartridges, and I think if any scientific gentleman were to examine it, he would find it to be as good a cartridge as could possibly be.

2819. Has it been subjected to many changes of temperature?—Yes, it has been in a frozen state, and partly in a frozen state, and we have been obliged to thaw it. It has also been exposed to extreme heat on sandy ground in the summer, and extreme cold in the winter; there is no more exposed situation than that is. At one time, indeed, it was believed that it would be washed away, for part of the ground was actually washed away. The house fell partly on one side, with a ton and a-half of nitro-glycerine in it. I have spoken hitherto of nitro-glycerine pure and simple. This is a dynamite cartridge (*producing a cartridge*), made from the nitro-glycerine imported in 1869, and it is made within the last week with ordinary kisselguhr brought over for the purpose. Now, in the year 1867, Mr. Nobel first supplied me with a small quantity of dynamite. At that time it was brought over in small barrels, very like ordinary gunpowder barrels, containing 10, 15, and 25 lbs. weight of dynamite. It was not made up into cartridges; it was simply in a state of powder. We found a difficulty in getting it down the bore-holes, and eventually in the year 1868, we made it into cartridges of this kind, and since then we have found that it is a most valuable, safe, and useful explosive. I believe it is, in fact, one of the most powerful, and at the same time by far the safest explosive known at the present time. I scarcely know how to illustrate that, but I may mention that I have been the sole importer, and knowing, I believe, of every accident that has occurred in connection with dynamite since its importation, I have never

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heard or known any single accident arising from the transport or storage of dynamite. In fact, I am quite confident that none has taken place. I understand that some evidence has been given before this Committee, tending to show that nitro-glycerine has exuded, or may exude, from cartridges, which may be productive, and in some cases has been productive, of accidents. Now I say distinctly that nothing of the kind has ever taken place. I do not mean to say that on no occasion has nitro-glycerine been exuded from a cartridge. I have myself known it to be so; but then that has not been in the ordinary way of trade, or the ordinary mode of carriage, or of dealing with it. I have exposed both gunpowder and dynamite in places of ordinary temperature, but very damp, intentionally damp, and the result has been this: the gunpowder has dissolved, and become a black muddy substance, something like ink, at the bottom of an inkstand. In the case of dynamite, the paper has become pulpy, while the dynamite has been perfectly soft, not at all like what I have in my hand, but perfectly soft; and the water which has accumulated from the extreme dampness which has come in connection with it has exuded from it; and inasmuch as nitro-glycerine is very much heavier than water, the nitro-glycerine has separated itself from the rest, and has leaked out at the bottom; but that has only been after exposure for a very considerable time to very great dampness, equal almost to a vapour-bath, or something of that kind. But for ordinary purposes, for carriage and storage, I have never seen anything approaching to exudation to complain of. If you take a cartridge of this kind, and expose it to extreme heat for a length of time, you may find that the inside of the paper appears to have a little exudation upon it, but that is perfectly immaterial; if I was to use it, I should greatly prefer using it in that state. I believe it to be as safe as that which I now hold in my hand, which is dry; and for use and for power, the mere fact of its being so warm is desirable and useful. I understand that some gentlemen have been before you who have referred to two cases in which they thought that some accident has arisen from the exuding of nitro-glycerine from the cartridges. One was at Cwm-y-glo, and the other was supposed to be at Festiniog; but nothing of the kind ever took place at Festiniog; I state that distinctly; and nothing of the kind ever took place at Cwm-y-glo. The Cwm-y-glo explosion is the one which I have just now mentioned, which occurred in the year 1869. A gentleman referred to something as having taken place within the last few months, when he stated that the station office at Cwm-y-glo was damaged. Now, it is really a mere fiction to say the station office was damaged from any explosion since 1869; the explosion which occurred in 1869 was about 150 yards from the station itself, and the station was damaged, as I very well know, because I had to pay the damage. Then, with regard to the other case at Festiniog, nothing of the kind has taken place. An accident did take place in 1867, at Pen-yr-Orsedd quarries, and from the description, I have no doubt it is what they alluded to. It was before dynamite was introduced into this country; it arose from nitro-glycerine, in this way: a quantity of nitro-glycerine had been sent to Carnarvon, and there put into an iron truck belonging to the Pen-yr-Orsedd quarries at Nantlle. It was

*Chairman*—continued.

carried there, and when they took it out, the men observed that at the bottom of the railway truck, which was iron, there was a quantity of liquid nitro-glycerine which had exuded from the cases (this was in the year 1867, before dynamite was introduced into the kingdom), and a man took a large piece of slate, and scraped out the nitro-glycerine as well as he could with the piece of slate, and he then threw the slate up into the air; it fell down again into the wagon, on the liquid nitro-glycerine; the blow that the nitro-glycerine received, being on iron, and from the slate, occasioned the explosion, and the effect of the explosion was to destroy the wagon; it was an iron wagon of about the size of this table, and the wheels of the truck stood up above the bottom of the sides of the wagon, and the force of the explosion was such, that the sides of the wagon were blown off, and the shape of the wheel was punched out of them. I heard evidence to this effect given on oath, at the trial relating to the "European," at Liverpool; since then, knowing that I was coming up here, I have communicated with Mr. Darbishire, the owner of the quarry, and he has confirmed what was stated at the trial, and has told me it was quite a mistake to suppose that any explosion ever occurred from exudation of nitro-glycerine dynamite, as far as he knows, or arising in any sense from dynamite. Nothing of the kind ever happened. Now, with regard to the carriage of dynamite, I may say, as the sole importer from the year 1868, when it was introduced, to the year 1872, when the British Dynamite Company began to manufacture it, I was connected with the transport of every case of dynamite throughout the country, and that I know of my own positive knowledge that no accident of any kind ever occurred. It was stated in the House of Commons (when Mr. Hill brought forward his motion for a Select Committee last year) by Sir Henry Storks, that he understood some dynamite had been sent by railway, consigned as slate, and that a case fell from the truck and exploded. Now I know exactly what has been sent, consigned as slate; and I know exactly what has been sent in other ways; and I know distinctly that nothing of the kind ever took place. I afterwards communicated with Sir Henry Storks, and he referred to the case, and told me that the foundation of the story was some that I myself had sent. Now I know that every case which I sent was duly delivered, and I have been paid for it.

*Mr. Whitwell.*

2820. You have sent dynamite consigned as slate, have you?—Yes; the railway companies refused to carry it, and therefore parties were obliged to send it as they could. I know that very considerable quantities of dynamite have been transmitted by railway, consigned as slate; it has met with all the treatment which slate, I apprehend, was likely to meet with, but there has never been an explosion. I may say this, that I would not have ventured for one moment to do that, or have connived in its being done, unless I was quite confident that no accident could by any possibility occur.

*Chairman.*

2821. Have any slate trains suffered by any accident from dynamite?—None whatever; there has been no accident whatever arising from the transport



*Chairman*—continued.

transport of it. I may state this also. I have carted this stuff, finding the difficulties of sending it by railway. I have been obliged to cart it in ordinary carts all over the country. I have sent half a ton at a time in a cart without springs from Llanberis to Swansea, to Clifton, to Cardiff, and to Sandwell Park—very considerable distances, upwards of 100 miles—also to Newport, Bolton, Burnley, and Cannock Chase. I do not now recollect any more places of so great a distance from Llanberis, but from Llanberis we have carted large quantities shorter distances; indeed, every pound of dynamite that has been imported, up to the end of 1872, into this country, has come down either to Newcastle or to Carnarvon; the great bulk of it came to Carnarvon, and also to Falmouth, and from each of those places it has been carted in common ordinary carts, a distance of about 10 miles, to the stores; so that it has all gone through that process: but besides that, we have been obliged to cart to the places I have mentioned. Now, a great number of tons we imported to Newcastle, and from Newcastle we have carted it across the country to Whitehaven, for we found that the saving of time and cost was considerable by taking that course, rather than shipping it direct to Carnarvon. On one occasion a cart containing dynamite was run into by another cart; the dynamite cart came to grief; it was disabled, and we got another conveyance, but the dynamite itself was uninjured; there was no explosion, or anything of the kind. I may perhaps state in addition the different degrees of danger which, in my opinion, arise from the carriage of different articles of commerce. Now, I may put it in two ways. If I had to sail in a vessel from here to Australia, or round the world, or if I had to insure a vessel for that distance, and was obliged to go in one charged or loaded with either of the following articles, I should treat them in this rotation. If one contained gunpowder, and another dynamite, a third gun-cotton, a fourth petroleum, a fifth coal, a sixth jute, and another cotton, I should prefer travelling in or insuring the one that contained dynamite; the next I would prefer travelling in would be the one with gun-cotton; the third would be the gunpowder; the fourth would be the petroleum, then cotton, then jute, and then coal. I believe coal to be the most dangerous article for carrying in any quantity.

*Mr. Stevenson.*

2822. Do you speak of whole cargoes in each case?—Yes, I speak of whole cargoes.

*Chairman.*

2823. The introduction of dynamite has relieved you from the necessity of transporting or selling nitro-glycerine pure and simple at all now, has it not?—I have been relieved in another way. I have been relieved by Act of Parliament, for the late Home Secretary, Mr. Bruce, refused to give me a license under any circumstances.

2824. I gather from your evidence that you consider the form of dynamite is so safe that you prefer it, and you have no reason to wish for anything better?—No; of course there are cases in which I should prefer nitro-glycerine pure, but I may say, that for all ordinary practical purposes, unquestionably dynamite has the preference.

2825. Have you any desire to see the law re-  
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*Chairman*—continued.

laxed with reference to nitro-glycerine?—No, I see no such reason, except that I desire the law to be carried out fairly and reasonably, but I hold that under the administration of the late Home Secretary it was not so carried out. The law was set at defiance.

2826. I suppose you admit that on both sides that was the case?—Yes, on both sides that was the case; one produced the other.

*Colonel North.*

2827. With regard to nitro-glycerine exploding between two pieces of iron, it appears that anything will do it, does it not, for you mentioned a slate which fell upon it and exploded it, did you not?—It is not necessarily between two pieces of iron, but slate is an article which is almost impervious to water or to oil. It would come down flat and heavy, and it would be very much the same thing as iron, marble or stone.

2828. But I suppose a heavy block of wood, which was twice the weight of the slate, would have exploded it?—I think it is very doubtful, being on iron; in all probability it would, but much would depend on the temperature of the atmosphere.

2829. Was it nitro-glycerine which you sent as slate?—No.

2830. Was it dynamite?—Yes, dynamite.

2831. You did not pack it in any particular way; you think it is so safe that you packed it like anything else?—Yes, in the ordinary way in which dynamite is packed in those cartridges, then packed in paper parcels and put into wooden boxes. With regard to the wooden box, I may say that the wooden boxes should not be excessively strong, as I conceive. I gave evidence before the Gun Cotton Committee on that point. I stated that extremely strong boxes were calculated to produce an explosion, and I believe the Government strong boxes were mainly instrumental in the explosion at Stowmarket; and I also believe the deaths of Messrs. Prentice were attributable in a great measure to that circumstance. After the first explosion, which may or may not have arisen from impure gun-cotton, Messrs. Prentice were so firmly impressed with the notion that gun-cotton would only burn and not explode, that they tried to pick up a box and get it away, and the box exploded. Now, I believe, if that gun-cotton had not been in a Government box, but in a box of the ordinary kind that were in use at that time by the Stowmarket Company, that explosion would not have taken place; but, of course, I may be wrong.

2832. Did you, in the case you have mentioned, have the boxes made to represent slate boxes?—No, nothing of the kind. I believe the parties who received it at the railway were well aware at the time what it contained. In the same way I may say that I have known gunpowder carried to a very considerable extent on railways owing to the prohibitory system of the railways. I have known cases of 75 lbs. and 50 lbs. of gunpowder forwarded by railway not being described as gunpowder, but merely treated as ordinary merchandise.

2833. How is the percussion cap attached to that cartridge?—We insert the percussion cap with a gutta percha fuse attached; this is one of the caps (*producing one*); we stick it on to the fuse, and we give it a nip with a pair of nippers to hold it fast, and we then insert it

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it into the end of the cartridge and set fire to the end; the fire runs down the fuse, and communicates with the cap, and causes the explosion.

Mr. Vivian.

2834. I did not quite understand in the category of vessels which you were going to insure, or travel in yourself, where you would put the petroleum-loaded vessel?—I put petroleum rather late in the category; I consider petroleum to be a much more dangerous article to carry than any explosive that I know of.

2835. But not as dangerous as coal, you think?—No, it is not so dangerous as coal in a cargo; I believe that a cargo of coal is one of the most dangerous of cargoes that leaves any port in England.

2836. I suppose you form that opinion from the number of accidents that take place with cargoes of coal?—Yes.

2837. Are there a considerable number of accidents taking place in coal-loaded vessels?—Yes; when they go long voyages it is considerable.

2838. There is a considerable per-centage of that class of accidents, you think?—Yes, when they go long voyages; I am not in the coal trade, so I cannot give an account of that.

2839. Do you think that with the commonest precautions it is dangerous to carry coal?—It depends in a great degree on the character of the coal; there are some coals which give out gas to a much greater extent than others; some coal would be perfectly safe.

2840. But even with the most fiery coal, with the most ordinary precautions, is there any great danger?—Yes, I think there is in a full cargo; I think that the cargo will heat very often, and the gas will escape, and then people go about with candles; they think that coal is a safe thing, and do not take care.

2841. Are there a number of accidents that occur in the course of the year in that way?—Yes, a considerable number; if you were to search Lloyd's List you would find that that is so, I think; I gather that information from what I see in the newspapers chiefly.

2842. When the ordinary precaution is taken of allowing the gas to escape after the first loading, through the hatchways being opened, it is still dangerous, you think?—I do not at all press this point, as my opinion may be of no value.

2843. You put dynamite before gun-cotton as safer, do you?—I do, most assuredly; I consider it much safer, and that has been shown by the experiments that have been made by the Gun-cotton Committee, which have proved it to demonstration.

2844. The next safest cargo, out of the seven which you enumerated, was, in your opinion, gunpowder, was it not?—Yes; my reason for putting gunpowder in that place, is this; that gunpowder is carefully and properly packed; everybody on board knows there is gunpowder, and they exercise a proper amount of caution; when you come to raw cotton, or jute, or coal, those things are treated quite as a matter of course, and those precautions do not take place; with regard to gunpowder, as compared with dynamite, there is this remarkable difference; the spilling of a few grains of gunpowder will operate as a train, and blow up the whole cargo; with regard to dynamite, that is not so; you have no train with dynamite.

Mr. Vivian—continued.

2845. Your experience of these explosive substances would lead you to believe that you might place dynamite certainly under no greater restrictions than black powder or gun-cotton, is that so?—Certainly; I should not place them under such exceptional restrictions. In fact, a powder magazine I would not enter into myself, nor would I let anyone enter it, unless he had magazine shoes, and I was quite sure that no grit was on the floor; I would enter a dynamite magazine with impunity without those precautions; I believe that no explosion has ever taken place, or can take place, from anyone entering a dynamite magazine.

2846. Would that be the case if there were exuding cartridges in that magazine?—With regard to the matter of exudation, I have no faith at all in the doctrine; I believe it is merely theoretical, and not practical; there is nothing whatever in it. This must be borne in mind: on examining it, you will see that it is a kind of dry paste, which contains 75 per cent. of nitro-glycerine; it is, in fact, a dry paste, and it will remain in that state for years without any alteration whatever in character or arrangement. If you look at it, you will see that it is quite impossible for anything to exude from it unless you expose it to extra dampness, or something of that kind; dampness will produce it to a much greater extent than anything else. I can state myself, with regard to both gunpowder and dynamite, that I have exposed them both to a kind of damp bath, and the gunpowder has settled down to the bottom of the vessel very much in appearance like the mud at the bottom of one of these ink-stands; the dynamite, on the other hand, being contained in paper, the paper has become perfectly wet and saturated, and it has allowed the dampness to get into the dynamite; it has become a wet pulp instead of a dry paste, and then the nitro-glycerine, being heavier than the water, it has found its way to the bottom. But apart from that, for ordinary trade purposes, in the way in which dynamite is used and desired to be transported for trade purposes, I have never known any exudation forming; and again, supposing there were exudation to the extent of a few drops, or anything of that kind, it must be borne in mind that those cartridges are packed again in paper, and then in a box; now, before you can have an accident from exudation, you must have the nitro-glycerine pouring out of the box itself on to the truck or carriage in which it is, and then you must have a concussion as between iron and iron, or something like that, and not the mere falling of it on to a wooden truck; that will not produce an explosion. As I have stated before, nitro-glycerine will not of itself explode. It desires to avoid an explosion until you fairly bring it to book, and you may bring it to book either by exploding the cap in it, or by striking it on an anvil with iron, but even then it will escape exploding if it can. At Whitehaven they got the notion that it could not be exploded under any circumstances except with a cap, and they took a cartridge four inches long and 7-8ths in diameter; they put it on an anvil, and the blacksmith was desired to strike it with his 15 lb. hammer, and he did so with all his strength, without any explosion taking place; it flattened the cartridge, but it did no more; there was no explosion. He then tried a second time, and it exploded, and I believe that it exploded from this circumstance, that

Mr. Vivian—continued.

that in the first instance the heavy blow flattened the cartridge, and brought out some of the nitro-glycerine on to the top of the anvil, and then, on his striking it the second time on the anvil it exploded. Now, the larger the quantity of dynamite the more difficult it is to explode it from a blow. If you see a cartridge which appears on the face of it to be wet, I mean where the paper appears to be wet inside with nitro-glycerine, and if you strike it with a hammer, or use it roughly, I should not have the least doubt that the nitro-glycerine would find its exit into the silica itself, and so escape, and prevent its being brought to book.

2847. Are you of opinion that an amount of exudation, such as was described by Major Ford, running in a stream out of a box of cartridges, is of no consequence?—I did not hear Major Ford's evidence, but described as you give it now, I should say if it were exudation from a box, then unquestionably it was not in a proper state; it could not have been manufactured in a proper way, or properly packed. I should rather suppose, if it were inquired into, it would appear that it had been exposed to extreme damp such as I have described.

2848. Then it would be in a dangerous condition, you think?—It would be in a dangerous condition in this sense alone, that if the nitro-glycerine finds its way on to the earth it is perfectly harmless, but when it exuded in that way, if it were in a railway truck, and it goes between two pieces of iron, the jolting might produce an explosion.

2849. You stated just now that you regard dynamite as safer than gun-cotton?—Yes.

2850. Was that opinion based on any special experiment?—I have not made very many experiments myself, but I have seen the experiments made by the Gun-cotton Committee. There is no doubt that gun-cotton is more susceptible to a blow than dynamite, and more liable to explode than dynamite.

2851. Do you mean in a dry or wet state?—Gun-cotton in a wet state will not explode at all from percussion.

2852. Is there any objection to keeping it in a damp state do you think?—Yes, there is a very great objection, to keeping it in a damp state, but before you use it you must dry it, and the drying of it is very mischievous under ordinary circumstances.

2853. Can you obtain power from gun-cotton in a damp state by using a detonator?—I do not believe that you can; I have seen that stated, but I doubt it very much indeed.

2854. Have you had any experience of No. 2 dynamite?—No, I have not.

Mr. Whitwell.

2855. I think you have stated that you went to the Continent to purchase nitro-glycerine formerly?—Yes.

2856. Where was the best nitro-glycerine procurable abroad?—The only place I bought it at was at Hamburg, from Messrs. Nobel & Company.

2857. Only from Nobel & Company?—Only from Nobel & Company.

2858. You have no experience of any other nitro-glycerine than that prepared by Nobel & Company?—Just so; but I have had information about others.

Mr. Whitwell—continued.

2859. Would you wish to have the Nobel nitro-glycerine examined or tested before you used it, or have you such perfect confidence in it that you are satisfied with it as it is?—I have perfect confidence in it; but where I have it by me for five years I think it right to test it, and I have tested it.

2860. But you would not like to go into the open market to buy it of whatever person offered?—No, certainly not.

2861. It is a sensitive article, and if impure might be dangerous?—Yes.

2862. And it might be very dangerous, might it not?—Yes.

2863. We must deal with very pure nitro-glycerine in order to command the first principles of security?—Yes, unquestionably.

2864. Now I understand from you that even in mining operations you would wish to forbid the use of pure nitro-glycerine?—We have good substitutes for practical purposes, and I should be disposed to forbid the use of it.

2865. Have you much experience of the use of dynamite and nitro-glycerine for practical purposes?—Yes.

2866. In slate quarries, in using nitro-glycerine, when you put it into the hole, how do you stem it?—Some men were very fond of the ordinary mode; but the way I always preferred was to stem it with water only. I have put nitro-glycerine down the hole, and then filled it with water, and then introduced a gutta-percha fuse with the cap.

2867. How do you tamp dynamite?—I tamp dynamite in the ordinary way; it must depend on the work to be done; in many cases it is not necessary to do it at all; you merely put it down the hole and fire it; when the rock is very hard you must stem it hard; I have on three occasions, myself, superintended and broken up large masses of iron which had accumulated to the extent of from 120 to 150 tons at the bottom of the Wigan Coal and Iron Company's furnaces; then I used dynamite four or five pounds at a time in the charge, and there I stemmed it as hard as I could with damp sand and cotton waste.

2868. Have you found it necessary to use only wooden instruments to stem it down?—I invariably advise wood, and I stick to wood; if you ask me whether I myself have used iron, I may tell you that I have repeatedly.

2869. You are prepared to run any risk, I suppose?—I never yet met with any accident, at all events.

2870. But, so far as the instructions given to the persons you employ goes, you would say, "Use only wood"?—Use only wood, but in some cases you may use copper; however, wood, as a rule, is the best to use.

2871. Do you issue any printed instructions to the people you employ as to how you use dynamite?—Not in the quarries.

2872. But otherwise?—Yes, in the ordinary way we send round general directions.

2873. When you sell it?—Yes, when we sell it.

2874. That is to say, you send precautionary instructions?—Yes, we send precautionary instructions with every package.

2875. Then do you think it is necessary to send those precautionary instructions?—Yes.

2876. But, with regard to the workpeople, you leave them to use it just as they please?—Yes.

2877. You said that a blacksmith near Whitehaven,

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haven struck a cartridge with a 15 lb. hammer and did not explode it?—Yes.

2878. Should you be surprised to hear that this Committee have seen a very small portion of a cartridge struck, and that the very first blow exploded it?—No, I am not surprised at that; that is exactly what I state; if you take that powder and spread it lightly over the anvil, and hit it with a hammer, you will have an explosion; but if you take a cartridge of this thickness and strike it, you will not have an explosion. I spoke of a cartridge seven-eighths of an inch thick, and I explained it in this way, that the nitro-glycerine escapes into the general body, and the thickness of the cartridge is sufficient resistance to prevent an explosion; but when it is flattened and the nitro-glycerine exudes, then you cause an explosion.

2879. But is not the Kisselguhr charged with nitro-glycerine?—Yes.

2880. Then into what portion of the cartridge can the nitro-glycerine escape?—I am supposing this state of things, that in this cartridge, from dampness, or over-heating, or some other cause, some portion of the nitro-glycerine has exuded from the Kisselguhr itself.

2881. I do not speak of exudation, but of an ordinary cartridge struck with a hammer on an anvil, and I understand you to say, that the pressure of a hammer will force the nitro-glycerine into an already charged cartridge?—I do not mean that exactly, because I take it for granted that there is no exudation. If you take a cartridge and strike it with a hammer, I say that the resistance which is offered by the Kisselguhr prevents the hammer coming in contact with the anvil immediately.

2882. But suppose a cartridge happened to be lying on a spade in a mine, and the man's boring rod were to fall upon it from some distance, would you like to be near it?—Certainly; I should not mind it.

2883. Would there be no danger, do you think?—Not the least. You may do what you please with them, provided you do not bring the nitro-glycerine in contact with iron and iron, or something like that.

2884. You have no doubt that nitro-glycerine does exude from cartridges under certain circumstances?—Under certain circumstances, no doubt it can be made to exude.

2885. It does naturally exude under those circumstances, does it not?—That is a state of circumstances brought about to induce exudation, but I say that a packet of cartridges packed in the ordinary way may be sent to the world's end without exudation.

2886. But suppose that a man is carrying a cartridge in his pocket, which a miner may very likely do, you are quite aware that there is a great deal of drainage from many of the rocks where mining operations are being carried on, and very often the mine itself is extremely moist. Would it not be possible for those cartridges to exude under those circumstances?—No, I think not.

2887. Not if the man's coat became wet?—I understand the case to be this: a man carries it in his pocket about his body; if it is carried in his pocket about his body, and we prefer that as being the easiest way of bringing it to a serviceable state in the winter, it produces the same

Mr. Whitwell—continued.

kind of thing that I have now in my hand, but no exudation.

2888. We sometimes see the workmen's clothes hanging up in a mine, while the rock is quite wet against which they are hanging. If the cartridges were placed in the pockets of such a coat, would there be no danger of exudation?—Not if they remained there for 12 hours; but if they remained there for a long time, no doubt it would be dangerous.

2889. Have you ever known cartridges to be laid aside on account of their appearance being dangerous?—No, never.

2890. Have you never known cartridge not used on account of their dangerous appearance?—No, except those that I have referred to myself.

2891. No explosions have taken place on account of their being in a dangerous condition?—No.

2892. You really state that you never knew of any danger from cartridges from which nitro-glycerine had exuded?—No, with this exception. I was once informed that some cartridges were exposed to damp earth in some stores near to Newcastle: they were found to be in a pulpy or wet state, and there had been some exudation from them.

2893. But you say positively from your experience, that from your own experience you cannot speak to anything of the kind, though the thing is possible?—Just so.

Mr. Stevenson.

2894. You have stated, I believe, that you had been importing nitro-glycerine some years back?—Yes.

2895. From what part of the Continent was it shipped?—From Hamburg.

2896. To what port was it sent in England?—Chiefly to Carnarvon.

2897. Was any shipped to Newcastle?—I am not quite certain, but I think none was shipped to Newcastle.

2898. Are you aware that some years ago there was a serious accident at Newcastle through an explosion of nitro-glycerine?—I am aware of that.

2899. Did you import that nitro-glycerine?—I did.

2900. Into whose hands did you send it at Newcastle?—Not to anybody's hands at Newcastle; I had no idea that it was in the place where it was found; I gave it into the hands of a Mr. Barras, who was our agent near to Wigan; and he, I believe, handed it over to some man at Newcastle, who put it in a most improper place.

2901. By that nitro-glycerine which you imported, the inhabitants of Newcastle were exposed to great danger for some time?—There is no doubt of it; the nitro-glycerine was contained in tins, such as I have described, seven inches square and thirteen inches long, and then packed in wood, with a something between them.

2902. Is nitro-glycerine still imported, or is that entirely at an end?—It is entirely at an end.

2903. You are now importing dynamite from the Continent, are you not?—No, I have ceased importing dynamite from the Continent since the British Dynamite Company was established. I imported it up to the end of 1872.

2904. Was it from Hamburg that you shipped it?—Yes.

2905. And it was landed at Newcastle, was it?

Mr. *Stevenson*—continued.

it?—Some of it was landed at Newcastle, but the larger proportion was brought round to Carnarvon.

2906. How was it described when it was handed to the steamer at Hamburg?—As dynamite; but I believe it was all shipped in a sailing vessel, there was none shipped in steamers, I think.

2907. Who was your consignee at Newcastle?—Mr. Edwards.

2908. Do you know where it was stored at Newcastle?—It was stored at a place somewhere near Bolden, some considerable distance down the river.

2909. Was it stored in a proper magazine?—Yes, it was a proper magazine prepared for the purpose. The Custom House and the town authorities were well aware of it.

2910. You found it necessary to describe it as dynamite, I suppose?—Yes.

2911. When you sent it as slate what was the external appearance of the box of the so-called slate?—It was an ordinary dynamite box.

2912. A 56 lb. box, I suppose?—Yes, but they now make them of 50 lbs.

2913. Was this 56 lb. box not marked on the outside as dynamite?—No.

2914. We thought that all the boxes that left the manufactory were so marked, as dynamite?—Those boxes were imported from abroad.

2915. Where were they landed?—They were landed at Carnarvon, and then carried over to Llanberis.

2916. Were they imported in a sailing ship?—Yes.

2917. As dynamite?—As dynamite.

2918. And they assumed the character of slate after they came into your hands?—Yes.

2919. They were not put into any other package such as slate will be put into?—No.

2920. What was the heaviest weight of each package?—Fifty-six pounds.

2921. Were those the slight wooden boxes which you described as being proper boxes for the conveyance of dynamite?—Yes, they are three quarters of an inch thick.

2922. Do you think that that is too strong?—No, I do not think so, for this reason: the Gun-cotton Committee took one of those boxes to the top of a quarry and threw it down and broke it; we took another and hung a heavy weight on it and smashed it, and we took a third and bored a small hole into it and introduced a fuze and set light to it and it burnt quietly away.

2923. We have been told that it is a great advantage to have them thin, so as to make but little fuel in the event of the box taking fire?—I think it is the strength of the box resisting the escape of the gas in case of fire and the question of fuel. If you set fire to a few pounds of dynamite in a confined state where the gases cannot escape you have an explosion, otherwise you have only the burning.

2924. You prefer a thin box?—Yes, most assuredly; if you set fire to a large number of boxes in the open air, you have no explosion, supposing they are thin enough to let the gas escape.

2925. Have you ever tried that experiment?—Yes.

2926. How many boxes have you fired at a time?—Four or five.

Mr. *Stevenson*—continued.

2927. You say that extraordinary dampness may cause exudation?—Yes.

2928. Supposing the cartridges have been so exposed, must they not be dried in order to be used?—If I had cartridges of that kind, I should destroy them, and not use them.

2929. I suppose there would be danger in drying them?—It is a nasty operation, and it is not worth the trouble; if I dried them, I ought to have a machine to compress them into proper shape.

2930. Do you think that other people who use cartridges would be equally willing to throw away those valuable articles?—Yes; no one would care about a thing of that kind, I should say; mere dampness would be a matter of no moment whatever. You may fire them under water, and we constantly do that.

2931. But you say, do you not, that dampness gets into the cartridges?—Assuming dampness to get into the cartridges, and that the dynamite shall become, not what it now is, a paste, but a loose kind of muddy pulp, then you may expect that the nitro-glycerine will exude.

2932. If the dampness gets in, it must be because the nitro-glycerine has got out; is that what you mean?—No, I put it the other way, namely, that the dampness getting in causes the nitro-glycerine to exude; the nitro-glycerine being heavier than water, the nitro-glycerine finds its way out.

2933. The dynamite, which is kieselguhr saturated with nitro-glycerine, becomes partly saturated with water; the nitro-glycerine is displaced by the water, and resumes its liquid form, which is a dangerous form, is it not?—You must take it in this sense; there is nothing dangerous in it itself; it is only dangerous in that form in contact with something that causes concussion enough to explode it.

2934. If once a cartridge of dynamite becomes damp, the only safe course, you think, is to destroy it?—No; it must be more than damp before you need do that; it must be damp so far that the nitro-glycerine is exuding from it; it must have become a wet pulp before it is necessary to destroy it.

2935. I speak of danger in use, as distinguished from danger, in transport, which is quite a separate question; you say that over-heating may cause exudation; what is the remedy in that case?—I know of no remedy.

2936. You would destroy the cartridge when it had been over-heated, I suppose?—Yes, if there was exudation sufficient to justify destroying it.

2937. What degree of over-heating will cause exudation?—I cannot tell. It must depend on the general state of the atmosphere, and the make of the cartridge itself.

2938. Would very hot weather cause it to exude?—No.

2939. Would the extreme heat of a deep mine?—No.

2940. Then what is the over-heating you refer to?—Suppose you put it into a steam kettle, or you put it into a kettle such as was used at the Clifton tunnel, where they had a kettle within a kettle, the steam running through it; it was exposed for days and weeks together to this extreme heat, and the result was, no doubt, the exuding of some of the nitro-glycerine, and an explosion.

2941. I suppose you would say that a long exposure

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posure to a temperature of 212° would cause exudation and danger?—I believe that it would.

2942. Then what would be the active cause of the explosion in that case?—In that case it must be the decomposition of the nitro-glycerine. I cannot conceive any person who knows anything whatever of nitro-glycerine, or any explosive whatever, exposing it to a heat for a long time of 212°; gun-cotton, most unquestionably, would decompose and explode if continued at that heat for any length of time, and so I believe would gunpowder, or any other known explosive.

2943. In the case of the experiment where the blacksmith gave one blow to a cartridge on an anvil, would not the force of the first blow be expended in merely flattening the cartridge?—No doubt.

2944. Supposing you had spread that cartridge into a thin coating on the anvil, would not the first blow have exploded it?—No doubt; it would not have exploded the whole of it, but it would have exploded that portion of the dynamite which was under the hammer. If you spread an anvil with either liquid nitro-glycerine, gun-cotton, or dynamite, you may hit it repeatedly, and wherever you strike it, you will explode the portion under the hammer, and no more.

2945. The Committee have heard of explosions by the tamping of dynamite with an iron rod in the bore-hole; but if your view be correct, why does not the iron rod merely explode, in that case, only the small portion of the dynamite with which it comes in contact?—Because it is confined, and cannot get away; but on the anvil the explosion will drive away what is immediately around it. I may mention a circumstance that took place near Wigan, on the Duke of Bridgewater's works, where they were sinking a shaft, and it is very desirable that the circumstance should be known to the public. The Duke of Bridgewater's trustees were sinking a shaft down to the coal, and when they came near to the coal they met with great difficulty in consequence of the dampness of the ground, and of the gases exuding from the coal below; the consequence was that they had great difficulty in exploding the gunpowder, and when they did explode the gunpowder; they always had the gases set on fire. Under those circumstances they applied for some nitro-glycerine; they used nitro-glycerine, and they overcame all the difficulties with regard to dampness, and also all the difficulties with regard to the gases, for the explosion of the nitro-glycerine drove away the gases without setting them on fire.

2946. In fact, while gunpowder produced a flame which would ignite the gas, dynamite produces no such flame?—It does not produce a flame to that extent; it does produce some flame. But here I am speaking of nitro-glycerine pure, though I believe the same result would take place from dynamite.

2947. There can be no flame from dynamite, can there. Kisselguhr will not produce a flame, I believe?—No, just so.

2948. With regard to danger in transport, I think you say that you rely on the mode of packing to prevent dangerous exudation?—Yes, that is one thing; but, first of all, I rely on the article itself. I say that this article, in the ordinary course of things, will not exude so as to cause any danger; secondly, I say that, assuming it did exude, the quantity that could by any possibility

Mr. Stevenson—continued.

exude would be taken up by the paper and the wooden case.

2949. Are not those wooden cases lined with paper also?—No, not ordinarily, I think; they are made up in paper packages of 5 or 6 lbs., and are then placed in the wooden boxes.

2950. So many cartridges are put into a small paper package and covered over with paper?—Yes.

2951. And several of those paper boxes are contained in the wooden box, but is not that wooden box lined with paper also?—No.

2952. You think that no exudation could escape so as to come outside the wooden box?—Certainly not, in the ordinary course of things; I do not mean to say that it cannot produce exudation, and that persons cannot talk about and make something of it, but as a practical man I have never met with it, and I do not believe it can take place.

Mr. Stanhope.

2953. The Committee had evidence before them that an explosion took place in Norway from the mere dropping of a can by one of the workmen; you would say that that explosion could not have taken place if the dynamite was in proper condition?—I never heard of the case; perhaps Mr. Nobel may know something about it, but I cannot conceive such a case.

2954. You seem to think that dynamite is safe if the materials are pure, and if they are properly mixed, and if it is kept in proper condition?—Yes.

2955. But in the absence of those conditions it might very well be dangerous, might it not?—That is putting it rather strongly. You may say that you do not know anything whatever that is not dangerous; the Houses of Parliament are lighted by gas, which is a most dangerous thing if not properly used.

2956. You do not agree to my three conditions then?—I say you must take it for granted that persons in ordinary business will carry it on in a straightforward manner, whether mine owners or quarry owners, all practical men exercise ordinary precautions.

2957. Supposing you were going to purchase a quantity of dynamite, how could you tell whether the proper conditions were being observed in the manufacture?—I should, first of all, only think of purchasing from a known manufacturer in whom I had the greatest confidence; I would not go into the open market, or purchase any at hazard that happened to be imported into London; I would not have anything to do with that; I believe that some which has been imported into London was not of a very good character.

2958. Other people might not be so careful as you; would there not then be some danger?—There might or might not. I believe the greatest danger generally with regard to explosions would arise from fireworks and from gunpowder.

2959. Would you ever take any steps towards testing the dynamite which you bought?—No. I should have such perfect confidence in the manufacturer that I should consider it a mere waste of material.

2960. You would not propose to rely at all on any system of inspection of the works where the dynamite was made?—I do not say that for an instant. I have not the slightest objection to an inspection taking place, whether by order of the Government or otherwise, but as a mere consumer

Mr. Stanhope—continued.

sumer I should be content to buy the article just as I should go to Messrs. Curtis and Harvey, or others, to purchase gunpowder. I should not undertake to analyse gunpowder any more than I should undertake to analyse dynamite.

2961. But we have had very much more experience in gunpowder than we have had in dynamite, we know how it is made; but dynamite may be made with materials of very different qualities, may it not?—I do not know. I believe that we have become too familiar with gunpowder, and that very extraordinary risks are run with gunpowder daily, in fact, very much greater risks

Mr. Stanhope—continued.

than you can by any possibility run with dynamite. People are indifferent to the risks of gunpowder, and that arises from their thorough acquaintance with it.

Mr. Whitwell.

2962. Have you a copy of the precautions which you send out to your dynamite purchasers?—I think the British Dynamite Company have delivered in a copy of their instructions.

2963. Yours are similar to those, are they?—Yes.

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Mr. GEORGE M'ROBERTS, called in; and Examined.

Chairman.

2964. ARE you chemist in charge of the British Dynamite Company (Limited) Factory at Ardeer?—Yes, I have charge of all the operations carried on in the factory, and the preparation of all the materials used in the making of nitro-glycerine and dynamite.

2965. Have you had much experience of nitro-glycerine and dynamite?—Yes, I have had very large experience. I have made all the nitro-glycerine and dynamite that have been made by the British Dynamite Company. Many hundreds of tons of both nitro-glycerine and dynamite have passed through my hands.

2966. Is it possible to manufacture nitro-glycerine pure on a large commercial scale?—No, it is not possible to manufacture it chemically pure. It is not possible to make nitro-glycerine chemically pure on a large scale, because the materials we work with to begin with are not thoroughly pure; there is always some impurity which gets into the apparatus, but none of those impurities which get into the nitro-glycerine are in the slightest degree dangerous to its stability.

2967. Are any of the impurities in your nitro-glycerine and dynamite of a dangerous character, or likely to become dangerous?—Not in the least dangerous; they cannot become dangerous, because if there was any danger in them at all it would be discovered during the manufacture, and if we were once to use dangerous materials the factory would blow up.

2968. How do you account for the acidity that has been found in some of your dynamite?—Major Majendie wrote to the company that he had discovered some of our samples to be acid. I had examined previously to that many samples of our dynamite, but I had never discovered any acidity in them. After we received that letter I made one or two experiments, and after some time I did discover some samples to be acid, but I found that it was not the nitro-glycerine at all that was acid. Dr. Dupré had directed the whole of his remarks against the nitro-glycerine, but on a thorough examination I found that the nitro-glycerine was not acid. We keep samples of every portion of the manufacture. Of every charge made we have samples from the very commencement. Since last week, I have again gone over the whole of them, and there is not one that is in a single case acid. Then the question was, how some of the dynamite came to be acid if the nitro-glycerine was not acid. On thorough examination I found that it was the kieselguhr that was to blame, and some samples of it gave a very

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Chairman—continued.

feeble acid reaction; it was sometimes very difficult to observe it at all. The reason why the kieselguhr was acid was this; the coal that we were using for calcining the kieselguhr contained a little sulphur, and during the burning of this coal in the kiln sulphurous acid was formed, and in the presence of the heat and moisture in the kiln, the sulphurous acid was absorbed by the silica in very small quantities. All our dynamite should under those circumstances have been acid, because we had been using the same coal all along; but the reason why some of the samples were not acid is this, that the nitro-glycerine had retained sufficient of the alkaline solution in which it had been washed, to neutralise the extremely small quantity of sulphuric acid which had been retained by the silica.

2969. Have you made any experiments to prove the stability of your dynamite under various conditions of temperature?—Yes, many hundreds of experiments have been made, and under all the ordinary conditions of temperature such as we may have in any climate, from a temperature such as at present up to 150° or 180°, our dynamite is perfectly stable and will not undergo decomposition.

2970. How do you account for the exudation of the nitro-glycerine from your dynamite that has sometimes taken place?—There are several ways to account for it; first of all the silica may have been overcharged with the nitro-glycerine; more nitro-glycerine may have been added than it had power to absorb; in the second place, the cartridges may have been exposed to water; indeed, I know that some of our dynamite has been exposed to water in the shipping of it; some of it had been in very wet magazines; if dynamite is dipped in water the kieselguhr will absorb the water, and the nitro-glycerine will run out; I can state that to be so, from an experiment which I have made with a dynamite cartridge; I dipped it in water, and in the course of two hours the whole of the nitro-glycerine had run out, and the water taken its place; exudation will not occur merely from exposure to a high temperature such as that in a tropical climate; there must always be exposure to excessive moisture; not merely damp, but a very wet atmosphere.

2971. Do you consider that exudation may be attended with danger?—I cannot see that any ordinary exudation can be attended with danger; nitro-glycerine itself is almost as safe as dynamite, except with regard to handling; I have tried so

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Chairman—continued

many experiments with nitro-glycerine, that I am pretty confident with respect to its safe properties; if it had been half as dangerous as it has been represented, I should have been blown up long ago; in the laboratory we often spill it on the floor and walk over it; we do not bother about it; I know that there is no chance of its exploding; if this table was covered with nitro-glycerine, and struck with a hammer by the strongest man in the room, it would not explode; if it were placed on an anvil, and struck with a hammer in a thin layer, it would explode under the hammer; if the face of the hammer is coated with nitro-glycerine, and struck on an anvil, it will explode just where it is struck; you may produce seven or eight explosions with the same hammer, and with the same coating of nitro-glycerine, but you only do that merely where it is struck. In the cases of exudation referred to by Major Ford, he described the nitro-glycerine as running out of the boxes; that was described to me by Mr. Downie, and it was not running out; it was merely a succession of drops; in that case there would have been no danger at all; if Major Ford and Mr. Downie had danced over it, they would have produced no explosion.

2972. Is there any means by which exudation can be prevented or rendered harmless?—Yes, there are means by which it can be prevented altogether. If dynamite is kept in a very wet magazine exposed for a long time to moisture, it will exude very slightly; but the company has taken means to prevent any danger from exudation in transport or storage by lining all their boxes with waterproof and nitro-glycerine-proof paper, so as to prevent any danger from water in shipping or otherwise.

2973. With respect to the impurities that exist in dynamite and nitro-glycerine, is it desirable to have it perfectly free from impurity?—Not in the least; the only impurity that could be dangerous to nitro-glycerine is hypo-nitric acid. The presence of hypo-nitric acid would be a source of danger in the presence of any organic matter. Hypo-nitric acid acts very energetically on organic matter, but otherwise it would be safe enough. I have kept nitro-glycerine containing hypo-nitric acid for many months, and exposed it to all the ordinary temperatures, to temperatures varying from 32° Fahrenheit up to 80° Fahrenheit, and I have not been able to produce the slightest appearance of decomposition; so that, even although there is a little acid in the nitro-glycerine present, I do not think there would be very much danger. However, it is desirable that nitro-glycerine should have no free acid, and all the nitro-glycerine we make is free from free acid.

2974. What means do you take to prevent unwashed nitro-glycerine from being used for the manufacture of dynamite?—We have a very careful arrangement of apparatus, and it is impossible that any unwashed nitro-glycerine can be drawn off for use until it has passed through the whole apparatus. It has to pass through three large tanks built for the purpose, and from the last tank, where the final washing is done, in an alkaline solution, it has to be passed into another tank still, and to be retained there for some time before the workmen can touch it. Before it is drawn off for use, the chemist in charge has to take several samples and test them thoroughly, to see that they are free from acid; and until he

Chairman—continued.

has told the man in charge that it is perfectly free from acid, he cannot draw it for use.

2975. What are the probabilities of explosion during the manufacture of nitro-glycerine, and in the making of dynamite?—In our factory the chances are not very great. The apparatus is so arranged that the least rise of temperature can be watched; our thermometers are graduated to the tenth of a degree centigrade, and the slightest excess is observed in a moment and controlled; and besides, we have always the means of drowning the charges in case of the least sign of danger.

2976. Is it necessary that your workers should wear special dresses?—Not in the least; it is not necessary that they should wear either special shoes or special clothing, because there is no inflammable powder flying about; the dynamite that falls on the floor is perfectly harmless.

2977. You say that you have handled a great deal of nitro-glycerine; has your health suffered from it?—Not in the least.

2978. Are other people equally fortunate? Is nitro-glycerine or dynamite poisonous, and what effect has it on the health of the workers generally?—I do not believe that it is at all poisonous. I have had headaches from nitro-glycerine, because I do not work in it every day, but the men who work in it every day always seem to be healthy; they do not wash before they dine; they may be said to eat it with their bread and butter, and they have no feeling of sickness after the first day. The first day it is much the same as sea sickness; they have terrible headaches, and sometimes they vomit; the next morning they have a very good appetite, and they come back to work not the least the worse for it. Nitro-glycerine has a sweetish kind of taste, and at first it produces very severe headache; next day the stomach is all right; it seems to act as a kind of tonic and appetiser. I should not be at all surprised if it found its way into the pharmacopœia by-and-by.

2979. Now, as regards the conveyance of dynamite by rail, would there in your opinion be much chance of an explosion in the event of a collision?—Very little indeed; extremely little. I witnessed a collision last Thursday with a dynamite van near the Ardeer works. A coal waggon ran nearly at full speed up against a dynamite waggon. The coal waggon had got a very narrow buffer, and at the end of the brake a long iron lever went right through the van into a box of dynamite, and there was no explosion whatever, although the box that had been struck was punched through.

2980. Will your dynamite explode when merely set fire to in large quantities?—Yes, in large quantities it would.

2981. What do you call a large quantity?—If seven or eight cwt. were piled up and set fire to in a pile, there would, perhaps, be an explosion before it was all burnt. About 10 cwt., at all events, would explode; perhaps about seven cwt. would burn away without exploding. If the contents of a waggon in a railway collision were scattered about on the line and set fire to one by one there would be no explosion, and there would be plenty of time to remove the boxes.

2982. How do you distinguish between explosion and fire in that case; would there be a series of small explosions do you think?—No, there would be no explosion at all if it was burnt separately;



*Chairman*—continued.

separately; it would burn gradually away; you might burn away several tons of it, I believe, if it were spread over the surface of the ground. If it were piled up so that the heat in the centre of the mass could get up to explosion point, there might be an explosion before complete combustion had taken place.

2983. What is the temperature, Fahrenheit, at which it would explode?—400° or 450° Fahrenheit.

2984. Do you think that an efficient system of Government inspection would be useful to the manufacturers and users of dynamite, and also be a safeguard to the public, and would you continue the present power of inspectors taking samples of dynamite for examination?—Yes, I think an efficient inspection is very useful to the manufacturer and for the users, but I would not give the inspector power to stop the manufacture when he thought anything was dangerous, because he might be very far wrong; it is hardly probable that he would possess all the requisite knowledge. With regard to taking samples, it is quite necessary he should do that sometimes, and I see no objection to it.

*Mr. Vivian.*

2985. I think you mentioned the fact of a free acid being present as likely to lead to decomposition, and so to exudation?—Decomposition could not go on long without an explosion.

2986. Is it not the fact that hypo-nitric acid alone would cause decomposition?—No, not alone, but the presence of hypo-nitric acid and organic matter would.

2987. Can you easily discover hypo-nitric acid by your tests?—Yes, we can readily discover it.

2988. In those cases of exuding cartridges which Major Ford discovered, was there sulphuric acid present?—No, I am quite sure that it could not have been that; it must have been damp or overcharging with nitro-glycerine; those cartridges may have been exposed to the water. I know a case in which we shipped some dynamite (I think it was to the same neighbourhood) where the boxes got very damp, and then our system of packing was not so good as it is now. The same case could not now occur.

2989. You discovered, in some samples which you examined lately, the presence of sulphuric acid in the kieselguhr?—Yes.

2990. Would dynamite made of this kieselguhr be likely to exude?—No, not at all; I have tried many samples since I made the discovery, and I have exposed them to varying temperatures and moist atmospheres without any appearance of exudation; I do not mean to say that I have exposed them to a wet atmosphere.

2991. But over-saturation of the kieselguhr will lead to exudation?—Yes; but we have devised means to prevent that over-saturation. We have a machine at the works, and there is a small chamber in it which holds the cartridge exactly, and there is a graduated lever, and at a certain point on the lever, when the weight hangs, the cartridge should give no exudation; if it shows signs of exudation, then we know that we have not enough silica.

2992. That weight, I suppose, is arranged to 75 per cent. of nitro-glycerine?—Yes.

2993. If your kieselguhr was passed to contain only 60 per cent. of nitro-glycerine, would it be less likely to exude?—Decidedly, there would be less chance of exudation.

0.84.

*Mr. Vivian*—continued.

2994. With a loss of power, I suppose?—Yes, but it is our object to make it as strong as possible, by putting in as much nitro-glycerine as the silica can take.

2995. Under those circumstances, the weaker the dynamite was, the less chance there would be of exudation, would there not?—Decidedly.

2996. What would the loss of power be for every 5 per cent. of nitro-glycerine; take, say 70 per cent. of nitro-glycerine, and 30 per cent. of kieselguhr?—The loss of power would be one-fifteenth at least for 70 per cent.

2997. In the mechanical combination, every per-centage of nitro-glycerine you took away would be so much loss of power, would it not?—Yes; the silica is quite inert.

*Mr. Stevenson.*

2998. It would be worse than that, would it not?—Yes; it would be a little more.

*Mr. Vivian.*

2999. What proportion of nitro-glycerine could be squeezed out of No. 1 dynamite?—It depends on the pressure, of course.

3000. Could you squeeze out the whole of it, do you think?—It would take a very large pressure to do so; but it would be possible, no doubt, only you might cause an explosion.

3001. It would be an extraordinary pressure to squeeze out 20 per cent., would it?—Yes; a very heavy pressure.

3002. You have stated that your last washing of the nitro-glycerine was an alkaline washing?—Yes.

3003. Under those circumstances, should not the dynamite that leaves your works be in an alkaline condition?—Yes; it is very desirable that it should be. I do not wish that the dynamite should not have a little alkali left in it.

3004. But I thought you stated that it was in a neutral condition?—Yes; the sample we test is in a neutral condition, but the nitro-glycerine that is drawn off to make the dynamite always contains a little of the alkaline liquor.

3005. It is much safer then, is it not?—Yes, it is much safer; because, if by any chance there should be any acid left, supposing there was a slight decomposition, it is immediately counteracted by the alkali.

3006. Dampness will produce exudation, will it not?—Yes, it may, but it must be excessive to do so. I have kept cartridges in a box with wet tow in it and exposed it to a considerable temperature, and I have not been able to produce exudation; but if water comes in direct contact with the dynamite exudation will follow.

3007. Is the wrapper of the cartridge waterproof?—No, it is not waterproof, but it is nitro-glycerine proof; it will not allow nitro-glycerine to pass through it, but it will allow water to pass through it.

3008. Are your laboratory floors covered with any sort of sand?—They are asphalt floors in the laboratory.

3009. Is it advantageous to have sand about in such a case?—No, there is no great advantage in having sand about. I think that sand or sawdust is a good thing, because in the event of any acid or nitro-glycerine escaping they would be immediately absorbed, but at the same time an explosion is impossible with us.

3010. Would it be an advantage that trucks containing

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M<sup>r</sup>Roberts.*

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containing dynamite should have sand on their bottoms?—No, because there can be no exudation from our boxes in transit; it is impossible.

3011. But in the event of an accident and the dynamite being thrown about, would it not be advantageous to have it to fall on to the sand?—The boxes are so packed that there are five wrappings round the dynamite; first there is a lining round the cartridge, then there is a small box of very thin wood, then that box is in brown paper; then again there is a waterproof paper outside that, and outside of that there is a thin wooden box. You might throw one of our boxes from 150 feet to the ground without exploding. We have allowed 3 cwt. of solid malleable iron to fall 45 feet on to a box of dynamite without causing it to explode; although the box was crushed into matchwood and the dynamite into paste there was no explosion.

3012. But you stated the case of a railway accident by which the dynamite was thrown all about?—Yes.

3013. In the event of an accident like that, would it not be advantageous to have it fall on sand rather than on iron plates?—Yes, but the sand in the waggon might not be thrown about, and the dynamite boxes might be pitched anywhere, but even if they were pitched anywhere, there would be no explosion.

3014. Now with regard to No. 2 dynamite, does the same regulation with regard to a special dress not being required for the workpeople apply to No. 2?—We do not require special dresses with No. 1 or No. 2, but they are forced upon us by the present regulations.

3015. No. 2 dynamite being more like gunpowder than No. 1, you think there is no necessity to be more careful about iron on iron, or any matters of that kind?—No; the conditions under which No. 2 takes fire or becomes explosive are just the same as those that apply to No. 1. It will burn away very quietly, but it is more difficult to explode by concussion than No. 1.

3016. Is No. 2 like No. 1, or is it more like gunpowder than No. 1?—In appearance it is very like gunpowder, except that it is not so dry or powdery.

3017. What is the power of No. 2, as compared with No. 1?—It would vary from about a third to a half as powerful as No. 1.

3018. At what temperature does No. 2 explode?—The nitro-glycerine which it contains will, of course, go off at the ordinary temperature at which nitro-glycerine explodes.

3019. Would No. 2 explode at the same temperature as No. 1?—I believe that it would, but I have never tried the experiment.

3020. In order to produce explosion as opposed to ignition, you must have a temperature of over 400°, must you not?—Yes; but it would be possible to induce that temperature in No. 1 or No. 2 dynamite by decomposition. If either nitro-glycerine or dynamite is exposed for a long time to a temperature of 180° to 212°, decomposition will set in, and that decomposition will very rapidly raise the temperature to 420° or 450°, and then an explosion would take place.

3021. The burning of dynamite in large masses will produce an explosion, because the internal portion of the mass is raised to a temperature of over 400°?—Yes, if it were possible to keep the temperature in the centre at the original height, it would burn away without ex-

Mr. Vivian—continued.

ploding, or if it was spread over a large surface there would be no explosion.

3022. From your experience of dynamite, I suppose, as a dynamite manufacturer, you see no objection to dynamite and black powder being stored in the same magazines?—Not the slightest, but if they were stored in the same magazines, the precautions with regard to gunpowder must be observed.

3023. Could dynamite be fired without exploding the gunpowder in the same magazine?—I have had no experience of that, but I would certainly expect the gunpowder to go off.

Mr. Whitwell.

3024. Do you agree with what has been said by other witnesses, that the safety of the dynamite depends on the purity of the nitro-glycerine?—It depends on what those witnesses mean; if they mean absolutely pure nitro-glycerine, it is impossible to make it. Even on a small scale, in the laboratory, it is very difficult; on a large scale, it is absolutely impossible. But we make it so pure that there is no chance of spontaneous decomposition. The mineral salts that are sometimes found in the nitro-glycerine are not injurious at all, and if it was possible to have a large quantity of them you might separate the particles of nitro-glycerine so far, that it would be very difficult to explode it.

3025. I suppose that there is no possibility of decomposition in gunpowder, so as to produce spontaneous explosion?—No; but if you added acids to it it would explode.

3026. There is a quality in nitro-glycerine which does not exist in gunpowder, is there not; that is to say, the risk of spontaneous explosion?—I cannot see that.

3027. If you expose it to a certain temperature you cannot prevent decomposition, and with that comes the risk of spontaneous explosion, does it not?—Yes.

3028. That is a phase of things which does not exist in gunpowder?—Yes, but that must be at a temperature to which in the ordinary course of things dynamite will never be exposed.

3029. Of course it is for the controlling power to take care that dynamite is never exposed to those conditions, if possible?—Yes.

3030. But in the process of your manufacture of dynamite, you have this machine for charging the kieselguhr in the shape of cartridges?—Yes.

3031. Do you think that that machine is so perfectly constructed that it will always pour into the cartridge the same proportion of nitro-glycerine?—No, not always the same proportion; but it will always let us know how much nitro-glycerine the silica can absorb.

3032. From your experience, what do you think is the variation in the absorbent power of the kieselguhr?—We have some kieselguhrs which will not absorb nitro-glycerine at all, and we have some kieselguhrs which will absorb rather more than 75 per cent. The kieselguhr has to go through a long and expensive process before it is fit to absorb the nitro-glycerine.

3033. Until you dry it, you cannot tell, I suppose, whether the sponge will absorb 75 per cent. or less than 75 per cent., or even more?—Just so.

3034. You cannot judge from the appearance, can you?—Yes, we can judge very nearly from the appearance.

3035. Is

Mr. *Whitwell*—continued.

3035. Is your machinery so applied that the operator can infallibly see whether there is any dropping or expression of the nitro-glycerine in excess?—Yes; he puts the dynamite into a small press; he applies the weight to the lever, and pushes it along the lever until there is a slight exudation of nitro-glycerine, and then he reads off from the lever the result; the figures read nitro-glycerine in one direction, and silica in the other.

3036. Is that merely used to test a sample, or does it test the whole?—Yes, a sample.

3037. It is not used in testing the cartridges, is it?—No, it is merely the sample that is tested; it would be impossible to test the cartridges.

3038. You do not test the whole mass of the Kieselguhr?—No, but it is so thoroughly mixed, that the sample must be like the bulk; it is impossible that the sample should not be like the batch.

3039. Do you test the Kieselguhr in any other process, with regard to its capacity of holding nitro-glycerine, except by testing the sample?—That is all; but of course there is the experience of the men in addition, and they can tell to a nicety by the feeling and appearance.

3040. Are you in the habit of selling much dynamite that is charged with a smaller proportion than 75 per cent. of nitro-glycerine?—Yes; we rarely have dynamite that contains less than 72 to 75 per cent. of nitro-glycerine.

3041. I suppose that you call 70 or 75 per cent. proof?—Yes.

3042. Do you mark it as over, or under proof?—No, we send out none that is under 72 per cent.; we reject all the bad silica.

3043. Have you ever exploded any of your dynamite or your cartridges with an electric spark?—With a spark acting on an Abel fuze we have, but not with the spark itself; I have sometimes sent a spark right through the dynamite, and divided it, without exploding it.

3044. Have you ever tried it with the two points of the current?—Yes, many times, and I have never been able to explode it; but it is possible that my battery may not have been powerful enough.

3045. Do you think that lightning would explode dynamite?—Yes, I should say so, decidedly, if it was a powerful shock.

3046. You exploded by a detonator?—Yes; we explode it by means of an electric battery; the spark ends in the Abel fuze inserted in the detonating cap, and it ignites the fulminate, and then we have an explosion.

3047. You never exploded dynamite with the electric spark simply?—No, I have never got a battery to do that, though I have a very strong battery.

3048. If a cartridge was put into water for two hours, the nitro-glycerine would work out of it, would it not?—Yes.

3049. Would you not hold that if a miner's coat had cartridges in it, and the pocket got wet, and then stayed there for two or three hours, there would be danger in using them?—No, there would be no danger, but he would get no explosion from the dynamite when he applied it.

3050. I suppose, if the nitro-glycerine was separated, it might be much more easily exploded than the cartridge itself?—No, the nitro-glycerine would run into the man's pocket, and it might run on to the floor, but there would be no danger of an explosion; he might walk over it.

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Mr. *Whitwell*—continued.

3051. Nitro-glycerine is a very dangerous article to be brought into contact with in mines where iron tools are used, is it not?—Yes.

3052. Consequently, if you got nitro-glycerine separated from that which holds it together, it would be dangerous. Have you ever tried whether you could get any material which would hold the nitro-glycerine mechanically, and which would not allow it to separate?—Yes, we have tried various materials, but none so good as kieselguhr.

3053. That would be impossible as a chemical combination, you think?—So far as our knowledge goes, but we take every means to prevent exudation; it is not so very dangerous, after all. I think that no exudation in transit and handling the packages would be possible; and if it were possible, the nitro-glycerine would be confined in the box, where it would be as safe as in the cartridge.

3054. The last witness stated that some of the tins in which nitro-glycerine had been packed, rusted from moisture in the carriage; is it not possible that nitro-glycerine might rust the tins?—I think not.

3055. It could not eat its way out of the tin, you think?—I think not at all, but if any acid had remained in the nitro-glycerine, it might be possible.

3056. But you use no tins, only paper and wood?—Only paper and wood.

Mr. *Stevenson*.

3057. What per-centage of free acid was there in this calcined Kieselguhr, which gave the acidity to that cartridge?—Perhaps about a millionth part of a grain; such a faint trace that it was scarcely possible to detect it.

3058. It could hardly contain sulphuric acid, could it?—Yes.

3059. An extremely small quantity I suppose?—Yes, the silica is very porous.

3060. You think that could be easily corrected by a little excess of the alkali?—Yes, the least trace of it.

3061. You think it was quite unnecessary that you should have been put to the expense of using coal free from sulphur, in order to be quit of that small quantity of free acid, do you?—It would be desirable to be free from that, because it might not always be possible to have a sufficient quantity of alkali present to neutralise the acid in the silica; but after thinking it over, and making experiments in connection with it, I did not think that it was very necessary to have coal altogether free from sulphur: the sulphuric acid that remained in the silica would be practically inoperative, and it has no effect whatever in bringing about a decomposition. I have exposed our dynamite for days and days to a high temperature.

3062. To how high a temperature have you exposed it?—I have exposed it to a temperature of 180°, without decomposition.

3063. But you said that a high temperature would produce decomposition, did you not?—Yes, if long continued, from 180° to 212°.

3064. Whether there was this slight amount of sulphuric acid or not?—Yes.

3065. What is the susceptible ingredient of the nitro-glycerine which would yield the decomposition?—After exposure it begins to give off the hypo-nitric acid itself, and the nitroxyl in the nitro-glycerine begins to come away.

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3066. But

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3066. But will not the excess of alkali prevent it?—Yes, if it were possible to have a large excess of alkali in dynamite it would stand a much higher temperature.

3067. What per-centage of alkali do you send away in dynamite?—It is very small indeed; the nitro-glycerine itself contains 1 per cent. of alkaline solution.

3068. Not 1 per cent. of free alkali?—No.

3069. Then the alkaline solution is washed away from the nitro-glycerine, is it?—No, it is not; we let it remain.

3070. You drain it off, do you not?—After we have washed the nitro-glycerine in the alkaline solution, it never entirely separates from that solution; it retains some of it intimately mixed up with it?—Yes.

3071. Do you mean mechanically mixed up with it?—Yes.

3072. It must be an extremely small percentage, must it not?—Yes, very small.

3073. It would never be sufficient to neutralise any hypo-nitric acid set free by spontaneous decomposition, would it?—No, it is not quite enough for that, but you cannot have spontaneous decomposition until you reach a high temperature.

3074. But it is impossible to provide for that decomposition by putting in alkali, is it?—We cannot do it, but it would be desirable.

3075. It is impossible, in the nature of the case, is it?—It cannot be done by any means which we have discovered.

3076. You said that you took security to prevent water getting into your packing boxes by putting inside the boxes paper which was impervious to water?—Yes.

3077. Suppose the box opened upside down, and was exposed to the water, would not the water get in?—It might; but we have a water-proof covering completely from the top to the bottom.

3078. Drawing a distinction between the danger of dynamite in use and dynamite in transport, you seem to think it is impossible that nitro-glycerine could be so exuded from cartridge as to appear in a dangerous form?—Yes.

3079. You think that if it exuded in the form of drops or a thin film, it could not be a source of danger?—Not in the least, not even in a gun-powder magazine; supposing it should explode by treading on it, it would only explode where it was actually struck; nitro-glycerine must be very closely in contact to make the whole of it explode by concussion.

3080. If it leaked into a miner's pocket, it would be still so diffused that there would be no danger, you think?—There would be no danger at all. Some of the wrappers of the boxes obtained from Major Ford had nitro-glycerine in them, and I found it impossible to produce an explosion by concussion; I tried very hard, but there was no explosion.

3081. Suppose the boxes got under water in the hold of a ship, and the nitro-glycerine was floated out of the boxes, what then?—In our boxes that would be impossible, because nitro-glycerine, being of a higher specific gravity than water, and insoluble in water, would lie on the bottom of the box; it would be separate; but in addition to that, our boxes have nitro-glycerine proof papers in them.

3082. Have you sufficient absorbing material in the box to take up the whole of the nitro-gly-

Mr. Stevenson—continued.

cerine, even though the box was wholly immersed in the water?—No; but the nitro-glycerine would lie at the bottom, and the water would float on the top; it could not put the nitro-glycerine out of the box. If you had a beaker half filled with nitro-glycerine, and then poured water in it, the water would run out over the top, and the nitro-glycerine would remain in the beaker; so in the same way the nitro-glycerine would remain in the boxes.

3083. And it would be protected from exploding by the water which would be always on the top?—Yes, in the way we pack it at present the nitro-glycerine would remain in the boxes.

3084. If they were too long exposed to the water, surely your boxes would begin to leak; say that they were exposed to the water for some hours?—It has resisted the water for weeks. I took a bag of it, filled it with water, and hung it up for weeks without producing any leakage.

3085. Have you immersed one of your boxes in a cistern of water, and taken it out after some days, and found that the water was not inside your paper?—No; but I took a bag of water-proof paper, and filled it with water, and suspended it for weeks without leakage.

3086. But what I want to ascertain is whether the nitro-glycerine would remain inside the box though the box was immersed in the water?—Yes, it would. I have tried it with nitro-glycerine but not in that way.

3087. Have you tried it with dynamite?—Yes, I have tried it with dynamite also for several days. Before using the paper we tested it to see whether it was nitro-glycerine proof, and if it retained the nitro-glycerine.

3088. But is it waterproof?—Yes, it is water-proof and nitro-glycerine proof.

3089. Did you ever put a cartridge of dynamite on a railway rail and pass a truck over it?—Yes, many times, and, generally speaking, if it was a very heavy waggon it exploded the first time, but sometimes a waggon passed over it and then a second waggon would explode it. The first waggon merely flattened it, and the second wagon had a thin layer to go over, and then it exploded.

3090. Did it explode the whole cartridge?—If it was very small it all exploded; if it was a large one it did not explode, but only the pasty stuff that the wheel passed over.

Mr. Vivian.

3091. Will you kindly inform the Committee of the chemical analysis of kieselguhr?—Some samples contain a very small trace of sulphate of lime, but kieselguhr is nearly pure silica.

3092. It is almost pure silica, is it not?—Yes, it contains about 97 per cent. of silica, a little water, a little oxide of iron, and but a very small trace of sulphate of lime.

3093. In what way does it differ from quartz rock, or sand, such as is used for fire-bricks?—It is extremely bulky and of very light specific gravity; it is very porous.

3094. With regard to inertness, the sand that is used for fire-clay is pure silica, is it not?—Not pure silica. Sand and silicate of alumina are used for fire-bricks.

3095. Take quartz rock, that is pure silica, is it not?—Yes.

3096. How does kieselguhr differ from that?—It differs very little indeed from it, so far as the analysis

Mr. *Vivian*—continued.

analysis is concerned. The silica which we use contains little oxide of iron.

3097. Will quartz rock absorb nitro-glycerine? No, it will not.

Mr. SAMUEL HOLLAND, a Member of the House of Commons; Examined.

*Chairman.*

3099. WILL you be kind enough to inform the Committee how you come to be well informed with regard to the subject now before it?—I am a considerable user of both gunpowder and dynamite.

3100. In what particular mode of business do you use it?—In slate quarries. I have slate quarries in the neighbourhood of Festiniog, where I employ rather over 500 men at my own quarries.

3101. Do you use many different kinds of explosives there?—I use three kinds, gunpowder and gun-cotton, and the men are also using dynamite. I find a difficulty in getting it.

3102. Are your men using gun-cotton in any quantity?—The monthly consumption of gunpowder is a ton and a half. Gun-cotton, since the explosion at Stowmarket, has been discontinued, and we have only got it very lately. I cannot get the quantity which we should like to use. I am only getting, I think, 10 boxes a month of gun-cotton.

3103. Of dynamite, how much?—I am not able to get it myself, but it is obtained by the men, and used in the works in small quantities. They have to smuggle it in.

3104. In what kind of packages do you receive those explosives?—The gunpowder is all in quarter casks, half barrels, and barrels, but more particularly in quarter casks; that is more convenient for distribution to the men, and for immediate use.

3105. How do you receive your gun-cotton?—We receive the gun-cotton in cases.

3106. Do you receive it wet or dry?—We receive it dry, packed in cartridges; we have a little railway of our own from the different quarries in the neighbourhood, and the railway company now refuse to carry gun-cotton, because it comes to us dry. It is conveyed to the neighbourhood in a wet state, and the gun-cotton company have erected works for drying it, and they have to send it to us in a dry state. It has to come in carts to us dry, though we have a railway to the very spot where they dry it.

3107. Now what is the amount of the consumption of explosives in your neighbourhood?—The whole amount of gunpowder used in our neighbourhood is about 220 tons annually. With regard to gun-cotton, I am not able to say, because of the difficulty of getting it; but I believe that some of the other quarries use about the same quantity as myself. I think that dynamite is only used by one or two others, who have also to smuggle it in through the men; they go down to the agent, and bring it up in their pockets, and they come by train, so that they run a greater risk unknown to the railway company than if they carried it in boxes in a regular way.

3108. Where is the gunpowder stored?—The different companies have magazines in the neighbourhood of Port Madoc; they supply it to us, and the railway brings it up in iron-covered

Mr. *Vivian*—continued.

3098. With regard to the oxide of iron, does that conduce to the absorbing power?—No, it is the extremely porous property of the silica.

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*Chairman*—continued.

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vans made for that purpose; but they are forced to send gun-cotton in carts.

3109. Do you store gun-cotton in the same magazine as gunpowder?—Each quarry has its own private magazine for storing gunpowder, and the gun-cotton is in the same magazine with the gunpowder.

3110. But the dynamite is not stored in any magazine, is it?—No, there is a difficulty in getting a building licensed for it. I erected a building, but I find a difficulty in getting a license, although I have made several applications to the Home Office for one.

3111. Now will you be kind enough to state to the Committee how all those different explosives which you have mentioned are used at your works?—Our men, for quarrying purposes, bore a hole with an auger or a jumper, and then drop the powder in, in the quantity required, according to the depth of the hole; and the same with gun-cotton, which is all in cartridges, and they put in one or two cartridges, according to the quantity they think necessary to explode the rock.

3112. Have you had many accidents at your works?—No, not many; there have been accidents occasionally, but I have been fortunate with my men for some years. My opinion is, that the accidents occur entirely through the men's own carelessness; a man blew his head off once; a blacksmith bored a hole into a cask of powder with a hot iron.

3113. Have you had any accidents in the magazines?—None; the first magazines in the neighbourhood were erected at my suggestion. Previous to that, there never had been an accident, even although the powder was stored and kept in a part of the shop of a shopkeeper in the neighbourhood, he being the only agent for the sale of it. I have seen him giving out powder to the people by candle-light, and, noticing that, forty years ago I advised the erection of gunpowder magazines.

3114. Do the railways in your neighbourhood carry these explosives without any difficulty?—No, they carry gunpowder freely, but not gun-cotton or dynamite. We are anxious to get them to carry dynamite, because it is very much stronger and much more useful to us in hard rock, and for falling large masses of rock.

3115. Are your mine magazines inspected?—Yes, all of them; I rather think that Major Majendie has been there.

Colonel *North.*

3116. You stated that you use about ten boxes a month of gun-cotton?—Yes.

3117. Is it by weight that you get it?—Each box contains about 120 of those cartridges; they are about three inches in length and from seven-eighths to an inch and a half, or an inch and a quarter in diameter.

3118. There is no danger with them, unless

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Colonel *North*—continued.

the cap is put to them, is there?—No, there is far less danger, either with gun-cotton or dynamite, than with gunpowder; they will not explode, unless they are fired with a cap or with loose powder. The men generally, after charging a hole with gun-cotton or dynamite, fling a little loose powder on the top of it, for the purpose of conveniently exploding it; otherwise they explode it with a fuze with a cap at the end; they never have to stamp the loose rock when using either gun-cotton or dynamite as they have with powder; they have to use an iron stamper with powder, a wooden one with dynamite; but, even then, a fuze is introduced to the powder so as to fire it. There is, in fact, less danger with either gun-cotton or dynamite; we use them more safely.

Mr. *Vivian*.

3119. Did you ever see damp gun-cotton used?—No, none of us have ever used gun-cotton in a damp state.

3120. Is there any tamping done with the gun-cotton?—Very little; they press it down with a wooden stick, and then they can drop earth or anything else over it.

3121. Have you ever had any accident from tamping with iron?—No.

3122. Tamping with iron is not allowed, is it?—We have never done it with gun-cotton or dynamite, only gunpowder; but previously to stamping the earth upon the powder, we always put a little moss or straw, a fuze being put in at first, of course.

3123. Have you ever had any difficulty from the dynamite freezing?—No; it is always stronger when warm. If a man before he uses it keeps it in his pocket, the warmth of the body is quite sufficient.

Mr. *Whitwell*.

3124. You say that you use about 10 boxes per month of gun-cotton, I believe?—Yes; 10 boxes of about 120 charges. I do not know the weight of them.

3125. How far from your mines is the place where the gun-cotton is dried?—Eight or nine miles.

3126. You say that the gun-cotton is brought from the manufactory in a wet state?—Yes, it is brought from Stowmarket, or wherever it is made.

3127. How far does it travel from the manufactory to the place where it is dried?—I do not know; 200 or 300 miles, perhaps.

3128. Then the railways will carry it without hesitation in a wet state, I suppose?—They did so, I believe, until very lately; but I have heard, since I came to town, that there is some further restriction.

3129. Then, if it is not carried in a wet state, it cannot reach your neighbourhood, unless it is made on the spot?—Just so.

3130. Do the railways who decline to carry the gun-cotton belong to some large company, or are they some local railway?—The railway in the neighbourhood is a small company.

3131. They are unwilling to carry it, are they?—they were willing at first to carry it; but from the reports they received, in one way or other, as to other railways declining to carry it, they now decline to carry it also.

3132. Did their decision in that case arise from some accident that had occurred?—Not at all; there had been no accident in transmission.

Mr. *Whitwell*—continued.

3133. That is to say, neither in gun-cotton or dynamite?—No.

3134. I think I understood you to say, that the quantity of dynamite which you use is very small?—Yes, very small; that is, in consequence of the difficulty in obtaining it.

3135. The men go down to Port Madoc to get it?—Yes; the agent said that he had sold about 3,000 *l.* worth, and he might have sold three times the quantity if he could readily transmit it.

3136. Do the men who go down to Port Madoc buy it themselves?—Yes; they buy it themselves, and they bring it up in a carpet bag or their pockets.

3137. Do you supply your men with gunpowder or gun-cotton?—Yes.

3138. And you charge them cost price, I suppose?—Yes.

3139. But they would rather buy the dynamite themselves than pay you for the gun-cotton or gunpowder?—Yes; they want it for some of the harder work. They do their work by contract, and they get this dynamite to assist them.

3140. I suppose for ordinary work they would find gunpowder quite as economical, but, for difficult work, dynamite is cheaper?—Yes; dynamite would not suit in the slate rock; dynamite would create too much destruction in the slate.

3141. You do not think it is likely that dynamite would be used for ordinary quarrying purposes in obtaining slate?—No; just so. It would only be used for removing waste rock or for any dead work.

3142. You say that no accident happens except from the carelessness of the men?—None.

3143. Then, do you think that any legislation can protect the workmen from their own carelessness?—You cannot do that. One would think that they would be careful for their own sakes. I have known one or two accidents which have happened through sheer carelessness. A man uses a quantity of powder to shake or throw down a large mass of rock overhanging one of the quarries; the powder makes fissures in the rock; he drops a quantity of gunpowder into the fissures; it has not gone off freely, and in five minutes the man goes to see the reason, and perhaps it explodes and kills him.

3144. You cannot pass an Act of Parliament to say that they must allow so many minutes to elapse before they go near a blast, I suppose?—In each quarry there is a horn blown at a certain time, and they are allowed 10 minutes to fire the charges; they are bound to attend to that regulation.

3145. That is a regulation in the quarry made by the proprietor, is it not?—Yes; we impose a fine if they allow their charges to go off outside of that time.

3146. Can you suggest any regulations suitable to be incorporated in an Act of Parliament for protecting the men from their own carelessness?—No; certainly not.

3147. The Committee wish to secure the greatest possible protection for the public and those employed in mines. Now, as a Member of Parliament, can you suggest any rule that could be introduced into any Act with a view of accomplishing these objects?—I should have thought that self-preservation and the existing regulations would have been sufficient, and, in fact, accidents do not very often occur.

3148. You would not ask Parliament to compel railway

Mr. *Whitwell*—continued.

railway companies to carry dangerous articles, would you?—They carry at the present time the most dangerous explosive of all, which is gunpowder. I would assuredly ask them to carry gun-cotton and dynamite which are not so dangerous.

3149. Do you know of an accident from carrying gunpowder in your neighbourhood?—No.

3150. Has not gunpowder been used from the time you first went into the business?—I have been a user of gunpowder for a length of time and no accident has happened.

3151. What makes you say that gunpowder is the most dangerous of the three articles that you have named, namely, gunpowder, gun-cotton, and dynamite?—Gunpowder could be fired with a light, even a man smoking might accidentally fire it, whereas that would not fire gun-cotton or dynamite.

3152. But have you had sufficient experience of the two articles to enable you to judge whether there may not be other ways of producing an explosion?—Gunpowder, we know, may be exploded in many ways, but those two other articles can only be exploded, so far as we know, by firing the charge with a cap in the cartridge; throwing them about never causes an explosion.

3153. You do not know that if dynamite was enclosed in a small metal thimble and thrown on the ground it would explode?—I believe that it would not, but I have not seen the experiment.

3154. Do you think that it would be proper for Parliament to direct that the railways should carry those articles?—I should say so, certainly. I should like to read a letter from one of my nephews who wrote to me the other day, after hearing about this Committee, with reference to the Barbara Gold Mining Company, Limited, of which he is the mining director. He says, "About six tons of dynamite are sent annually to our mines in Brazil, where it is used instead of gunpowder, which it has entirely superseded for mining purposes, and if our operations extend, we shall use, I expect, fully double that quantity. Nearly all the gold mines use dynamite in preference to gunpowder. We get ours, and I believe that other companies get theirs, from Messrs. Nobel and Company, of Hamburg, who ship it into sailing vessels; we have used it, more or less, for about three years, and we find that whereas in our mine, in raising the mineral which is a kind of pyrites, we could raise during the month nearly five tons with gunpowder, we can with dynamite raise, on the average, 18 or 20 tons per month, and we can work our minerals with the assistance of the steel borers, owing to the small hole required for dynamite. Our manager reports that it is as safe, if not safer than gunpowder to handle. The men have sat on the boxes for days together and I never heard of an accident from dynamite. It is very dear at present, but even at the high price it is far cheaper than gunpowder."

3155. But your nephew does not say, I suppose, whether the railways in Brazil carry it?—I do not suppose that they have a railway there. I think it is near the river, and they have water carriage.

3156. But there are railways in the Brazils to many of the mining districts, are there not?—Yes.

3157. You would not ask Parliament to compel a railway company to carry dynamite unless

Mr. *Whitwell*—continued.

they were willing, would you?—I think there is no law to say that railways must not carry it; but there is perhaps a certain penalty in case of accident which makes them afraid to carry it.

3158. But I ask you whether you would propose to ask Parliament to compel railway companies to carry articles which they feel are dangerous to carry?—I do not consider it dangerous.

3159. But would you compel railway companies to carry articles which they think are dangerous to carry?—I have understood from some of the railway managers that they do not consider it dangerous to carry, but they are afraid to carry it, from the reports which are circulated about it.

3160. Would you pass an Act of Parliament to compel railway companies to carry it?—If they are compelled to carry gunpowder, I do not see why they should not be required to carry gun-cotton or dynamite.

3161. But if a railway company declined to carry gunpowder, is there any law to compel them to do so?—I am not certain about that.

3162. You would not ask Parliament to compel a railway company to carry an article which is considered dangerous, would you?—No: not if it were really dangerous, but I do not consider these dangerous.

Mr. *Stevenson*.

3163. Do you think that the public would desire, when they wanted these valuable new explosives, that they should be prevented from getting supplies through the mere prejudice of a railway company?—I think that the public ought not to be deprived of those articles, and I know that they are anxious to get them.

3164. Supposing that gunpowder were a new invention, the same as dynamite and gun-cotton, and if we had had the experience of 100 years or 200 years as we have had in the case of gunpowder, would gunpowder as a new article be more or less dangerous than dynamite or gun-cotton?—I think it would be more dangerous; I think both those other articles have been used and carried about a sufficient length of time to prove that they are not so dangerous as gunpowder.

3165. You think that there has been sufficient experience with the new articles to justify their being carried?—Yes; certainly.

3166. Supposing all these articles were new, and we had had no experience of any of them, would you still consider dynamite and gun-cotton safer than gunpowder?—I think there is no doubt about it; that is the opinion of all who have used both dynamite and gun-cotton.

3167. In what consists the greater safety of dynamite compared with gunpowder, in the matter of transport?—I do not see how dynamite can explode except by a cap being put into it and firing it; by tossing it about and rolling it over, I do not suppose that you would get it to explode. If you put a light to a cartridge, it merely goes off like a squib, unless it were confined in a hole.

3168. Whereas gunpowder may be ignited by a spark?—Yes, gunpowder may be ignited by a spark, which may be caused from the engine, and which has been the case, I believe, before now; or even striking fire in any other way near to it will cause it to ignite.

3169. You think that if railway companies would

Mr. *Holland*,  
M.P.  
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Mr. Holland,

M.P.

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Mr. Stevenson—continued.

would give a candid consideration to the matter they would come to the conclusion that dynamite and gun-cotton are safer?—I have understood from several managers of railways that they have no fear themselves.

Mr. M'Lagan.

3170. Are your operations principally quarrying or mining?—They are entirely slate quarries.

3171. Therefore, it is not of so much consequence to the health of your men whether they use gun-cotton, dynamite, or gunpowder?—We do not use those two articles in ordinary slate work, but in removing loose work and dead work we do use it. None affect the men's health.

3172. In your experience, gun-cotton and dynamite are being far more extensively used than gunpowder, are they?—They would be more extensively used if they could be fairly got.

3173. But it is not so extensively used at present?—No; we cannot get them.

3174. Can you give the reason why railway companies object to carry gun-cotton in a damp state?—I do not know; but it is some late regulation, I believe, on the subject.

3175. You have never heard any reason given for it, have you?—No; but it is since the explosion at Stowmarket.

3176. That is to say, within the last two years?—Yes, within the last two years.

3177. Two or three questions have been put to you with reference to the right of the Legislature to compel railway companies to carry dangerous articles; do you not think that it is right, when the Legislature gives a monopoly to a particular company that it should impose certain conditions on that company connected with that monopoly?—I think they ought to allow one thing to be as freely carried as others; and if they restrict anything they should restrict all.

3178. Is it right, do you think, to leave the question of deciding what is a dangerous article to a railway company, or rather to an unbiassed individual appointed by the Government?—I suppose the Committee are sitting to decide that question.

Mr. PERRY FAIRFAX NURSEY, C.E., called in; and Examined.

Chairman.

Mr. P. F. Nursey, C.E.

3187. You are an engineer in this country, employed by Messrs. Krebs & Co., of Cologne?—Yes.

3188. They are manufacturers of lithofracteur, are they not?—Yes, they are.

3189. You are their accredited agent in London, I believe?—I am.

3190. You have had much experience in the use of lithofracteur both experimentally and practically; will you be kind enough to state to the Committee the nature of the compound, its composition, and where it is made?—Lithofracteur is a nitro-glycerine compound, manufactured by Messrs. Krebs Brothers & Co. They have two factories, one at Deutz, and the other at Kalk, on the opposite bank of the Rhine to Cologne. The principal factory is at Kalk. The one at Deutz is a small factory for preparing the dry ingredients. Lithofracteur is a stiff pasty substance of a dark grey colour, composed of 55 parts of nitro-glycerine, 12 parts of

Mr. M'Lagan—continued.

3179. But I ask you as a practical man, is it right to leave it to a railway company to say what is a dangerous article, or rather to the Government to say what is a dangerous article?—To the Government, certainly.

3180. Therefore, if the Government, under the advice of its officers, say that the railway company should or should not carry an article, you see no objection whatever to an Act of Parliament enjoining it on the railway company?—Certainly not, if they are perfectly satisfied that the article is not dangerous.

3181. I presume that your magazine is not near any particular dwelling?—No, our private magazines are at the quarries, not near dwellings; and those belonging to the companies are also at some distance from dwellings.

3182. Have you ever been annoyed by people coming and building houses near your magazines?—They cannot well do so, because it is all our own property.

3183. Have you heard of people in any new district being annoyed by people coming and building houses near the magazines, and compelling people to remove their magazines?—No, never in our neighbourhood. In fact, I never heard of any such case in Wales.

Mr. Knowles.

3184. I think you stated that the reason you preferred dynamite to gunpowder was that it was stronger?—Yes, it is stronger than gunpowder.

3185. Do you know the difference in cost of the two articles?—Gunpowder we pay £.48 a ton for. With regard to dynamite, so far as I have understood, they consider 1 lb. of dynamite equal to 5 lbs. of gunpowder, but I have not got the cost. It is much more expensive, but it does much more execution.

3186. What is your opinion with regard to sporting gunpowder, is not that much stronger than ordinary blasting powder?—What we use in our work is fine grained; it is very little coarser than sporting powder. We consider that the finer the grain the stronger the powder.

Chairman—continued.

kieselguhr, and 33 parts of other chemical substances, including the ingredients of gunpowder. I have here the details of the composition. We have first, 20 parts of a mixture composed of 70 parts of ground nitrate of baryta, 10 parts manganese, 10 parts bi-carbonate of soda, and nine parts prepared sawdust, with a solution of one part resin in five parts spirit. This mixture is incorporated with 17½ parts of a second composition, prepared of silica. To prepare this, 100 parts thereof are mixed with 2½ parts carbonate of soda, and 2½ parts nitrate of baryta, which after being mixed is heated dry, ground, and, if necessary, sifted. After the above ingredients have been thoroughly mixed, a preparation is made of seven parts of sulphur, dissolved in bisulphuret of carbon, which contains two parts solution of sulphur added to three parts of finely pulverized and sifted charcoal. To this mixture are then added one part prepared sawdust, and one part bran, previously saturated with nitro-glycerine.



Chairman—continued.

rine. Nitro-glycerine is then added to the whole composition, until the total amount of nitro-glycerine in the substance amounts to 55½ parts, thus giving a compound of 100 parts.

3191. For how many years has it been known?—The manufacture commenced in the year 1863, but it was not then in its present form; it was gradually improved by Mr. Engels, until in 1866 we produced the present article from which dates the manufacture of lithofracteur, as at present constituted. Some slight variations of the ingredients were made in 1872, and we now work to the formula in the English patent which I have just given.

3192. Will you be kind enough to state how it is manufactured, and the character of the machinery which is used?—The manufacture consists in the preparation of nitro-glycerine in lightly-built nitrating houses, surrounded by traverses. From the nitrating houses the nitro-glycerine is run to the mixing-house by gravitation through earthenware pipes. It is always kept under water until drawn off in the mixing-house, when the nitro-glycerine is mixed with the other ingredients by hand in wooden bowls. As mixed it is conveyed away to the mixing-sheds surrounded by traverses, where it is made up into cartridges by girls. Then it is packed in cardboard boxes of 5 lbs. and tied up in waterproof paper. It is then taken to the packing-house, where it is packed in deal cases holding 50 lbs. each. There is a lining of India-rubber to the wooden case, which is fastened with cement, and the cases are copper nailed. They are then stored in magazines which are sunk into the earth and which are well protected by lightning conductors. There are a great number of magazines in the grounds of Messrs. Krebs at Kalk, one of which belongs to the Prussian Government. They keep a permanent store there on the premises. There is a small handbill of regulations, several of which are put into each cartridge-box (*handing in a handbill*).

3193. Is that in English?—Yes; they are printed in various languages according to the country to which the lithofracteur is sent.

3194. About what quantity of lithofracteur is made yearly?—The average manufacture is about 10 tons per week, or about 500 tons per annum, and the factories are capable of turning out double that quantity. The number of hands employed ranges from 150 to 200, on the average. Some are employed of course in making boxes, and in preparing the paper, and others in manufacturing a manure from the spent acid.

3195. To your knowledge, has any accident ever occurred in the manufacture, storage, transport, or use of lithofracteur?—None, to my knowledge; certainly not in the manufacture, as is proved by a certificate from the Burgomaster of Deutz, which was sent to the Home Office last December. This is a translation of the certificate: "At the request of Messrs. Krebs & Co., proprietors of a dynamite and lithofracteur manufactory at Kalk and Deutz, I hereby certify that since my tenure of office as Burgomaster of Deutz, since 1867, I have not heard of any accident to any one workman at their factory. An explosion of a box of percussion caps, which occurred at their factory about two years ago, was caused by the fall of a chimney, but no workmen were injured thereby, only the building.—Deutz, 2nd December 1873.—(Signed) The Burgo-

Chairman—continued.

master *Reisch*." With regard to transport, we have never had any accident.

3196. Are there any special precautions taken in Messrs. Krebs' factory with respect to the dresses of the men, and so on?—No, none at all. Two accidents have been reported to me, which occurred in Australia, in the use of lithofracteur, but they arose from gross carelessness, or perverseness, or obtuseness, on the part of the working men. The greatest danger in the manufacture of these compounds, say dynamite or lithofracteur, exists in the nitrating houses in the preparation of the nitro-glycerine, but we have never had any accident whatever in that respect. We take every possible care to keep the temperature low, and certain other special arrangements which we believe conduce to perfect safety are adopted. There has been no accident whatever in the nitrating-houses, or in any other part of the factory.

3197. Special precautions, I suppose, are taken in the factory with regard to dress, and so on?—No; no special dress is worn; the chief precautions consist in lightly-built nitrating-houses, with traverses placed round them, and in having the magazines well sunk into the earth, and well protected by lightning conductors, while the danger buildings are grouped by themselves, according to their nature.

3198. Does the law of Germany affect you?—No, not at all seriously; we have the inspectors in occasionally, they simply look at what we are doing; they do not interfere so long as as we work under the conditions which they first imposed.

3199. Have you a copy of the conditions imposed upon you by the German Government?—No; but I will get them from Cologne, if the Committee desire it. The rules of the factory are of a very simple character, and they are also approved by the Government. These are the rules: "Rules of the Lithofracteur Factory of Messrs. Krebs & Co. Every workman and workwoman employed in the factory is subjected to the following rules: (Working hours.) The working hours, exclusive of meal times, are 10 hours per day; five hours count as half a day; two and a half count as one quarter of a day; one hour is one-tenth of a day. Nobody is allowed to leave the factory during working hours. (Time.) The time for beginning work, as also of the beginning and ending of meal times, and the end of the working day, is regulated by the nature of the work in hand, and determined by the working manager. The factory clock is the only acknowledged standard of time. (Fines for being late.) The fine for being 10 minutes behind the time is 1 sgr., or within half an hour, 2 sgr.; or if after that, he will not be admitted unless he works a quarter of a day. Any one who repeatedly comes late is liable to be discharged. (Smoking.) Smoking in the factory is fined 10 sgr., but may also be punished with instant dismissal. (Spirits.) The same penalty applies to any one bringing spirits into the factory. (Insubordination.) Insubordination, or rudeness to superiors, is punished by instant dismissal. (Meals.) Meals can only be taken in the dining-room provided. (Strangers.) Strangers are under no circumstances permitted to enter the factory, and anyone found therein must at once be conducted to the office. Every workman is bound at once to send away any stranger from his place of work. (Pay.) Pay-lists will be

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closed every Friday evening. Advances are never made. By entering the service every workman declares himself liable to the above rules. (Superfluous clothing.) Superfluous clothing can only be left in the dining-room; should any such be left about the factory, the owner may be fined to the extent of 6 *d.* (Notice to leave.) Should any workman wish to resign, he must give 14 days' notice, which notice he is entitled to receive from his employers." Those rules are drawn up by Mr. Engels, and sanctioned by the Government. There are no special dresses, boots, or anything else of that kind.

3200. How is the transport of lithofracteur effected on the Continent?—In Germany it is effected by water in loads of 30 tons, and by land carriage in loads of 15 tons. It is taken by public carriers. I have some pamphlets which give the certificates of the carriers. I should mention that the pamphlet is marked private and confidential for this reason, that at the time it was drawn up we were in full expectation of having a license in a short time to manufacture in England; but from certain circumstances the licence was not granted; it was through an imperfection in the sample which was submitted to the War Office, and there is a paragraph at page 4 which assumes that the license was obtained. At page 27 you will find two public carriers' certificates (*handing a book to the Committee*); they are near the bottom of the page, and are signed by A. Linger and Balshaser Meune, both carmen, and both certified.

3201. Is the lithofracteur carried by the railways?—Not at present, except for their own purposes, and during times of war they carry it; but there has been a movement in that direction lately, and it is very possible that within a short time there may be something definite known or done with regard to carrying it by railway. The Privy Councillor Reuleaux, Director of the Academy of Commerce at Berlin, recently inspected our factory and the process of manufacture, and he reported to the Government very highly on its safety, and Government are now thinking it time to allow the transport of lithofracteur by rail.

3202. Where is the lithofracteur chiefly used?—Lithofracteur is used in Russia, Sweden, Spain, France, Belgium, Holland, Switzerland, North America, Mexico, Peru, Chili, and Australia.

3203. You have stated that it was occasionally used for war purposes?—Yes, it was used very largely against Metz, and for other purposes in the Franco-German war. It was introduced into Belgium in the year 1872. Its introduction was a very simple process there. We submitted some samples to the Government chemist, who tried it in the laboratory, and he approved of the sample so far that it was then desired that we should make some practical experiments. We did so in the presence of the Minister of the Interior and the Minister of War. The experiments were carried out at some quarries at Quanast. We did some quarrying and blasting work; we then took down a railway bridge. Those experiments lasted about a couple of days, and at the end of that time they were perfectly satisfied with a little explanation from Mr. Engels our managing director and Mr. Luckow our chemist, and they came to the conclusion that it was safe to license it, and within a very short time we had a license,

Chairman—continued.

and it is now an article of commerce, subject to the usual restrictions in Belgium.

3204. Will you state to the Committee what are the special features and characteristics of lithofracteur?—They are very much the same as those of dynamite. Lithofracteur can only be exploded by a capped fuse or by electricity. I have exploded it at Jersey under a rock by electricity, but then it requires a cap at the end of the wires. It only burns when set light to, just the same as wet gunpowder or dynamite. The effect of a high temperature is only to volatilise it. At page 12 of the pamphlet there is an account of some experiments made before the War Office Committee, at Shrewsbury, in February 1872, and among those experiments we had some lithofracteur put into a small cup and placed in an oil bath with a thermometer. The temperature was gradually raised until it reached 374° Fahrenheit, and at that point the lithofracteur simply vaporised away; there was no explosion. It was afterwards ignited by fire from without; a 5 lb. box was put into the midst of a large bonfire. That was so far considered satisfactory by the Committee. On a previous occasion we put about 12 lbs. into an inch thick deal box fastened down, and put that into the bonfire, and when it caught fire at last, it simply burnt away, and a volume of smoke was raised. In another instance we placed a box of cartridges in a hole in the rock, filling the hole in the rock up with stones and guarded it with iron plates, so as to exclude the air; we had previously led an ordinary fuse into it. We laid the fuse without a cap so as simply to ignite, and it simply burnt away, the central cartridge being ignited first, and burning the bulk away from within.

3205. Have you made any experiments on a practical scale to prove the safety of the compound in cases of railway collisions and for military purposes?—Yes. At the quarries at Shrewsbury there is an incline 500 yards long, with a gradient of 1 in 8, and at the bottom of this incline we fixed some old quarry waggons, and put a cartridge on their buffers; at the top of the incline we had another carriage similarly constructed, with lithofracteur tied on to its buffer, and we let it go; it ran down the incline and came into violent collision with the one at the bottom. In the first instance we had wooden buffers, and we had no explosion. I tied also four cartridges on to the rails, and on its way down at a velocity of 40 or 45 miles an hour, as could be confirmed by Mr. Bidder, who was present, the waggon exploded one cartridge on the rails out of the four; it was not a complete explosion, and I found upon examination afterwards that it had squeezed out the lithofracteur from the cartridge, and that the wheel had picked up a piece of it and carried it with it, and exploded it on completing the first revolution, which I proved by measuring the diameter. The explosion took place away from the mass of lithofracteur. We then tried iron buffers, and tied cartridges on them; when the waggon at the top reached the bottom there was an explosion, but the cartridges were not totally exploded, because I picked up iron plates, which were smeared with the stuff in some parts, and there were white spots, which showed that the explosion had confined itself to the immediate points of contact.

3206. Have you any observations to make to the Committee as to exudation or decomposition?

—I do

*Chairman*—continued.

—I do not think it is possible to take place, unless it is subjected to a very severe test, which could not occur in practice with lithofracteur, if the nitro-glycerine is properly proportioned to the absorbent medium; and if the compound is properly manufactured; we have had no experience of exudation lately. A few years ago some was sent to Australia, and it was found to have slightly exuded; but since then there has been an improvement in the manufacture, and we have no exudation, and the manufacture is very large. With regard to the point raised by one of the witnesses examined before this Committee, who said that he thought exudation was likely to occur in transit, by the nitro-glycerine being shaken out, that could only be a matter of opinion. As a matter of fact, it could not possibly occur if the substance were properly made.

3207. Have you had any experience with lithofracteur at a low temperature?—We have had some made in hot weather and brought into the Thames; some of it has passed the tropics and reached Melbourne in hot weather in a sound state. We have not heard in practice of even a tendency to decomposition. I have heard of an acid reaction taking place; it may have taken place from the same cause as in dynamite, through some acid absorbed by the kieselguhr in the process of baking it. With regard to freezing, I have examined into it. It freezes at a comparatively high temperature, but it is easily thawed; if you have it in a large mass, and place it in a heap of manure, it is a very ready way of thawing it; or a small quantity put in the trousers pocket can be very easily thawed there. I have often thawed it in that way. The compound is not dangerous; at least, as far as my experience goes, when it is frozen. In the pamphlet before the Committee, at page 14, it will be seen that experiments were made before the War Office Committee; we made, among others, military experiments against stockades. In one instance we had a long indiarubber tube, about three inches in diameter, and about 12 feet long, and it was charged with 27 lbs. of lithofracteur. The object was to clear the stockade off and blow it forward; the lithofracteur which had been laying on the top of the hills all the morning had become frozen; the first cap exploded a portion of the charge and threw about 4 feet of the stockade forward. I recapped the charge and fired it, 2 feet more exploded. I then capped the remaining quantity about 6 feet, and the two caps exploded; there were two reports like pistol shots; the lithofracteur took fire and blazed up, and set the stockade on fire, thus showing that the lithofracteur was perfectly safe under those conditions.

3208. Have you any experience of the use of lithofracteur under water?—Yes, we have used it experimentally in torpedoes. Last autumn I was over in Jersey, and I removed some rocks there for Sir John Coode. I used charges under water, one of 50 lbs. and one of 120 lbs. That was placed in a crevice of the rock, to be fired at high water. I found that at night it was so rough I could not land. It was Saturday night, and it was left there until Monday morning. On Monday morning I fired the fuse, and the charge did not explode. On examining it at low water, I found that the fuse had become disconnected. I then re-fused it, and on Monday I fired it with good results. It had been 55 hours under water.

0.84.

*Chairman*—continued.

3209. In your opinion is lithofracteur a superior preparation of nitro-glycerine to any other?—I am not prepared to say that it is greatly superior; dynamite is also an excellent one, but we have had no explosions in our nitrating houses. I understand that there have been no explosions in the dynamite factory in England. There have been explosions in dynamite factories abroad, but I do not understand under what conditions the nitration is carried on there.

3210. What is the superiority of lithofracteur to the ordinary No. 1 dynamite?—We suppose that it is a trifle stronger, but we do not set it up in opposition to it. According to the report of General Von Kamecke, an officer appointed by the Prussian Government, he does lay down that lithofracteur is stronger, but there is no great practical difference, or it is a very slight difference.

3211. In your opinion will the explosion of a nitro-glycerine compound cause the explosion of an adjacent mass of a similar compound?—I think not. That question was raised by hearing from one of the witnesses that an explosion of dynamite had taken place from an explosion of nitro-glycerine, that being caused by a man throwing a stone at a truck. Mr. Nobel told me, some six years since, that upon one occasion there was an explosion of nitro-glycerine at his factory, and that the dynamite store was blown down, but none of it exploded; of course it would be a question of distance and quantity. I have no data, but practically, I think lithofracteur is quite safe.

3212. But cannot you give an opinion to the Committee as to what is considered a large mass, and what is a small mass?—A large mass might be 10 or 20 tons.

3213. Do you think that as much as a ton of lithofracteur would burn away, and not explode?—I think so. I think it is superior to dynamite in that respect. We can reach 374° Fahrenheit without exploding, and it only smoulders away, so I think it is just possible that if it was tried on a large scale we should have the same results, and that it would simply smoulder away.

3214. Is any lithofracteur used in England?—Not at the present time, because we cannot satisfy the War Office with the samples submitted. There have been several samples submitted, but in the first we did not comply with their conditions; in the second we complied with some of their conditions, but not with others; and in the third, the War Office asked for some more to be sent in for testing for exudation in damp. With regard to testing as to dampness, we stood the damp test exceedingly well, but, unfortunately, we did not stand the test of heat. I have now a license from the Home Office to import a further sample for trial by the Government, with a view to a license to manufacture in England, which I hope to obtain, if it is found satisfactory.

3215. At what temperature did it begin to exude?—I think it was nearly 100° Fahrenheit, but our idea, or even complaint, is that some of their conditions are really very delicate, and do not apply in practice. In the manufacture and transport of 500 tons a year for some time past we have had only very slight exudations indeed, and no exudation whenever it was exposed to a very high temperature; in transport no exudation takes place. I have myself a small cartridge which has been round the world, and it is in a very satisfactory condition at present.

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3216. The

Mr. P. F.  
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Chairman—continued.

3216. The Committee understand you to say that you consider it would be dangerous in a state of exudation?—Yes, if it is excessive, but a small moisture on the surface could not be dangerous. We take all precaution by wrapping it in a waterproof casing: first, there is paper round the box, and an india-rubber lining, too, to the box, and, moreover, the parchment wrapper is slightly absorbent. If you wrapped a piece of cotton waste in a piece of paper, and found it greased it, you might complain of exudation then, but there would be no more reason in the complaint in one case than in the other.

3217. Are you aware that one sample which was sent to the War Office was found, at a temperature of less than 100°, to exude?—Yes, according to the Report, I believe that was so.

3218. You would admit, would you not, that 100° may be easily reached?—Yes, but we have had it at a far higher temperature than 100°, at which no exudation took place; but I can understand that if a single cartridge was exposed to that temperature constantly it might exude, but they are never so exposed.

3219. Not to 100 degrees?—No, I should say not; at all events, they have not been found to exude.

3220. Not in the transport?—No, they cannot exude.

3221. Have you seen the suggestions which have been proposed by Major Majendie as to the amendment of the law relating to explosives?—Yes.

3222. Have you any observations to offer to the Committee upon those suggestions of Major Majendie?—Yes. Those suggestions are exceedingly good in the main, and so far as one can judge of them, we conceive that nothing could be more favourable to the makers and users of nitro-glycerine compounds than those conditions. It is what the public want, and what we want. But in the first place, though it is a trifling matter, I may say with regard to storing 10 lbs., that I see no practical use or good or harm in that restriction. If I could store 10 lbs., it would be simply worthless; it ought to be 50 lbs. as the minimum. I cannot see the reason for suggesting 10 lbs. It is not in the printed suggestions, but it has been stated in examination. In No. 27, I observe, it says that it shall be “carried in public vehicles, omnibuses, &c., or as cargo in passenger ships, by permission of the Board of Trade.” That point occurs to us as presenting a difficulty. We might only get a ship at the last moment, and there might not be time to apply to the Board of Trade for the necessary permission, and the ship might have to go without it. That is a point on which Mr. Jones might have given evidence, and he would say more on that point than I can if he were recalled. No. 28 states that the harbour authorities are “to have the power to make bye-laws, as in present Liverpool Gunpowder Act, to regulate the navigation and place of mooring of ships, safe stowing and safe keeping of explosives on board, regulating the kind of ship, barge, &c., licensing the same, fixing the place, time, and mode of shipping explosives, the precautions to be taken, and so on.” It occurs to me that the harbour authorities should be under the control or direction of some competent officer connected with the Home Office inasmuch as a short time since, when we had a cargo of litho-fracteur in the Thames, we were ordered by the authori-

Chairman—continued.

ties instantly to ship it into iron barges, which is a thing unheard of. Of course that order was reversed afterwards, on our representation to the Home Office; but certainly the harbour authorities should know what they are dealing with before they have that authority vested in them. No. 35 provides for “fit persons to be appointed inspectors under the Act, by the Secretary of State.” There should also, we think, be some condition that the inspectors should be thoroughly competent men, otherwise they may set up frivolous objections on points with which they are unacquainted; but of course there are men quite capable of doing the work.

3223. Have you seen a Report from Victoria on the subject, dated the 23rd of June 1873, Office of Mines, Melbourne?—I am informed that that refers to an imitation lot which was sent to Melbourne.

3224. Are you aware that the Government analyst in Australia reported that some litho-fracteur imported into that country contained free nitro-glycerine; that there could be little doubt that it was quite as hazardous as free nitro-glycerine; that every possible precaution should be taken in handling and storing it, and that it was liable to explode violently on being struck by a hammer?—I can quite understand exudation having taken place in the early stages of our manufacture some years ago, but I have not seen that report.

3225. Do you know of any accidents which have occurred in dynamite factories on the continent?—Only in the nitrating houses; I know that they have occurred there.

3226. But you have no personal knowledge of them?—I have not been on the spot or near it at the time, nor have I examined the ruins, but I have received reports from those who have.

3227. Are you aware that samples taken by the inspectors in two cases from cargoes in the Thames were found to be exuding?—I have heard it so stated, but that is a question of degree.

3228. You still have great confidence in it?—Yes; from the large amount used, and the amount of experience which I have had myself in the use and handling of large quantities made and used and transported in all directions. I do not go to the length to which I have heard some of the witnesses go; I think every explosive ought to be treated as dangerous. I believe that with due precautions no danger arises either with litho-fracteur or dynamite. Accidents only occur from gross carelessness and wilfulness on the part of the men. If moderate exudation takes place, what you might call sweating, I think there is no danger from it; we have proved it very severely. We have, of course, our own safety to take into consideration to begin with, and before submitting anything to the public we have been anxious to find out all the weak points in our compound.

Mr. Vivian.

3229. You have stated that there were about 10 tons a week of litho-fracteur manufactured at the present time?—Yes, that is about the average quantity.

3230. That is all used abroad, is it not?—Yes.

3231. None of it is used in England, I believe?—None in England; we have no license.

3232. Is it used entirely for mining purposes?—Yes, it is used for blasting purposes; for artillery purposes it is too local and too violent.

3233. It

Mr. Vivian—continued.

3233. It is not used in the Army?—Not for artillery, but for engineering operations.

3234. It was used in the Franco-German war, you say?—Yes.

3235. Under what conditions was it transported?—It was transported by land and by water.

3236. By railway?—Yes, by railway.

3237. Were any special precautions taken?—No, none that I know of; it was packed in our usual way, not then having the india rubber linings which we now use.

3238. Can you state at all the quantity which was transmitted by railway?—No; Mr. Engels directed and carried out all the operations before Metz and other places, and it was many tons.

3239. Do you think that litho-fracteur would explode by a blow of iron on iron?—Yes, it would explode, but not the whole mass.

3240. Would iron and wood explode it?—I think not; we do not find it so. I put a cartridge under a locomotive, and it did cause an explosion in that way, the locomotive running at the rate of 45 miles an hour; it was a very good explosion.

3241. Do you tamp your litho-fracteur with wood?—We load with wooden rammers; that is our strict practice, and we tamp with water; that is a very great safeguard against miss-fires; but when a miss-fire does occur, allowing sufficient time to elapse after lighting the fuse, you go to the fuse, and by having it water tamped you can get hold of the fuse and draw it out; then you can put another cartridge in and press it down with a wooden rammer, and then you have an explosion.

3242. In this little pamphlet you recommend that litho-fracteur should not be stored in the same magazine as black powder and dynamite?—Yes; the reasons are these, that gunpowder is very much more susceptible to explode and ignite than litho-fracteur; if you drop a spark into gunpowder it immediately explodes, whereas, if you drop a spark or apply a candle to litho-fracteur it simply burns. Now, if an explosion of the gunpowder were to take place it might explode our litho-fracteur, which would get all the discredit, and we consider it dangerous.

3243. It is only a matter of self interest with you, I suppose?—No, it is the interest of the public as well, because the explosion would be much more violent.

3244. Is free acid in the finished article detrimental?—We do not find free acid in it; but if we had free acid I have no doubt in course of time that it would be detrimental.

3245. What per-centage of nitro-glycerine is there in litho-fracteur?—Fifty-five and a half per cent.

3246. Is that the only explosive power in it?—No; we have 33 per cent. of other ingredients which form the explosive, and only 12 per cent. kieselguhr.

3247. As compared with dynamite, what is your idea of the explosive power of litho-fracteur?—Taking the whole mass of explosive material, we get 88 per cent. of explosive power. On the face of that you might argue that as dynamite only contains 75 per cent., ours must be so much stronger; but you must allow for this, that our 33 per cent. is not so powerful as the additional per-centage of nitro-glycerine, and therefore only a moderately greater power is developed.

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Mr. Vivian—continued.

3248. You do not apprehend any great danger from those chemical combinations?—No.

3249. There is no danger of the nitrate of baryta being decomposed?—No, it does good, inasmuch as it prevents exudation under moisture.

3250. You look on the nitrate of baryta as an absorbent, do you?—Yes, it is an absorbent, in place of nitrate of soda.

3251. Can you squeeze out the nitro-glycerine from litho-fracteur?—I never tried it; but I dare say, owing to its being a mechanical incorporation, it might be squeezed out: I have no doubt it might if supersaturation takes place.

3252. How are your cartridges packed?—They are packed in 5 lb. packages in a cardboard box, being first made up into cartridges of different lengths, two inches, three inches, and five inches; the card box is then put into a sheet of black waterproof paper, and tied up with string, and then those 5 lb. boxes, to the extent of 10 in number, are packed in a small deal case like that for dynamite.

3253. Being lined with india-rubber sheeting?—Yes.

3254. Are the fumes from the explosion of litho-fracteur the same as those from the explosion of dynamite?—In many of my experiments I have very carefully tried to detect those fumes; but I have not worked in mines, and I am not satisfied about it. I have gone into the holes of quarries where explosions have occurred, and I have found no deleterious fumes. I believe that the fumes are not so great as from dynamite. I do not say that on my own testimony, but on the testimony of Mr. Sadoine, the engineer and manager of the works of John Cockerill at Seraing, which is contained in a letter of the 6th May 1873, on the last page of the book on litho-fracteur, issued for private circulation by Messrs. Krebs Brothers & Co. The letter is as follows:—  
“Seraing, 6th May 1873. John Cockerill, to Mr. Bovier, Litho-fracteur Dépôt, Fanbourg Viveguis, Liege. We duly received your letter of the 12th April. The litho-fracteur supplied by Messrs. Gusgen & Dubois, agents of Messrs. Krebs Brothers & Co., has been used in our coal mines, and the following is the report thereon: ‘The use of dynamite is indispensable, especially in hard ground, in order to obtain the full benefit of the excavations, but it has the disadvantage of greatly incommoding the workmen through its deleterious fumes, even where the space is not confined. This inconvenience has completely disappeared by the substitution of Messrs. Krebs & Co.’s litho-fracteur. The gas generated by litho-fracteur is not more harmful than that of ordinary gunpowder. It also possesses the advantage of greater explosive power than dynamite. This has been confirmed during the three months we have now been using litho-fracteur. We have found a great economy by using it in hard veins and seams, inasmuch as we have been enabled to diminish by one-fourth the necessary number of bore-holes.’”

3255. You have stated that litho-fracteur began to exude at 100 degrees Fahrenheit?—According to the War Office report, exudation takes place at that temperature.

3256. That is to say, exudation of nitro-glycerine?—Yes, exudation of nitro-glycerine.

3257. Does damp affect it?—Not at present; it did formerly, but since we substituted nitrate

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Mr. P. F. Nursey, C.E.

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Mr. P. F. Nursey, C.E.  
5 June 1874.

Mr. Vivian—continued.

of baryta, a most favourable report has been given by the War Office committee.

3258. Does litho-fracteur freeze at a higher temperature than dynamite?—No, it freezes at about the same temperature.

Mr. M'Lagan.

3259. I think you mentioned that you have had three specimens examined by the War Office?—Yes.

3260. The first specimen examined did not conform to the regulations, I believe?—Just so.

3261. The second was reported upon favourably, with the exception of one test?—Yes.

3262. What was the composition of that second sample?—It was very much like what I have stated to the Committee, but there was a smaller proportion of nitro-glycerine in the second sample.

3263. What was the proportion?—I think it was  $47\frac{1}{2}$  per cent.

3264. With regard to nitrate of baryta, or nitrate of soda, which did it contain?—Nitrate of soda.

3265. It did not stand the moisture test, I believe?—Yes, just so.

3266. Was that on account of its containing nitrate of soda, and being a deliquescent salt?—Yes.

3267. Your third sample was pronounced good in all respects but one, was it not, namely, that the nitro-glycerine exuded at 100 degrees?—Yes, it contained according to the report a higher percentage of nitro-glycerine than the previous sample.

3268. What proportion did it contain?—Fifty-nine per cent., I think.

3269. Were all those samples taken from your ordinary manufacture?—I believe so.

3270. Therefore, during those years you were continually changing the composition of your article?—It was undoubtedly so, to some extent; but, practically, we did not consider the change of any consequence, neither has it proved so, practically.

3271. But you state that the present material contains nitrate of baryta, and is, therefore, better?—Yes, I must make that exception; but, in practice, we have had no complaint of exudation.

3272. Would not people be very apt to say that your manufacture was in course of transition?—It was so far in the course of transition, owing to the delicate requirements of the English authorities.

3273. But were the tests of the Woolwich authorities changed?—Yes, they added the damp test.

3274. And you think that it was a good addition, do you not?—Yes, I believe so; it brought us to the introduction of the nitrate of baryta, which was a point of safety for ourselves; we perfectly satisfied their conditions.

3275. Then, as your article was in a state of transition, you could scarcely blame the authorities of this country for not giving you a license, could you?—I do not blame them at all. I simply think the tests are much too delicate. On the other hand, the great safety in the use, storage, and

Mr. M'Lagan—continued.

manufacture for years past should be taken into consideration, as it was by the Belgians, who used no such delicate test. Throughout the whole of the proceedings I have received the greatest courtesy from the War Office committee and the Home Office officials, but of course they are acting under the Nitro-glycerine Act, which is a very difficult Act to deal with.

3276. With reference to dangerous articles of this kind, whether dynamite or litho-fracteur, or any other nitro-glycerine compound, do you not consider that one element of danger is the number of ingredients that it contains?—I do not.

3277. Do you think that an article which contains 10 different ingredients is quite as safe and as little liable to decomposition as an article that is composed of only four materials?—Quite so, provided those materials are properly manufactured, and tested at each stage, and properly incorporated. Such materials as these have no deleterious action or re-action on each other; the only reason I regret the greater number of compounds is that it is somewhat puzzling to the chemical analysts who differ in their conclusions.

3278. That is all in your favour, is it not?—Not quite so; they are apt to conclude rather wrongly on some points.

3279. But do you think that an article which contains a great many different substances is as little liable to be decomposed by heat and moisture as any article that contains few ingredients; in fact, that it makes no difference?—It makes no difference, and our experience confirms that conclusion.

3280. Litho-fracteur contains a less quantity of nitro-glycerine than dynamite?—Yes; our maximum is now 55 per cent.

3281. But still there is exudation at a temperature of 100 degrees, is there not?—Yes; that may be accounted for possibly in this way, that some of the ingredients are less absorbent than the kieselguhr, which is an extraordinarily absorbent medium.

3282. Could you not overcome that difficulty, as it seems to be the weak point in your composition?—The difficulty is not a very real one. We have never found it arise in practice.

3283. If you could prevent that exudation up to 200 degrees, would it not be safer for you and the public, and every one else, than if it exuded at 100 degrees?—It would be safer, no doubt.

3284. Your object would be to attain the greatest possible safety?—Yes.

3285. Have you the means of doing that?—We have a very eminent chemist at work upon it, and since the Committee has been sitting, one great point has been found out in our favour, which might have told very much against us, which was not known before.

3286. The objection to your last specimen sent to the War Office was, that it exuded at 105 degrees, was it not?—Yes, it underwent a long trial at 100 degrees.

3287. If you could overcome that difficulty, you would satisfy the War Office, would you not?—No doubt.

Tuesday, 9th June 1874.

## MEMBERS PRESENT:

Mr. Dillwyn.  
Sir John C. D. Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. M'Lagan.  
Colonel North.  
Mr. Norwood.

Sir H. Selwin-Ibbetson.  
Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Vivian.  
Mr. Whitelaw.  
Mr. Whitwell.

VICE ADMIRAL THE RIGHT HON. SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Mr. CHARLES WILLIAM CURTIS, re-called and further Examined.

*Chairman.*

3288. IN your evidence of the 15th May, you spoke of certain other gunpowder factories, and your belief that they were generally well conducted; have you any further information to give to the Committee on that point?—In my evidence of the 15th of May, several questions were put to me about other factories which were so pointed that I considered it desirable to write to the manufacturers who are represented by a committee in London, and I have received numerous replies. There are nine replies with the inspectors' reports, two replies with extracts from inspectors' reports, and three replies without reports. These reports are very voluminous, and bear specially on each factory; but the general tenor confirms most fully the statement I ventured to make, that the gunpowder factories now are well and carefully conducted in most cases, with the full approval of the inspectors, whose suggestions are attended to in nearly every case. Three manufacturers have not replied to my letter, but it is possible that they may do so in the course of a day or two. Perhaps a short extract from the report of each manufacturer might be useful. I have here the replies in full, which I have received, including also some reports on our own factories, which were not put in on the previous occasion. I will not weary the Committee by reading these, but my evidence was questioned on the 15th of May, as to what I knew of the internal working of other factories, which I think it would be desirable to allude to for the information of the Committee. The first paper I have is from Messrs. Wakefield & Co. There was a question with regard to the door of the charge-house being exposed. That was immediately altered and approved of by the inspector. The report is most satisfactory. The next is the East Cornwall Gunpowder Company. They write to say that they have adopted all the suggestions made in the year 1872 by the inspectors. They make no special remarks however. The Kames Gunpowder Company state that the general condition of their factory is satisfactory. They have adopted all the suggestions made by Major Majendie, except three, and those suggestions they wish to talk over with that gentleman when next he visits their factory. Messrs. Pigou & Co. (Limited), of Dartford. The in-

*Chairman—continued.*

pector's reports show their works are carried on legally and satisfactorily. There were questions about oil waste, exposed iron, and one or two other matters; but the inspector's suggestions have been attended to, with the exception of one, which was with reference to whether the magazine-keeper should be allowed to have a pocket in his coat. The managers think that the magazine-keeper cannot carry on his business properly without a pocket. The Plymouth and Dartmoor Company state that they have carried out all the suggestions which have been made by the inspectors. Messrs. Williamson & Co., of Fernilee, were called to account for having a green charge than they ought to have, namely, 67½ lbs; the floors were said to be dirty, and that they carried on the mixing in a green charge-house; but generally the condition of their manufactory is said to be satisfactory. The New Sedgwick Company send an extract from the inspector's report, stating that their factory is in a clean and satisfactory condition, and grit carefully excluded. Messrs. Shortridge & Co., of Barnsley, state that some suggestions have been complied with, but that one suggestion is pending the inspector's decision. They also say that no man has been injured on their factory during 26 years. With regard to the St. Allen's Powder Company, the few improvements which have been suggested have been at once adopted. The Kennal Vale Company have carried out the inspectors' suggestions where practicable, and they have every reason to believe that the inspectors are now satisfied. Messrs. F. C. Dickson & Co., of Black Beck, have been called to account for excess in charges in the incorporating mills, but at the last visit of the inspectors, however, they appeared quite satisfied. The Elter Water Gunpowder Company have had a very long correspondence with the inspector with regard to several matters. I do not know that I need read all the particulars; but there are one or two points in connection with the factory which I think I ought to state to the Committee. There have been one or two summonses against the Company for infringing the law. There have been complaints about grit, and not placing at the entrance of the different buildings

Mr.  
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Mr.

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buildings proper foot-boards, or using proper shoes. There was also a complaint that in the corning-house there was not a proper wooden lining. A correspondence took place on this subject between the inspector and the Elter Water Gunpowder Company, and in consequence of the Elter Water Gunpowder Company maintaining that the corning-house ought to be left in its present state, reference was made to Waltham Abbey officials, and the report states that the Waltham Abbey authorities decided in favour of the arrangement as it existed at the Elter Water factory. In fact, this is a very old building, where the dust had necessarily and unavoidably accumulated in the crevices; and it would have been very dangerous indeed to attempt to make any alteration or change. I may state that they have had no explosion in their factory for nearly 40 years. There are one or two arrangements in use which are considered by some people old-fashioned; for instance, the corning arrangement is carried out in a different way to what it is in other factories, but in order to go with the times the Elter Water Company erected a new corning-house, but I am informed that the men on the factory decline to work in this corning-house. Messrs. J. and T. Sharp & Co., of Chilworth, have had several small questions between the inspector and themselves as to there being no expense magazine, no charcoal stores, no lightning conductor to the store magazine, exposure of iron, the pockets of the workmen not being sewn up in their clothes, foot-boards, and clean floors. But all those matters I am informed have been now attended to. The next report refers to our own factory at Tunbridge. In my previous examination I put in two reports on Hounslow and Bedford, but I did not put in this report. The inspector called attention at Tunbridge to the lightning conductors not being properly attached to the buildings; two or three cases of pockets in the workmen's clothes, and iron keys in the expense magazine doors; but immediately those suggestions were pointed out they were attended to. A question arose with reference to the quantities in the dusting-houses and the glazing-houses, and the practice of allowing semi-manufactured powder to lie about the floors of the buildings. Those questions have been argued with the inspectors, and we feel that the system which has been hitherto adopted, of allowing the floors to be used for that purpose, cannot be deemed unsafe. As to our factory at Glyn Neath, the report stated that the charcoal store was too near the mixing-house, and the unground charcoal allowed to remain in the mill all night; both were immediately remedied. The mixed charges were removed in an uncovered barrow or truck. It was arranged after that that there would be no danger in removing those charges from the mixing-house to the charge store in the same way as is now adopted. There was a complaint of using the second corning-house as a temporary store. There was no doubt that that was an improper proceeding, and, perhaps, under the Act of Parliament illegal, but immediately it was pointed out to the manager he removed the unfinished powder from that house to the proper store. The inspector called attention to there being no traverse between the dusting-house and the stove. Very soon after the inspector made that suggestion a traverse was put up. The same remark was made with regard to the Glyn Neath factory as

Chairman—continued.

as at our other factories, with regard to placing powder on the floors. With regard to our Scotch factory, the first objection raised was with reference to the position of the store magazine. This magazine is situated legally, but it is not considered to be safely situated by the inspector. We held the opinion that it was safe, and still do so. There was a small quantity of powder in excess in the press-house, which was immediately remedied. A complaint was made about the dust in the corning and press-houses, which cannot be avoided, and also with regard to spilt powder in the expense magazine. Subsequently the inspector wrote on the 9th of September 1873, stating that all the suggestions had been adopted. There are three manufacturers who have not replied to my letter, and I think I have now only one more, which I have not mentioned, viz., the Low Wood Company send a copy of the inspector's report, which is very satisfactory.

3289. In Major Majendie's evidence, he spoke of having been in correspondence with the manufacturers, with regard to any new legislation. Had any recommendations with regard to the internal working of the factories been agreed upon, and if so, will you be kind enough to enumerate them?—Yes; there was much discussion on the subject. The inspectors met the committee of the gunpowder makers on three occasions, and the whole subject of the manufacture of gunpowder was carefully considered in connection with the existing law. The meeting, on the 8th of May 1872, was an important one, as several questions were then and there settled. I would beg leave to read the minutes then specially made for the use of the private makers.

Mr. Whitwell.

3290. Who was present at that meeting?—Major Majendie and Captain Smith, and I will add the names of the manufacturers present when I see my evidence in print.

Mr. Stevenson.

3291. Did they represent the whole of the trade?—The manufacturers generally have established a committee in London to consider the whole subject. The following were present at the meeting of the committee on the 8th May 1872:—Captain Majendie, R.A., Captain Smith, R.A., Inspectors; Mr. C. W. Curtis, Chairman; Mr. J. F. Hall, Mr. F. Pigou, Mr. C. T. Lawrence, Mr. A. D. Knightly, Mr. J. Bonsfield, Mr. A. G. Hope, Mr. H. Toogood. The memorandum is as follows: "Memorandum of a meeting between Her Majesty's Inspectors of Gunpowder Factories, and a committee of the trade, on the 8th May 1872. Materials: These are to be sifted or subjected to some other similar process, either separately or in the mixed charges; agreed to by the committee. Rules and Regulations: The inspectors maintain that all factories should have a code of rules adapted to the establishment, to be approved by the Home Secretary, and enforced by law; the rules to be signed by the owners of the factory, exhibited conspicuously on the premises, and copies periodically distributed amongst the workmen; that was agreed to by the committee. Charcoal: If stored in a building of brick, stone, or iron, with wooden rafter roof, covered with slates or tiles, the distance from a manufacturing building must not be less than 20 yards; beyond 40 yards no special construction



Mr. *Stevenson*—continued.

tion of stone would be required; it must not be stored in any manufacturing building; that was agreed to by the committee. **Mixing Houses:** Charcoal only sufficient for the day's work to be kept in these buildings; all unused quantities to be removed, when work ceases, to the storehouse. **Mixed charges,** except for immediate use, to be removed to the charge-houses; that was agreed to by the committee. **Incorporating Mills:** The inspectors having been called upon by the trade generally, through the committee to abolish the existing distinction between inferior and Government, and sporting charges, and that 60 lbs. be a maximum for both descriptions, the inspectors undertake to make these alterations in the new Bill. The committee did not deem it desirable to ask for any special provisions to extend the weight of mill charges beyond 60 lbs.; this was also agreed to by the committee. **Charge-houses:** To be used solely for green and worked charges or any other unfinished materials necessary for the supply of the mills. This was also agreed to by the committee. **Press-houses:** The proposed quantity under the new law to be 24 cwt., the same as allowed in corn-ing houses. This was also agreed to by the committee. **Glazing and Dusting-houses:** Much discussion took place as to limitation of quantities. The committee strongly objected to any fixed rule. It was then suggested that—the wording (immediate supply and work in the existing Act) remain as at present, no more precise limitation being introduced; but that provision be made for the inspector to inquire of the manufacturer as to the necessity for any given quantity; and if they disagree a report to be made to the Secretary of State, and a written notice to be given to the manufacturer to limit the quantity (with power of appeal). If the appeal be decided against the manufacturer he is to be required to observe the quantity specified in the notice. This question still remains open till the next meeting. **Stores:** Under the new law the quantity allowed would be 100 cwt. without cooling or drying. This was also agreed to by the committee. **Store and other unlimited Magazines:** The inspectors desire to limit their extension on lands already licensed. The committee strongly object to any interference with their existing right. **Re-erection of exploded buildings:** The inspectors maintain that the law should give them power to interfere, not only as to re-erection, but as to alterations, improvements, and extensions in existing factories. The committee strongly object to any interference with existing powers and rights. **New Factories:** The inspectors propose to make stringent regulations as to distances, buldings, sites, and other arrangements, but the committee did not consider it desirable to offer any special opinions or objections. From this paper it appears that, with two or three exceptions, Major Majendie, Captain Smith, and the manufacturers had arrived at an adjustment so far as the factories were concerned. Major Majendie refers in his report, page 6, which, by the bye, is dated only eight days after the meeting of the committee on the 8th May 1872, to meetings with the committee, but he omits to make the recommendations agreed upon with the trade on the 8th of May 1872. Indeed, since that time, the manufacturers have not heard that Major Majendie raised any question on these recommendations until this report, and the suggestions

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for fresh legislation, came into their possession after their evidence was taken; and now they find that all the agreed recommendations are omitted.

3292. Have you any remarks to make in that report of Major Majendie, commencing at page 53, with regard to the result of the inspections?—I think that along with what I have just read, I ought to read to the Committee the letter received from the inspector with reference to the arrangements made with the trade. On the 10th of May 1872, or two days after the meeting of the committee, Major Majendie wrote me this letter, as the chairman of the gunpowder manufacturers. “Dear Mr. Curtis, Captain Smith and I have considered the proposition made by the committee at our last meeting, relative to the interpretation to be put upon the words ‘immediate supply and work of that house,’ wherever they occur in the Bill, in connection with the limitation of quantities. We think that the case may be met by the arrangement proposed by the committee, and we shall be prepared to recommend that this arrangement be embodied in the new Act, namely, that the wording (‘immediate supply and work’) remain as at present, no more precise limitation being introduced; but that provision be made for the inspector to inquire of the manufacturer as to the necessity for any given quantity; and if they disagree, a report to be made to the Secretary of State, and a written notice to be given to the manufacturer to limit the quantity (with power of appeal.) If the appeal be decided against the manufacturer, he is to be required to observe the quantity specified in the notice. This leaves only two points upon which we are not in accord with the committee, namely, the re-erection clause; and the extension of existing unlimited magazines. I trust that we may be able eventually to arrive at some agreement upon these points; and I shall give the subject my best consideration, as I am sure you will do, with a view to that end. I am, dear Mr. Curtis, very truly yours, V. D. Majendie.” It may be in the recollection of the Committee that, in my examination of the 15th of May, I alluded to two memoranda; in fact, I put in evidence two memoranda written by Major Majendie, and addressed by him to the firm of which I am a member, which clearly showed to our mind that even Major Majendie was unable to arrive at a conclusion as to what should be done with reference to the limitation of the quantities.

3293. I think you desired to make some remarks on Major Majendie's reports of the results of inspections, commencing at page 53 of his report?—Yes, it is with regard to the tabular statement at the bottom of that page. At page 53 we read: “The following table gives in a compact form the result of my inspections; namely, gunpowder factories, 25 (of which one not at work), and out of this number I observed violations of the law (more or less numerous and considerable) in 18 factories, and precautions (more or less important) omitted, or practices (more or less dangerous) permitted in 25 factories;” and over the page there is also this “Analysis in Table A. Number of instances in violation of the law in gunpowder factories.—One violation of the law observed in seven factories; two violations of the law observed in six factories; three violations of the law observed in one factory; four violations of the law observed in two factories; five violations of the law observed in one factory; and six violations

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violations of the law observed in one factory. Table B. Number of instances of precautions omitted in gunpowder factories.—At least one precaution omitted in two factories; at least two precautions omitted in three factories; at least three precautions omitted in six factories; at least four precautions omitted in five factories; at least six precautions omitted in two factories; at least seven precautions omitted in five factories; at least eight precautions omitted in two factories; some precautions omitted in all.” Now, with regard to those Tables showing the instances of non-compliance with the inspectors’ suggestions, it is really impossible to answer such a statement. Those instances of want of precaution are given without any date, or particulars, or names, and perhaps no single case of non-compliance now exists. I am not disposed to doubt that something, amounting in Major Majendie’s mind to non-compliance with a reasonable suggestion, has in each of those cases taken place, but without a date, or a name, or even a place, I cannot answer that table, or even understand it. With regard to the future powers of the inspectors, I may say that the difference between them and the manufacturers would be, that the inspectors claim a right, not only to see that the statute law is enforced, but also the right, from time to time, to make new laws and enforce them. We, the manufacturers, think that the statute may be amended, and its restrictions extended, and that the inspector may enforce the law, but that they may only make suggestions, without the power of making new orders beyond what the statute law justifies; there is nothing to show how many of those non-compliances would be breaches of the new statute law, and without knowing this, it is impossible to know if the greater proportion of those assumed defects have not been cured; and if the inspectors’ views of the new laws have been abandoned, neither is there anything to show which of the suggestions were essential, and which of them were not material. The inspectors put it as if all the non-compliances would have been cured if they had been invested with greater power, but some of the omissions were omissions to comply with the statute law, and this at least cannot have been occasioned by any infirmity of the inspectors’ powers. The manufacturers submit that this table of omissions and non-compliances of offenders not named ought not to be allowed to influence any proposed changes in the law.

Mr. Whitwell.

3294. Let me ask you whether you know of more prosecutions or summonses before the magistrates, than the one which you alluded to on the part of the inspector?—I think there is one, Messrs. Hall, of Faversham, were summoned on one occasion, but not, I believe, in connection with the manufacture of gunpowder.

3295. As Chairman of the Committee of Gunpowder Manufacturers, do you think there have been any more than those summonses?—I think there was one at Black Beck, but I am not acquainted with the circumstances.

3296. So that the inspectors have, in fact, on three occasions, to your own belief, summoned manufacturers for non-compliance with the law?—Yes.

3297. Then there is power, under the existing

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law, to summon the manufacturer for non-compliance?—Yes, undoubtedly.

3298. But that power has not been exercised, and so if the statutory conditions under which the manufacturers work have been allowed to go unenforced, that is not for the want of new legislation, I suppose?—I think not.

3299. You have stated that you have had in your hand a satisfactory report of the inspectors with reference to a large number of manufactories?—Yes, generally satisfactory.

3299\*. What do you mean by “generally satisfactory”?—Several small defects were pointed out, but those defects appear to have been quickly remedied.

3300. Are those reports generally satisfactory then, from other manufactories?—Irrespective of our own factories, I have 12 letters containing the inspectors’ report which are generally satisfactory.

3301. What was the last report on your own factory?—The last report on our own factory was that all the previous suggestions had been complied with.

3302. It was not generally but entirely satisfactory, I suppose?—I will not say that.

3303. Were there many complaints?—No, only on one or two small matters; we must always expect some criticism, but I maintain that our manufactories, generally, are in safe working order.

3304. Then those points in the generally satisfactory reports would not occur to you as referring to matters which endanger life or property?—Certainly not; there have been many matters pointed out with regard to iron exposed and iron beams. I admit that copper or wood beams would be better, still an iron beam for a weighing scale does not necessarily cause danger; there have been suggestions by the inspectors to cover with leather, and, where practicable, it has been done. I believe those would be perfectly safe even without leather, but we adopted the suggestions without any hesitation.

3305. How many of those 22 reports are absolutely unsatisfactory, in your opinion?—The only one that is really unsatisfactory is the Elter Water Company; but even there, there was a redeeming point, because they have had no accident for 40 years.

3306. That is the only one which you consider in an unsatisfactory state, is it?—I think that the Elter Company have not as quickly adopted the suggestions of the inspector as they might have done.

3307. You wish the Committee to believe that the business of gunpowder making by the principal gunpowder companies is, on the whole, satisfactorily conducted?—I do, most decidedly.

3308. Do those reports, which you consider satisfactory, represent the largest of the gunpowder factories?—Yes, decidedly.

3309. Consequently, you would say that one or two bad reports applying to small manufactories, should be taken more or less in connection with the proportion of gunpowder which they may make, to the whole trade of the country?—Yes, I think so.

3310. If your works are three or four times the size of some smaller works, you think the Committee, in reading the satisfactory report of your works, should take into consideration the size

Mr. *Whitwell*—continued.

of the other works, and the extent of your production?—Yes, certainly.

3311. May I ask where you grind your charcoal?—We grind our charcoal sometimes in a charcoal mill specially constructed for the purpose, and sometimes we grind in the building where the process of mixing is also carried on.

3312. Have you been cautioned against grinding your charcoal in the mixing house?—I think that in one of the reports there was mention made of that.

3313. Was that in the last report?—I cannot quite call to mind which report it was; but I think that in one of our factories we have mixing and grinding charcoal houses under the same roof.

3314. Do you consider, as a gunpowder manufacturer of many years' standing, that there is any danger in grinding charcoal in the mixing-house?—Not the least.

3315. An honourable Member begs me to ask how many reports you have received out of the whole?—There are 24 factories now in use. We have received letters enclosing reports of inspectors from 14. We have five factories ourselves; that would make 19; and there is a factory at Battle, belonging to Mr. Lawrence; that would make 20. I have not received replies from three manufacturers; that is 23; and there is one letter that I have not got here, from the Loch Fyne Company, in Argyllshire, which would make up the 24.

3316. So that you have received a letter or report from 21 out of the 24 manufacturers?—Yes.

3317. I will ask whether you expected the interview, which took place in May 1872, to be preliminary to further interviews with the inspectors?—Yes; on that occasion it was mentioned that the question of limitation of quantities should be deferred to subsequent meetings.

3318. During the year 1873, while the Bill was being prepared in the Home Office, no consultation was held with you, or any member of your trade, I believe?—I believe none with reference to new legislation. There were meetings with the inspectors with regard to the inspection of the factories.

3319. But there had been no meetings with you or your committee, as representing the trade at large?—None.

3320. During the year 1873, while the Bill was in preparation, you had no communication whatever with the inspectors, and they did not ask you to give them any further information?—Not on the subject of new legislation.

Mr. *Stevenson*.

3321. We gather from your summary of those reports from the factories that they have very generally carried out the suggestions of the inspectors; was that because they thought those suggestions were in their cases reasonable and necessary, or only because they did not wish to quarrel with the inspectors?—I think that some of the suggestions were accepted by the trade as advisable, and possibly tending to greater safety; but in other cases we adopted the suggestions because we were desirous of meeting the views of the inspector as far as possible. There were many small matters where we thought it would be better to adopt the suggestions than run the risk of not adopting them, and of any explosion occurring in consequence.

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3322. Though you thought that they might be somewhat fanciful?—I think that it might be so, since you put that word into my mouth.

3323. You mentioned the case of an inspector requiring the scale of a beam to be made of copper, rather than iron, was that insisted upon?—It was not insisted upon, but immediately it was pointed out, it was covered with leather; it was an old beam at one of our factories near London; I have never seen it myself, but it was pointed out, it was quite high up out of the way, and immediately it was pointed out it was remedied.

3324. Do you think that the covering of it with leather in the least degree increases the safety of the manufactory?—I think not.

3325. The inspectors have no power to enforce recommendations of that kind, have they?—I think not; I think the law would not empower them to do so.

3326. Has the inspector the power to bring you before a tribunal for carrying on your work in an unsafe manner at present?—I think not.

3327. Only I suppose for violations of specific regulations of the Act of Parliament?—I think that is so.

3328. Are you willing that the inspectors should be at any time empowered to do more than that?—It is very difficult to define what the danger is in a gunpowder factory. With regard to the Elter Water Company, they have carried on their business for 40 years without an accident, and yet according to the report of Major Majendie, they have not conducted their business as carefully perhaps as other manufacturers.

3329. Did they conduct their business in accordance with the Act of Parliament?—I understand that there have been one or two prosecutions, so I assume that the business has not been conducted in accordance with the Act of Parliament.

3330. You say that the manufacturers upon meeting to decide what regulation they would submit to, were willing to be tied down to a maximum charge of 60 lbs. of mixture in the incorporating mills?—Yes.

3331. Are you willing that that should be the stereotyped quantity in all time to come?—The maximum quantity; there was a difference of opinion about it, but those who thought that there should be a larger quantity succumbed to the opinion of those who thought 60 lbs. was enough.

3332. Why is there any limitation at all?—There was a limitation in the Act of 1772 to 42 lbs.; that was considered too small; then an arrangement was made to increase it to 50 lbs., in the case of sporting powder and Government powder, and 60 lbs. for common blasting powder; but the distinction between the two seems to be quite unnecessary.

3333. Why is there a limitation with regard to any kind of powder; why is the larger charge supposed to be a greater source of danger?—I do not know that it is a greater source of danger; it might be the other way.

3334. You might make the powder more safely with a larger charge, might you?—It is possible; I will not say it is certain.

3335. Then why did the manufacturers agree to prevent the adoption of a larger charge, which might be worked with equal or greater safety?—In connection with working the larger charge,

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comes the question of quality, and this is a very important consideration.

3336. You would not have an Act of Parliament describe the charge with regard to the quality, in the view of the public safety, would you?—The public safety, I think, has nothing to do with the question.

3337. Nor the safety of the workmen?—If a charge of 80 lbs. was to explode, it might not do, under some conditions, nearly so much harm as 50 lbs.; for instance, a charge has been recently put under the mills, and the incorporation has just begun; that charge may explode and do little or no damage; but if it has been in course of incorporation for two or three hours, then the strength of the powder begins to show itself; and in the event of an explosion, it is much more serious than if it took place when it was just put under the runners.

3338. I presume the danger is in the running of the iron roller on the iron plate bed?—Not necessarily; but if the two come in contact, the chances are that an explosion will take place.

3339. Is it not possible that some other substance might be discovered which would not, as iron does, create that danger, in which case you could work the incorporating mills without risk of an explosion; would it not then be very inconvenient to have a limitation in the Act of Parliament to 60 lbs.?—It has been suggested that we should use copper or brass edge runners, but our experience tells us that we should not be able to make the powder as well in that case.

3340. But by adopting the limitation of 60 lbs. as the maximum, are you not really preventing future improvement which might be discovered?—I do not think so.

3341. You propose that there should be an appeal in the case of the inspector and you differing with reference to the reasonableness or necessity of his requirements; to whom would you propose that that appeal should be made?—An appeal has been suggested in Major Majendie's report. He suggested, and I concur in that suggestion, that in the event of a dispute a reference should be made to two arbitrators, one appointed by the inspector, and the other appointed by the manufacturer.

3342. The committee of manufacturers, however, seem to have made a point that there was to be no interference with the internal details of the existing manufactories?—Yes.

3343. Would you not propose to extend that to future manufactories?—Yes, I would.

Sir Henry Selwin-Ibbetson.

3344. You have read to the Committee portions of reports stating that certain gunpowder manufactories have been well conducted?—Yes.

3345. Has your attention been called to the Paper put in by Major Majendie, No. 13?—I have heard of the Paper:

3346. In that Paper are there not many cases substantiating what he stated in his evidence of factories that have had their attention called to defects, not only once, but twice, and even oftener, and still neglected those precautions that were recommended to them?—I have heard of that Paper, but I think that it is too general to offer an opinion upon. It appears to me that there are no names mentioned of factories. I believe that they are not specified by names, but by numbers, and the omissions to adopt the recommendations

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and precautions are not enumerated in any way that I can understand.

3347. I suppose numbers only are put to the factories for the sake of casting no reflection upon them. There is a factory which we will call No. 4, which had a recommendation made to it in 1871, with regard to the clothes of the workmen, the same thing again in 1872, and it had not been attended to in 1873. Take No. 12 factory; it was pointed out in December 1871 that the magazine keeper wore clothes with pockets in them. The suggestions were continued in 1872, and in February 1873, without effect; have you noticed that case?—I presume that must be the factory to which I have already alluded in my evidence, namely, Messrs. Pigou & Wilks, of Dartford. A question had arisen as to whether it was possible that a magazine keeper could do without a pocket in which he would keep his keys and his memorandum book. I understand that the firm objects to remove his pockets or have them sewn up, and I think very properly so.

3348. Do you mean to say that you think the regulations, which have always been supposed to be useful regulations, with reference to the abolition of pockets in the clothes of these workpeople, is a worthless one?—Not at all in gunpowder manufacturing buildings, but I assume that this is in the magazine; there is generally only one man to look after the magazine; he must keep certain records of his deliveries; he must keep certain keys in his pockets or about him; and it appears to me that it would be unreasonable to require him to have his pockets sewn up; whereas, the corning-house man, or the glazing-house man, or any man in a gunpowder manufacturing building, I quite agree that there should be no pockets.

3349. Will you kindly refer to No. 20 factory; in page 3 of the report of 1872, you will there find, that it was agreed that the men should have no pockets in their working clothes, on condition that heavy penalties should not be asked for. In December 1872, and again in October 1873, the men had pockets; evidently those men were not magazine keepers?—Of course the case of workmen's clothes is very different to those worn by a magazine keeper.

3350. Will you kindly carry your eye a little lower down that page, and you will see as to pockets worn by the work-people; that there are other cases; ought that to be allowed, do you think?—No, that ought not to be.

3351. Therefore, clearly in those cases that rule has been neglected, has it not?—It appears so.

3352. I suppose that though the inspectors were anxious to be as conciliatory as possible, and, therefore, gave only numbers, those facts are reported as having taken place during the continuance of a series of years, where the manufacturers had refused to comply with the regulations which you have admitted in your previous evidence, are sound ones; is not that so?—I think my previous evidence was general, and not particular.

3353. But now, turning your attention to particulars, do you think that a manufactory, where those regulations as to clothes are neglected, is properly conducted with regard to safety?—I cannot admit, with regard to safety, there is any positive necessity to sew up a man's pockets.

3354. You think that it is no protection, in the way

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way of safety, against workmen bringing matches and other dangerous things into the buildings?—It is no protection if the workmen are searched, as they are in many of the factories, on entering the factories; besides, their clothes when they enter the factory, are changed for their gunpowder clothes. I cannot, myself, attach any great importance to having no pockets, but I quite agree with the inspector, that it is desirable to have none, and we adopt that plan accordingly.

3355. Then, going through the paper, there are several other points as to cleanliness of floors and powder buildings, and there are numerous cases where the recommendations have not been attended to; is not that so?—We are on our trial, and are quite willing to have the names of those firms who have not carried out the recommendations of the inspector mentioned. It has been urged upon me, because then we should be able to look into the different cases; I have this list now put into my hands for the first time, and it would require considerable investigation; I see a great many points alluded to, and it is quite possible that many of those things spoken of here, have long since been corrected.

3356. But is it not an argument which I may use, that were you see the same defects pointed out in 1871, again pointed out in 1872, and again in 1873, that it is possible even that they may not have been corrected in 1874, seeing that the instances are so numerous?—Take the case of the magazine keeper, and the question of no pockets. I rather hold with the manufacturer who said, “Unless you compel me by law to have the man’s pockets sewn up, I object.” I cannot see any danger.

3357. Then take the question of clean floors and clean powder buildings, do you think that there is no danger there?—There is no danger whatever provided there is no grit.

3358. Do you think that cleanliness does not apply to the question of grit?—I assume that cleanliness applies, in that case, to powder dust hanging about the building; we have it in many of our buildings, in the corners and edges of roofs and ceilings, but I do not consider them unclean.

3359. I suppose that iron and steel implements being left exposed in a powder building would be dangerous?—Yes, if they are so used; but I cannot think that they are so used at present.

3360. Take the same page a little lower down, and take No. 20; you find that the proprietor agreed in 1872 to cover up or remove exposed iron and iron or steel implements, on condition that heavy penalties should not be imposed; but later in 1872 and again in October 1873 it had

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not been done, had it?—I question the power of the inspector to say that he will impose a penalty if certain things are not done in a building of that kind. I do not believe that there is that power under the law, but it may be suggested.

3361. But you acknowledge that those things ought not to occur, and that they are unsafe?—Not necessarily.

3362. You think that iron and steel implements might be safely used, do you?—I think that iron and steel implements ought not to be used.

3363. Do you think that any power should be given to prevent the use of them?—A defined power.

3364. Then, if it is done, it is contrary to safety?—I think I did not say that.

3365. I understood you to say that the employment of steel implements in such buildings would be contrary to safety?—I said I thought iron and steel implements ought not to be used.

3366. What is your reason for saying that they ought not to be used; is it because you think that they would not conduce to the safety of the buildings?—I do not think that buildings necessarily become safer because no steel implements are used in them; but I do not use them myself.

3367. Would you like the names put in, in place of numbers, in the case of those who have neglected to comply with the recommendations of the inspectors?—Yes.

3368. But, at all events, a certain number of these factories have continued to resist the recommendations of the inspectors; is not that so?—I regret not to have had this paper earlier in my hands, and therefore I cannot say; but that is what appears on the face of it.

3369. And so far it justifies what Major Majendie said in his evidence, that he had constantly called the attention of certain manufacturers to recommendations conducive to public safety, which had been in many instances neglected, and were still neglected. But now with regard to another point. You have stated that there have been only three prosecutions of gunpowder manufacturers, so far as you are aware. I believe that there have been nine cases; but you were not aware of that?—I was not aware of that.

3370. You are aware of the fact, I suppose, that prosecutions in many cases have not been commenced, only because there was a desire rather to persuade them to adopt the more violent method?—In fact, the inspectors have been lenient under the circumstances. I suppose that is it.

3371. The inspector’s power is not a very large one at present, is it?—With all deference, I think that he has a very considerable power.

Mr. GEORGE PARKER BIDDER, called in; and Examined.

Chairman.

3372. I THINK that you were a member of the War Office committee on Explosives?—Yes.

3373. You represented the Civil Engineers on that Committee, did you not?—Yes.

3374. I believe that you have had before you at the War Office Committee on Explosives the subject of the storage and conveyance of various explosives?—Yes, dynamite, litho-fracteur, and gun-cotton.

3375. You have instituted some experiments

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with reference to the safe conveyance and storage of those various explosives, have you not?—Yes.

3376. Will you be good enough to give any information to the Committee which you possess on those points?—First, as to gunpowder. With regard to that explosive, it has not been much considered by that committee. Our attention has been directed to the new explosives, dynamite, litho-fracteur, and gun-cotton. Nitro-glycerine, of course, would apply to all explosives, in  
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which it is a constituent, such as dynamite, and litho-fracteur. With regard to those, the experiments which we saw showed that they could be conveyed with safety under ordinary circumstances, provided they were so manufactured as to prevent exudation, and that the materials of which they were composed, were pure; that is to say that the constituents were pure; they in themselves are extremely valuable as explosives, and for many purposes they are the best explosives; dynamite is used almost exclusively in Norway, but with very great care; on the other hand, there is but one concurrent voice with regard to nitro-glycerine, namely, that it is to be avoided in every possible shape or way, because it is so dangerous; as to dynamite and litho-fracteur, they are dangerous if the exudation of the nitro-glycerine in them is not effectually prevented.

3377. Can you give the Committee any information with regard to the storage of explosive substances; I mean information founded on the conclusions at which the War Office Committee arrived?—The conclusion to which we came was distinctly with regard to gun-cotton, that if it is kept in a state containing from 25 to 30 per cent. of moisture, and if it has passed the proper tests on its manufacture it is absolutely safe against accidents, both in storage and conveyance, absolutely safe; as to dynamite and litho-fracteur, we had not the same experience with regard to their stability, because up to the present time there has been no experience as far as I know to any extent of the substances being made in perfect form, that is to say, effectually preventing exudation.

3378. Is it your opinion that railways might safely be allowed to carry those explosives as they carry gunpowder?—Certainly; as compared with gunpowder, there is no comparison; gunpowder may explode, but gun-cotton cannot explode by accident; an explosion with gun-cotton must be an explosion made by an expert and by special apparatus. It is quite true, I was just asked by a railway manager, "How are we to know that there is 25 per cent. of moisture in it?" my answer was, "Very simply; carry it in open boxes; there is nothing so safe as conveying it in open boxes; no spark from the engine can explode it, not even if you emptied the fire-box on it would you explode it." With regard to conveyance by railway, it is the most extraordinary thing in the world why there should be any difficulty about it. I am interested in collieries in Staffordshire, and we have ascertained from experiments that gun-cotton is a very effectual explosive in coal mines, and very safe; gun-cotton has one advantage over nitro-glycerine compounds, that the fumes are very much less, and not so unwholesome; in fact, the men do not lose a minute after the explosion in going up to the scene of the explosion.

Colonel North.

3379. Dynamite is considered much more powerful than gun-cotton, is it not?—I should think probably that there is very little difference between them. It depends on how much nitro-glycerine is in it, of course. Dynamite is an extremely valuable explosive for many purposes. I dare say it can be used in some cases advantageously in competition with gun-cotton. It is a

Colonel North—continued.

pity that all explosives are not open to free competition.

3380. Do you consider that the carriage of gun-cotton is safer than that of dynamite?—Yes, it is safer than that of dynamite, especially in this respect. You cannot, as far as I know, get any large amount of dynamite absolutely free from exudation; if it is free from exudation, there is not much difference in the safety.

3381. What would you call a large quantity?—You can convey three or four tons of gun-cotton in a single truck with absolute safety; in fact, much more safely than you can convey petroleum. With regard to dynamite, I cannot say, but from what I have seen it would be very difficult to say that the cartridges may or may not exude. I think, however, that science in the end will enable us to overcome that difficulty, which presses very severely on the minds of all the chemists who are engaged on the subject.

3382. You find railroad proprietors or directors very much averse to carrying dynamite at all, under any circumstances, do you not?—Yes, they are against carrying any explosive substances.

3383. You consider that nitro-glycerine, in a pure state, should on no account be carried?—Certainly not; there is no difference of opinion on that subject.

Mr. Vivian.

3384. I gather from what you say that if dynamite is pure and in good condition, that is to say, free from exudation, it can be carried by railway as safely as gun-cotton?—Very nearly, but not quite. You cannot set light to gun-cotton when damped, but you might get a flame from dynamite.

3385. With regard to gun-cotton containing 25 per cent. of moisture, can it be used with effect in that condition?—Yes.

3386. That is to say, without further drying?—Yes.

3387. Is there any loss of power in using gun-cotton under that condition?—No.

Mr. M'Lagan.

3388. What precautions would you consider necessary in carrying these explosives, beginning with gunpowder?—I suppose you must impart some spark, and, of course, if there is a collision, you could not insure the gunpowder not coming in contact with, perhaps, the contents of the engine.

3389. Are there any special precautions which you would recommend for carrying dynamite?—Simply that you should ascertain first that there is no exudation of nitro-glycerine, and then convey it in packages as lightly put together as possible.

3390. The ascertaining whether there is any exudation of nitro-glycerine would necessitate the inspection of the dynamite first of all, would it not?—Yes.

3391. You would, therefore, inspect the dynamite before it is put on the railway?—Yes, in every way, before it is conveyed, the question of exudation should be tested; if there is exudation, it is exposed to all the dangers to which the conveyance of nitro-glycerine is subjected.

3392. Suppose it were inspected at the manufactory, and a certificate were given as to there being no exudation, would you consider that a sufficient

Mr. *McLagan*—continued.

sufficient safeguard for the railway company to take it?—Yes.

3393. Who would be the party that you would recommend as inspector; some one appointed by the Government, I suppose?—It must be some one appointed by the Government, of necessity.

3394. The same remarks would apply to litho-fracteur, I suppose?—Yes, of course.

3395. And you say that you see no objection, with these precautions, to railway companies carrying these explosive substances?—No; under any circumstances I consider that they are safer than gunpowder, which they daily convey.

Mr. *Whitwell*.

3396. You use gun-cotton in your Staffordshire mines, I think you said?—Yes, we have got enough to begin working with it entirely.

3397. How do you use gun-cotton?—In cartridges specially made for that purpose.

3398. How are those cartridges put into the bore-holes?—Just shoved in. I was not present at the experiment.

3399. I think you say that no accident can happen with gun-cotton; but should you be surprised to hear that I once came upon a poor man who had been stemming gun-cotton in the bore-hole, and that he had from that cause a broken leg, from the effects of which he died?—It is possible that that might have happened with the old gun-cotton, but not as it is now made.

3400. Do you think that such accidents could not now occur?—Just so.

3401. You think that no heat created by a blow of iron against stone could explode it?—I think not.

3402. You think it quite unnecessary to carry gun-cotton in any other than a perfectly open way?—The more open the better.

3403. You would explode it with a detonator?—It can only be exploded with a detonator.

3404. And that must be ignited by a fuse?—Yes.

3405. And the fuse must be a proper one in all respects?—Yes, in all respects.

3406. It requires not only that the gun-cotton should be proper, but that the fuse should be proper also?—Yes.

3407. In the evidence taken before the War Office Committee, dynamite was found liable to exudation, was it not?—Yes, the first specimens.

3408. And the more recent specimens?—A great many of them were not.

3409. Your attention was drawn to what would produce exudation, namely, moisture, was it not?—Yes.

3410. You suggested, I think, that a Government inspector should see that it was in proper order before it was sent out for use, or was conveyed?—Yes, a Government inspector; I do not know of any other; but some inspector, at all events.

3411. You know that it would be difficult to

Mr. *Whitwell*—continued.

appoint a Government inspector, unless he was paid for by the parties employing him, do you not?—Somebody must pay him.

3412. Would you not think it hard that I should have to pay for inspecting your dynamite. If it were inspected to day, and it was brought in contact with moisture before it was used, would it not be liable to exudation, and would the inspection in that case have been of any use?—Exudation might take place, where it is subject to a moist atmosphere under certain conditions of temperature for a certain time.

3413. You consider that it is practicable, do you, to carry out an effective inspection of dynamite?—I cannot say how far what the Committee have done would be practicable in a general commercial way.

3414. If the factories were distributed largely all over the country, it would be impracticable, I suppose?—It would be very difficult, at all events.

Mr. *Whitelaw*.

3415. You have seen the exudation, I suppose?—Yes.

3416. It was produced by exposure to damp, was it not?—Yes.

3417. Have you known exudation to occur from any other cause?—No, except from heat.

3418. You have stated that you are expecting to find gun-cotton valuable in the Staffordshire mines?—Yes.

3419. Is it used in a wet state, as carried there?—No, they dry it.

3420. Is it not dangerous then?—No, it is not dangerous; but of course it is more dangerous than when it is damp.

3421. Can you fire a cartridge when damp?—No, not without a detonator, and some dry cotton.

3422. I thought, from what you previously said, that you believed it would explode without any drying process whatever?—I did not mean to convey that impression.

Mr. *Hicks*.

3423. Is not dynamite conveyed in small cases?—I have not seen the mode in which it is conveyed.

3424. If it is conveyed in small cases, and you were to allow one of the cases to fall a few feet, would it cause such a concussion as to explode the dynamite?—No; not if there is no nitro-glycerine exuded; we have tried it; we have had it fall more than 100 feet in a quarry on a hard bottom, and there was no apprehension of danger at all.

3425. Do you think that the jolting together of the waggons in which it was placed would not cause an explosion?—No, I think not, unless the nitro-glycerine exuded; no accident from ordinary concussion would result either in dynamite or litho-fracteur exploding.

Mr. ALFRED NOBEL, called in; and Examined.

Chairman.

3426. How long have you been manufacturing dynamite?—Since the end of 1866; about eight years.

3427. How many dynamite factories have you now in operation?—I have 13 at present in operation. 0.84.

Chairman—continued.

ration, and I am putting up two more, which will make 15 in all.

3428. Will you state in what countries those works are situated?—There are three in Germany, two in America, one in England, or rather Scotland,

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*P. Bidder.*

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Mr.  
*A. Nobel.*

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A. Nobel.  
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Chairman—continued.

Scotland, one in Spain, one in Portugal, one in Sweden, one in Norway, one in Italy, and one in Switzerland.

3429. Are there other dynamite factories besides your own?—Yes, there are in those countries where I have no patent; I believe there are some eight or nine such factories altogether.

3430. Have any accidents occurred in your own and other factories in the manufacture of dynamite?—Yes; I count one accident for each 1,500 tons of dynamite manufactured.

3431. Is that one fatal accident?—Yes; but the number of killed and wounded in all those accidents put together is less than in the one single gun-cotton explosion at the Stowmarket factory.

3432. What precautions have you been taking against accidents?—One main precaution consists in cutting up the factory into many separate buildings, and putting embankments between; in that manner an accident is very much localised; and even when there are workmen killed, they are generally reduced to two in number.

3433. How far, in your opinion, should a dynamite factory or a dynamite magazine be placed from public and other buildings?—It depends on the formation of the ground to such an extent, that any attempt to fix the requisite distance by law, must be based on vague and meaningless guess-work; if the legal distance is too short, it may, when the formation of the ground is unfavourable, prove a source of danger to adjacent buildings; if, on the other hand, the legal distance is too great, it must embarrass or cripple the explosive trade by necessitating the purchase of large tracts of land, not only for a factory, but even for putting up a magazine. I have known  $1\frac{1}{2}$  tons of nitro-glycerine to explode only 15 yards off from buildings which did not suffer the least, though there was nothing to protect them but a small embankment; this example will show that the distances fixed or to be fixed by law ought to be maximum, not minimum distances, with the widest power for a Government inspector to reduce them whenever it can judiciously be done. It is evidently better to entrust with that power an enlightened officer, who has gained or will gain experience in this matter, than to leave it in the hands of local authorities who know nothing of the matter, and will for that very reason be tyrannical in the extreme. It would, for instance, be very difficult to make them understand that a ton of dynamite or gun-cotton can be stored at a less distance from buildings than a ton of gunpowder; yet the reason is obvious; dynamite being a fulminate is intensely active in a small area round the explosion; but its local fury spends its power, and its destructive limits are in reality as narrow as public fear and public prejudice makes them wide; the local destruction of gunpowder is much less, but that is the very reason why it is destructive at greater distances; then again, gunpowder is very apt to set fire to distant buildings and magazines, which dynamite does not. I have just sketched the difference in that respect between gunpowder and dynamite, in order to show how very difficult it is to regulate those matters by a law, and how necessary it is in that case to let individual authority decide.

3434. How far, in your experience, do impurities in nitro-glycerine influence the chemical stability and sensitiveness to concussion of dynamite, and what measures have you adopted to rid

Chairman—continued.

it of such impurities?—I must begin with nitro-glycerine. Nitro-glycerine, though easily decomposed under the influence of heat or strong concussion, is remarkably indifferent to almost every chemical substance. To that rule, however, hyponitric and nitrous acids form exceptions, and as they naturally adhere to crude nitro-glycerine they must be washed out carefully. Dr. Dupré has suggested to test after washing with water, and also after doing it with alkaline solution; this is the practice in my factories, because in the manufacture of nitro-glycerine on a large scale the use of alkali offers great practical facilities. Complaints have been made of some dynamite having been found which showed a very slight acidity; but slight acidity means nothing unless it is stated what acid was present; the very porous silica which forms a chief ingredient of dynamite is an acid, while hyponitric and nitrous acids are the only ones to be guarded against. Owing to traces of sulphuric acid in the porous silica or kieselguhr used, dynamite cartridges made with perfectly neutral nitro-glycerine will sometimes show an acid reaction; that is no indication of danger; still, we have taken steps to prevent its re-occurrence. I freely admit the importance, in fact I called attention to it myself, of ridding nitro-glycerine or dynamite from the presence of hyponitric acid, and that my system of washing out that acid is reliable is amply proved by the fact, that since I began to manufacture dynamite there never has occurred a case of decomposition of that material. I cannot say as much for nitro-glycerine. There were decompositions; hence the current belief that it is less stable than dynamite, which is quite a mistake. During the first period of the manufacture of nitro-glycerine I was not sufficiently acquainted with the necessity of washing it free from hyponitric acid; since that has been done no decomposition has taken place amongst the thousands of samples kept for years at the factories. During the beginning of the trade I did not sufficiently know the danger of the presence of hyponitric acid. Since I knew it I have taken precautions against it.

3435. What amount of danger can, in your opinion, arise from exudation?—In dealing with the question of exudation, we have to consider what causes it, what danger it can lead to, and how the exudation can be prevented, or the danger it leads to guarded against. Exudation may be owing to either of three causes; the first is over charging the silica with nitro-glycerine at the factory; in that case the surplus of nitro-glycerine can scarcely be said to have exuded, since it has never been absorbed by the silica. The second cause is strong pressure, or a great weight put upon ready-made dynamite, which squeezes out part of the nitro-glycerine, an occurrence which cannot well take place, since dynamite is not sent loose, but packed in boxes. The third cause is the displacement of the nitro-glycerine in dynamite by water. In my opinion, the cases of serious exudation reported by Major Ford have all been owing to the influence of water, not to a damp atmosphere, which has no effect, but to the direct influence of water. I must briefly sketch how that could take place. After the dynamite factory was started, we could not for a long time obtain the use of any harbour, so we were compelled to load on the sea beach. The workmen waded out in the shallow water, carrying the



*Chairman—continued.*

the dynamite boxes on their shoulders, and occasionally they dropped one or two into the sea. As water entering the boxes will displace the nitro-glycerine contained in the dynamite, exudation, of course, must ensue. To prevent such occurrence in future, I took immediate steps to line the boxes inside with water-tight material, and it is my firm belief that that measure will put a full stop to exudation. I have received information from Glasgow that it is perfectly water-tight. There appears to be a complete misapprehension as regards the exudation of dynamite. People seem to imagine that it is the normal condition of that material, while in reality it is a most exceptional case, owing to circumstances unforeseen; and against the recurrence of which I have already taken precautions. Under exudation, in this case, I do not mean the slight traces of nitro-glycerine which wet the cartridge wrapper, and which can scarcely be completely avoided, nor is there any necessity for so doing. Millions of moist cartridges have been used without any inconvenience, and their somewhat wet appearance is due not to exudation, but over-charging with nitro-glycerine. I will just mention that when, for instance, 75 per cent. of nitro-glycerine forms a dry cartridge, 75½ per cent. will form a cartridge which is somewhat wet in appearance.

3436. What measures have you taken to prevent exudation from the overcharging of the porous silica with nitro-glycerine at the factory?—There is a little machine which I have adopted in which the cartridge is put under pressure, a weight is carried forward on a lever so far until it shows traces of exudation. We are thus perfectly enabled to see whether to add nitro-glycerine or to add kieselguhr, and in what proportions.

3437. Are there any laws or regulations in foreign countries to guard against exudation?—There are no laws against it, but there are regulations which are certainly not favourable to the safety of dynamite. The Belgian inspector, not knowing its nature, imagined that it was continually giving off vapours; he ordered that the boxes should be made with small holes, which was the very best means of promoting danger, because the rain-water ran in and caused nitro-glycerine to ooze out. I am very happy to say that this caused no accident, but it was a very imprudent regulation. The Prussian Government have done another unwise thing, they have compelled us to put dynamite cartridges into tin cans, because nitro-glycerine was in tin cans. They did not know that dynamite was a solid substance; they actually wrote regulations containing instructions to put dynamite into tin cans; and all that came of not knowing and not investigating the material.

3438. How long have you known dynamite to keep without exudation? Have you had any experience of dynamite in tropical climates?—Yes, there have been considerable quantities exported to the Brazils, Peru, Australia, and, in fact, nearly every hot country. I cannot say that I have kept dynamite for very many years, because I never had occasion to do it, but I have kept nitro-glycerine, and that is a warrant that dynamite will keep. I have kept nitro-glycerine for as much as 12 years and it showed no trace of decomposition at all, and that nitro-glycerine is older than the practical manufacture of nitro-glycerine.

3439. What inconveniences to the dynamite  
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*Chairman—continued.*

trade have resulted from the Nitro-Glycerine Act, and what, in your opinion, will be the result should it be kept in force?—The Nitro-Glycerine Act has altogether crippled the dynamite trade in Great Britain. The best proof of it is that up to the beginning of this year this country had only used 200 tons of dynamite, against more than 3,000 tons used in Germany. It is a wonder that even 200 tons could be used, because the regulations are such that it is utterly impossible to base a trade upon them.

3440. Can you state what quantities of dynamite are being made and sold annually?—I have before me the exact figures from my Hamburg factory. It sold last year 1,337 tons of dynamite. From the other factories I have not yet collected accurate returns, but collectively they sell about 1,500 tons. The produce of competition factories I estimate at from 600 to 700 tons a year. This forms a total of 3,500 tons a year. Estimating it at only three times the power of gunpowder, which is certainly moderate, it equals 10,500 tons of blasting powder a year, which is more than half the powder consumption of the whole continent of Europe. Therefore the experience already gained should not be lightly treated. It certainly outweighs the importance of many theoretical views.

3441. Have any accidents occurred, in your experience, from spontaneous combustion, or otherwise, in the storing of dynamite?—None that I ever heard of, and such a thing could not well have failed to be reported to me. My Hamburg firm have from the beginning insured dynamite at one per cent. on its value, covering the risks of transit and storage. The account shows a net profit of nearly 2,000*l.*, and there never was a loss. That, which can be verified from our books, speaks very much in favour of dynamite.

3442. What quantities of dynamite have you forwarded by carting and by rail, what precautions are you taking, and what accidents have occurred, if any?—Dynamite, at least in Germany, is generally forwarded in quantities of 45 cwts. net at a time. Owing to the very limited number of factories, the distance of conveyance is far greater than for gunpowder, so that the mileage run by the same quantities of these explosives will be at least three or four times greater in the case of dynamite. Thus, for instance, my Hamburg factory supplies Silesia, Poland, Bavaria, Belgium, and Switzerland, nay, until lately, even Italy, with dynamite. The mileage run by each load averages about 250 miles, which brings the total mileage for the 12,000 tons hitherto produced up to 1,333,250 English miles. Of this, about two-thirds are by rail and one-third by carting. It is carted all over Prussia, which is almost the only country where no explosives are forwarded by rail, except for Government purposes. In the mileage as computed here there is not included the circulation of smaller quantities than 45 cwts., which would certainly double at least the figures. Dynamite is freely carried by rail in Austria, Sweden, Norway, Denmark, Italy, Spain, Portugal, and the United States. No extra precautions are taken, except that the Austrian Government insists on the use of wooden pegs instead of copper screws in the boxes, because they are rather afraid of metallic concussion. No accident has ever taken place in the transit of dynamite, and as the quantities transported are  
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very large, so the experience gained is a weighty one. It is evident that 480,000 boxes with dynamite in them cannot be forwarded an average distance of 250 miles each without being exposed to much rough handling, and it is also evident that if exudation was, as many believe, a standard property of dynamite, it must by this time either have caused many accidents, or have proved that it is safe in spite of exudation.

3443. I suppose the Committee are to gather that you are of opinion that there is no more risk in conveying dynamite by rail than conveying any other explosive?—Not with regard to gun-cotton, because wet gun-cotton is entirely free from any risk. But it is so as regards all other explosives. I do not mean to say that gun-cotton should be sent wet, because it is very troublesome to dry on the spot; but if it is sent wet, it is certainly far less dangerous than any other explosive.

3444. What accidents have taken place through the use of dynamite in mines and quarries, and what measures have you adopted to reduce them to a minimum?—All the accidents have been owing to raking out the tamping after miss-fires, scratching the fulminate in the caps, or thawing cartridges on or near the fire. It is impossible to guard against those things. We have a very excellent thawing pan, in which dynamite can be thawed in winter without danger. The first instruction I ever gave about it was to put the cartridges in the breeches pocket, that being the easiest mode of thawing; and it is getting more and more into use. At the beginning of the trade, there were in Germany a good many explosions through careless thawing, but now they have entirely disappeared; and if you look through the statistics of the Prussian Government which show accidents in mines, you will find that accidents with dynamite are less in number than accidents with gunpowder. In former times they were far greater, but now they are far less. There are large mining districts where last year there was no accident at all from the use of dynamite.

3445. But in spite of all that, the Prussian Government have still more stringent regulations than even the English Government with regard to the carriage and storage of dynamite, have they not?—Certainly, their regulations are stringent in everything; and I believe that the absence of that stringency in England has caused the great expansion of English trade.

3446. Are there not other Governments which are unfavourable also to the free transit of dynamite?—Yes; I think that the Belgian Government is the worst.

3447. In what sort of packages do you send it by foreign railways?—It is all packed in wooden boxes; first we pack the cartridges into a cardboard box, each box containing 5 lbs. Those are wrapped in black tarred paper; they are put 10 into each wooden box, which makes 50 lbs. In the wooden boxes, we put a little kieselguhr at the bottom. We take even greater precautions in England.

3448. Are you bound to give any particular notice to the railway directors that you are sending the article, or can you send it by any train?—In Austria we can send it by any train. It is different in different countries.

3449. It is all in cartridges, is it?—Yes, it is

Chairman—continued.

all in cartridges, except for some very heavy blasts; then we send it in india-rubber lined bags.

3450. You have mentioned that on one occasion a ton and a half exploded, but that no damage took place, because the place was surrounded by an embankment?—Yes; one and a half tons liquid nitro-glycerine, not dynamite.

3451. What caused the explosion?—People get extremely careless when they have dealt for a little time with these explosives. For instance, a chemist who the first time he makes nitro-glycerine in large quantities, is almost frightened to death, a fortnight afterwards gets so careless as to expose himself to the utmost danger. In the case just referred to a leakage had taken place which was very easy to stop, but instead of doing that, or letting it proceed, the chemist sent for a hammer; he wanted to hammer it tight himself. If he had done it himself he would certainly have succeeded; at least I should have succeeded, but it took some time ere the hammer could be brought, and meanwhile he ordered a workman to take up a large stone, and knocking hard he caused an explosion. Nitro-glycerine will not stand much knocking; it will stand it to some extent, but not between hard bodies. You could scarcely get nitro-glycerine to explode if you put it on wood and strike it heavily with a hammer; but if it is spread over iron, and an iron hammer falls upon it, a very slight blow will suffice to explode it.

3452. It would only be by concussion between two iron substances that it would explode?—Yes, the concussion of metal substances renders some of those explosives very sensitive; it is the same with gun-cotton to a certain degree; all those explosives which will go off by a blow, are sensitive to metallic concussion. Dynamite packed in wooden boxes, as usual, resists the strongest concussion. If the boxes were banded with iron the danger would become greater; but there is no iron in our packing cases.

Mr. Vivian.

3453. I think you discovered nitro-glycerine, did you not?—No, I did not; but nitro-glycerine could not be used without certain means of ignition, which I discovered, and certain facilities for its manufacture; that is all I discovered.

3454. You discovered the method of using it practically by means of absorbents, did you not?—Not only that, but first of all the ignition by means of a cap or gunpowder charge. Though nitro-glycerine has been known to explode accidentally, setting fire to it for practical purposes is not so very easy; it will stand a gunpowder charge, and the gunpowder charge will blow out, the nitro-glycerine being found in the bore-hole unexploded.

3455. At first, when nitro-glycerine was discovered there were a great many accidents, were there not?—Yes; and that by comparison proves the safety of dynamite, for whilst nitro-glycerine with a small sale gave rise to many accidents, dynamite in spite of a large trade has caused none. There were three or four very serious accidents from nitro-glycerine; but before the Nitro-Glycerine Act was passed in England I had published in German papers that I refused to sell any nitro-glycerine; therefore I had taken steps before the the British Government took steps to stop the sale of it.

3456. Those accidents led to the passing of the Nitro-Glycerine Act, did they not?—Yes, but I had

Mr. Vivian—continued.

had stopped the sale long before, and I was the only manufacturer of the article.

3457. Were these accidents, in your opinion, the sole cause why the Nitro-Glycerine Act was passed?—Yes, but no doubt if nitro-glycerine had continued to be used as an explosive substance we should have found means to make it perfectly safe in handling by not using metallic packing, and using some other precautions, but it was more easy to convert it into a solid. My objection to nitro-glycerine was less from the difficulty of carrying it than from its liquid state, which causes it to leak into the crevices of boreholes, thus getting filtered into the rock, and causing accidents difficult to prevent; that was my chief reason for going over to dynamite.

3458. You had given up the sale of nitro-glycerine before the Nitro-Glycerine Act was passed?—Yes, long before.

3459. Did you manufacture it?—Yes, I manufactured it for the purpose of making dynamite.

3460. But not for itself?—No; after the first serious accident was known which could be attributed to the real danger of the material, I stopped immediately; I could not do more.

3461. Without dampness, or without considerable moisture could you have exudation from good dynamite?—No; the Gun-cotton Committee was instituting some experiments in that regard, which proved very favourable to dynamite. Besides, when the Gun-cotton Committee went down to make experiments in Wales with dynamite, they were using cartridges which had been stored in Wales for three years, and were in a perfect condition. Now North Wales is one of the wettest places in Great Britain.

3462. Exudation may proceed from the over saturation of the kieselguhr?—Yes, but we guard against it; there is no danger from that source. But in the cases reported by Major Ford, I must certainly believe that it proceeded from water running direct into the boxes; that cannot take place in future, owing to improved packing.

3463. Would it be oppressive on your trade to require you to guarantee that no dynamite shall leave your works with the kieselguhr over-saturated?—Of course that is not for me to decide; but, in my opinion, the less regulations there are the better, particularly where things are not completely settled; it stops improvement, and generally causes just the evil it is meant to prevent.

3464. In the event of the kieselguhr being over-saturated, the cartridges being packed in a box containing loose kieselguhr, would not that meet any exudation which might hereafter take place?—We have always put a considerable quantity of kieselguhr into the boxes. I will undertake to throw a box with extremely exuding cartridges in it, so much that one-half of the nitro-glycerine will have run out; I say I will throw such a box from 100 feet down on to the ground without explosion, in order to show that the danger is no so great, even with exudation. I do not mean to say that exudation of that kind should be tolerated, and I do not think it will occur; but I can show that it is not so dangerous as people believe.

3465. You think that free kieselguhr, which has no nitro-glycerine in it at all, would be an advantage in packing cases of dynamite?—I would prefer sawdust; water displaces nitro-glycerine from kieselguhr much easier than it

Mr. Vivian—continued.

does from sawdust; that is to say, if the nitro-glycerine was leaking out, and was taken up by the sawdust, it would not leak out on coming in contact with water as readily as it does from kieselguhr.

3466. It would, at all events, be an advantage in the conveyance of dynamite to have some loose absorbent in the boxes?—I think so; still it is perhaps less necessary now with our water-tight and nitro-glycerine-tight packing.

3467. But still it would be a safeguard, would it not?—Yes, we always use it.

3468. Under what regulations is dynamite conveyed by foreign railways?—There are very few regulations.

3469. Do any of the foreign railways object to carry dynamite?—No, only in Prussia. The Prussian railways take no explosives.

3470. The Belgians object also, do they not?—Yes.

3471. When you send dynamite into Prussia, you send it by water and land carriage, I suppose?—I cart it everywhere.

3472. Have there been any explosions at all on the Austrian line in carrying dynamite?—Never. They carry it to this day, and the Swedish railways also. The Swedish experience is the longest; they have carried it since 1866, nearly eight years ago.

3473. How much have they carried in that time?—They have scarcely carried as much as the Austrian lines. The Swedish sale has been from 150 to 200 tons a year. That is what it used to be, but it is much larger now.

3474. Do those lines, which have been in the habit of carrying dynamite for a few years past, carry it at a different charge as compared with gunpowder?—No, it is the same charge; they cannot charge as they like, as they do here.

3475. Have the Government interfered with the carriage of dynamite in those countries?—Only in Austria, where they compel the companies to carry dynamite.

3476. At what rate do they take it, as compared with the English railways?—I do not remember that; but it is the same charge as for gunpowder.

3477. At what rate is it carried as compared with other articles?—That I am not prepared to say, but it is considerably higher.

3478. Are your factories carried on abroad under Government inspection?—Not regularly; it is very different in different countries; most factories are under no inspection at all; there is one in Prussia that is inspected, but that inspection is a mere matter of form.

3479. But is there inspection in your large factory near Hamburg?—Yes, that is the one I spoke of.

3480. What power has the inspector there?—Very little power; he can report to the Government, and then the Government will decide.

3481. I suppose the Government can compel you to make any alteration which the inspector recommends?—Yes, but the Government in Prussia never did; it interferes very little with us.

3482. Is it difficult for the inspector to discover any adulteration in dynamite, or any over-saturation?—No.

3483. The Committee have heard a good deal of hyponitric acid in dynamite. Is it a difficult test to discover the presence of that acid?—No.

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Crude

Mr.

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Mr.  
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Mr. Vivian—continued.

Crude nitro-glycerine can scarcely be made without containing it. It attacks all organic compounds, and acts decomposingly also on nitro-glycerine; we therefore wash it out with alkali.

3484. The Committee have understood that dynamite ought to be free from hyponitric acid when it leaves your premises, so that it is clearly an adulteration, is it not, if it exists?—Yes, it is certainly a thing to be guarded against. Very minute traces will not in our climate become a source of danger; still it is a thing which should be guarded against. I have taken, perhaps, more precaution than I would do if I only went by practical experience; it is a matter of theory with me.

3485. Do you consider it advantageous that dynamite should leave your works, giving an alkaline reaction rather than quite neutral?—Yes.

3486. Is it better, do you think, that it should be in that condition?—It is an additional safety; it is scarcely needed, but it can do no harm.

3487. With regard to inspection in this country, would you object to the inspectors having the power to punish a manufacturer of dynamite being sent away, either with adulteration or with over-saturation; say, a punishment by a fine?—I think that measure is rather dangerous in the beginning of a manufacture; a manufacture is generally not brought to perfection at once, and a manufacturer is, in his own interest, anxious to do the best he can. It is almost impossible, when you employ men to do a certain work, to say that they will be infallible. If the inspector has power to stop a factory, because of exudation, which, in the opinion of the manufacturer, is not dangerous, or which has not been proved to be dangerous, then I think there is too much power given to the inspector. I have no objection to that power vested in the present inspectors, but it might be dangerous in future.

3488. That is to say, provided the inspector was well up to his duties, you see no objection to his having the power to stop a manufacture if the inspector sees improper dynamite leaving it?—That would be of course a dangerous power to give; it might lead to excluding a useful trade from one country while other countries were using it.

3489. Would it not be better for you instead of having your factory stopped, for the inspector to have you fined if convicted?—I would stop a factory of mine in that case. If, for instance, an inspector simply took a cartridge which was in good condition, and just as normally good as you could possibly make it, and put it into his portmanteau with some pressure on it, it would get squeezed. After some time he might believe it to be exuding, though the nitro-glycerine had simply been squeezed out. A mistake of that kind might lead to the stopping of a very useful factory.

3490. I suppose you would give the inspector no summary power at all?—I would give him a power of inspection, but not the power of stopping the factory.

3491. The inspection to be backed by suggestions only?—Yes, whenever a law can be made to specify a thing, individual power is not well to substitute for it.

3492. With regard to dynamite No. 2, do you think it should be put under exactly the same

Mr. Vivian—continued.

restrictions and conditions as No. 1 dynamite?—I think so, but not with regard to exudation, which can scarcely take place in No. 2 dynamite except you pour water upon it, because in No. 1, the nitro-glycerine being absorbed in a porous substance, can be squeezed out by strong pressure, but in No. 2 it simply moistens the surface of each particle; and therefore it will stand a much greater pressure before it begins to exude.

Mr. Whitwell.

3493. I think you say, as other witnesses have said before you, that nitro-glycerine was the explosive constituent part of all dynamite?—Not entirely so, because in several kinds of dynamite I use other substances which are more or less explosive.

3494. What other substances do you use which are more or less explosive?—There are several kinds of dynamite, and there is one where nitro-glycerine is the only explosive.

3495. Confining ourselves to that which you manufacture in Scotland, in that I presume the explosive part is nitro-glycerine?—In No. 1 it is.

3496. Taking No 1 only, in order to make it you must procure the nitro-glycerine from some source or other, must you not?—Yes, we manufacture it.

3497. But persons might manufacture dynamite and purchase the necessary nitro-glycerine, might they not?—They might, but they have no license now to do it.

3498. All dynamite must be manufactured either by the transit of nitro-glycerine into the works or by the maker of the dynamite making his own nitro-glycerine?—Yes.

3499. Consequently the manufacture of dynamite should include also those protective precautions which are necessary to produce safety in the manufacture of nitro-glycerine?—Yes.

3500. It is not simply as it is in some manufactures, a single process, but it is a compound process?—Yes.

3501. Consequently the dynamite manufacture requires precaution in the production of the most explosive article in the world, as well as in combining that article with the medium by which it is sent out into the community for consumption?—Yes; the manufacture of nitro-glycerine is entirely separate from the manufacture of dynamite, but it is contained in the same works.

3502. So that any inspection of dynamite works would include also the inspection of nitro-glycerine works?—Yes, necessarily so.

3503. Consequently this would be as a whole a more dangerous manufacture than if it was only the preparation of dynamite from imported nitro-glycerine?—Yes, to a certain extent; still, even importing the nitro-glycerine might be dangerous unless the packing was suitable.

3504. We may presume that the importation and transit on a railroad of nitro-glycerine would hardly be allowed by any country?—Not until it has been proved that it can be packed so as to insure safety.

3505. Which has not yet been proved, I believe?—It has not yet been investigated, so that it cannot be proved.

3506. The manufacture of dynamite on the cheapest principle would probably include the preparation of the explosive material as well as its combination?—Yes, it always has been so.

3507. Did

Mr. *Whitwell*—continued.

3507. Did your remarks about dividing the manufacture into small sections, include a similar division with reference to the preparation of nitro-glycerine?—Yes, it has been sub-divided as much as possible. The Scotch factory looks more like a village than a factory, there are so many buildings in it.

3508. You spoke of embankments or mounds which separate one building from another; how do you make them, what height and what width?—Generally so high that the top of each embankment covers the top part of the apparatus in the building, that height having been found quite sufficient.

3509. You would say 14 to 15 feet, I suppose?—It depends on the height of the building, the dynamite buildings are much lower than the nitro-glycerine buildings. The latter are made so high, in order that the nitro-glycerine may be run off, without manual labour, from one apparatus to another.

3510. What is the average height of your nitro-glycerine buildings?—There are three nitro-glycerine buildings which constitute the factory, and each building is on an average 16 to 20 feet high.

3511. What is the height of the dynamite buildings?—We generally make them from 10 to 12 feet high.

3512. What would be the width of the base of the embankment for a dynamite factory?—For a 12 feet building, it would be about 16 feet at the base.

3513. That is to say, rising up to 12 feet in height?—We do not require it of the full height, but it has been in England made to the full height.

3514. Have you ever had the strength of your embankments tested?—Yes, and by the most efficacious test of all.

3515. Do you mean by an explosion?—Yes, I can mention a very practical instance of that; in the Prague factory we had not a sufficient distance to allow of an embankment as large as I might have liked; we could only dispose of eight feet between each building, and an explosion took place through great carelessness on the part of a workman; after the explosion the other buildings were intact, though there was only eight feet between.

3516. That is to say the embankment was within eight feet?—Yes, within eight feet; it was a clay embankment, and they had coated it with turf, and it did lie against the building which is not the best mode of doing it; but the result showed that the protection had been sufficient.

3517. Then the explosion could not destroy the embankment?—No, it crushed it a little, but it did not interfere with the building at all.

3518. And yet it was so close to the building that it might have been almost part of the wall of the building, you say?—Yes.

3519. Do you think that some protection could be obtained by increasing the thickness of the wall?—I believe that the best mode of making an embankment is by leaving a space between.

3520. You think there is greater protection from the existence of these embankments than there would be from an increased distance from house to house?—Yes, quite; I believe the distances used in Scotland are far greater than is needed; I have made several experiments to test this, and those explosions which have actually

Mr. *Whitwell*—continued.

taken place have perfectly proved that very small distances are sufficient; I can mention a case in which a ton and a half of liquid nitro-glycerine exploded at the Hamburg factory (that is the same explosion that we were speaking about before); a kind of trellis work which had been ordered by the Government inspector had been placed on the top of the embankment, and when the explosion took place that net work, which made almost no resistance at all, was not blown away by the explosion, but the explosion created a vacuum before it could be blown away, and it fell down into the very pit where the explosion had taken place.

3521. What inspection have you in Sweden?—Very little; nothing but the law, and occasionally the Government will send somebody to look at the factories, but we have no serious inspections at all.

3522. What is the law in Sweden?—The law in Sweden is that there should be a certain distance between powder works and surrounding buildings; I do not remember the distance. I believe they have let the nitro-glycerine works be placed too near the city, not that the explosions which have taken place have made any damage, still there are houses, perhaps, too near the factory.

3523. When people work your patent, in Sweden, and want power to establish a factory, have they to go to some authority for leave to build it?—Yes, the local authorities decide.

3524. They decide locally on the position and safety of the factory, and the arrangement of the buildings as well, do they?—Yes.

3525. It is not the law?—No, the local authorities have that power.

3526. Has the local government the power to summon you before a magistrate for a breach of any of the regulations?—Yes.

3527. Has he any power to make laws?—No.

3528. Is there any country where your factories are established where any inspector has the power to make laws, the breach of which would involve you in damages?—No; but a breach against existing laws can be fined.

3529. Is there power in the inspector, whoever he may be, to make a law himself, on the breach of which you would be punished?—No, they would not in any country permit that at all.

3530. You would willingly submit, I suppose, to any statutory law, the breach of which would cause you to be punished, if you broke it?—Yes, certainly.

3531. But would you think it objectionable, or would you think it a stretch of power to vest in the hands of any individual the right to make laws out of his own head, the breach of which would involve you in the responsibility of a fine?—I certainly think that very objectionable; but there are certain cases for which laws are extremely difficult to make, and where power might reasonably be vested in the inspector; for instance, the distances for magazines and factories from adjacent buildings cannot be fixed by law; those persons who have fixed the distances cannot possibly have had a clear conception of what is the real distance needed; therefore it has been so much exaggerated as to create great inconvenience to the trade.

3532. You would think it proper for the inspector to be cognizant of the arrangement of the buildings in the first instance, would you?—Yes.

3533. But

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Mr.

*A. Nobel.*

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Mr. *Whitwell*—continued.

3533. But when the practice was found to be quite safe, and no accident resulted from it, would you think it proper that your trade should be liable to regulations imposed upon you at any moment by the wish of an inspector, though it was not a statutory regulation?—I do not think it ought.

3534. Do you know of the existence of any such regulations in any country where your factories are established?—No; nothing even approaching it.

3535. That you say from your own knowledge?—Just so.

3536. If regulations were made by the inspector on the original establishment of the building, and if his rules were submitted to the Secretary of State, and sanctioned, and then, if bye-laws were made from time to time requiring the approval of the Secretary of State, you would not object, I suppose?—Certainly not.

3537. You say that you would not be afraid to throw a box of dynamite 100 feet on to the ground?—Just so, even exuding dynamite.

3538. But would you like to throw a tin canister of dynamite from a height of 100 feet?—Certainly not, if I stood near.

3539. Are there conditions or circumstances in which dynamite may be placed where the explosion may be terrific?—Yes.

3540. Did you say that if dynamite thrown on rock was tamped with metal, it would explode spontaneously?—No, I said a tin cartridge; I have not tried it with dynamite, but I have tried it with nitro-glycerine; I presume that in the case of dynamite it would explode, if it fell from a sufficient height, if enclosed in a tin, and I suppose that gun-cotton would do the same thing.

3541. What is your opinion of the distinction between mechanical and chemical mixtures, as to safety?—With reference to safety, there can scarcely be any distinction at all; but gun-powder is a mechanical mixture, and might require a distinction, because it is a very old and well-known substance, and the danger has been very much diminished through the advantage of long experience, but there are other mechanical mixtures which should be treated with the utmost strictness; chlorate of potash is not in itself very dangerous, but if mixed with sulphur and carbon it becomes intensely dangerous, so dangerous as to be almost worse than any chemical compound; I know they have tried to use it, but it is highly dangerous, and the slightest friction will set it on fire.

3542. You stated, I think, that you would prefer that the box in which the dynamite cartridges were contained should contain on its floor

Mr. *Whitwell*—continued.

sawdust rather than an additional quantity of kieselguhr; but is not sawdust combined with nitro-glycerine more easily exploded than nitro-glycerine combined with kieselguhr?—No, not at all. It has no chemical influence on it. We have kept it for years, and it has had no effect. Nitro-glycerine is chemically speaking a very indifferent substance.

3543. How do vegetable fibres compare with kieselguhr for your purposes?—The only difference between the vegetable fibres and the silica is this, if it is absorbed in vegetable fibre a very small pressure will squeeze out the nitro-glycerine; but if it is in the kieselguhr it resists a far greater pressure; that has been my chief reason for adopting kieselguhr; otherwise I might have chosen many other substances instead. Kieselguhr has the advantage over all others, that it resists pressure so well.

3544. You think that kieselguhr can be more safely and accurately charged with nitro-glycerine than any other substance, besides being not so easily squeezed out?—Yes, hitherto that is so, but I think we may yet find something better still; this is far from being the ideal.

3545. Though I do not like to ask an advocate of gun-cotton about dynamite, or an advocate of dynamite about gun-cotton, I will ask you this, whether in your opinion gun-cotton as now made will explode during the stemming of the bore-hole?—Yes, it will, but only for this reason; if you could use wet cotton it would not do it; but even if you use wet gun-cotton you must put a dry gun-cotton cartridge over it; and also a detonator, and then you will always be liable to have an explosion through hard stemming.

Sir *Henry Selwin-Ibbetson.*

3546. Did I not understand you to say that you thought nitro-glycerine preparations in the form of dynamite should be always packed in waterproof packages?—Yes, as much as possible.

3547. Then would you approve, in any new Act, of its being laid down that dynamite should be so packed, unless specially exempted?—I think it would not be well to put that into an Act, because it would render it impossible to use any better plan that might be discovered; I should think it would be better to give a power in this matter to the Government Inspector than to fix anything in the Act, because it would not stop our employing some better mode of packing if it were submitted to the inspector; Major Majendie himself would immediately consent.

3548. You would be satisfied, would you, if some such power were given to an inspector, instead of its being specified in an Act of Parliament?—Yes, I think you could not do it as well by an Act of Parliament.

Mr. THOMAS TOLLEY JONES, re-called; and further Examined.

Mr.

*T. T. Jones.*

Chairman.

3549. YOU wish to add something to a former answer given by you, do you not?—Yes, I wish to add something with regard to the carriage of these explosives in Australia and the colonies, and the difficulties we have in shipping them to the colonies from the river Thames. But first with regard to price, I have to apologise to the honourable gentleman who asked me a question with regard to the price of litho-fracteur. I

Chairman—continued.

stated that it was 1 s. 9 d. a pound. I find that I had the recollection in my mind at that moment of an old contract we made at that price, but the present price is 2 s. to 2 s. 3 d. in the river Thames. With regard to the transport in the colonies there are very few restrictions. We have advantages in sending litho-fracteur by railway which are not accorded to gunpowder even. The railways in Victoria belong to the Government, and they

*Chairman*—continued.

they allow us to send litho-fracteur by their goods trains; whereas powder can only be sent by powder trains, and the freight we pay is the same rate of freight for litho-fracteur as is charged for gunpowder by the gunpowder trains. That the officials there are on the alert may be gathered from the fact that when our first shipment arrived at Melbourne it was refused admission into the magazines on account of the cases being nailed with iron nails. We had to take it all away in a lighter out into the bay, and have all the nails extracted and copper ones put in their places. They were then taken into the magazine. We have had very little trouble since. There were some objections to the carriage by railway, and certain officials were deputed to inquire into the matter, and they were so satisfied about it that we have had no difficulty since. We have often sent it by bullock drays hundreds of miles up country, over the natural rough roads, and I think there cannot be worse in any part of the world. That has been done without the slightest accident either in transport or in manufacture, though it has been done for 8 or 10 years, which cannot be said of dynamite or gun-cotton, or any other explosive. Notwithstanding that the manufacturers say it is the safest blasting material known to commerce, and we can certainly bear them out in this assertion, for it can be said of litho-fracteur that no accident has occurred in the manufacture, storage, or transport. The only two accidents that I ever heard of in the use of it were the two mentioned by Mr. Nursey, and they were owing to great carelessness. Though litho-fracteur holds this proud position, it is yet subject to the greatest restrictions and humiliations at the present moment. We have our books overloaded with orders; we have magazines in Germany full of the material, we have ships willing to take it to the different markets where it is required, and we are constantly deluged with letters and telegrams, telling us that this or that important work will be stopped unless we can send them supplies, and yet all this is of no avail, because we cannot get a license from the Home Office to ship it in an unfrequented part of the Thames. Gun-cotton can be shipped right under the windows of Gravesend; gunpowder can be shipped under very simple regulations, and moreover we hold a license enabling us to import it into the Thames. Dynamite can also be shipped a little lower down the river: dynamite which contains 75 per cent. of nitro-glycerine as against 55 per cent. to 60 per cent. in litho-fracteur. From all our experience we see reasons for much preferring litho-fracteur, yet we are unable in consequence of this to supply our friends or our own mines abroad with this material. With regard to the certificate from Melbourne from Mr. Cosmo Newbery with regard to some exuding litho-fracteur, I have every reason to believe that that report is a report on an imitation of litho-fracteur. It is so little known in this country that you may be surprised to hear that large quantities of imitation are already in the market, and already being sold in the Australian colonies. Our firm there were so satisfied that it was not a genuine sample of litho-fracteur, that they asked Mr. Johnson, one of the analytical chemists there, and Mr. Cosmo Newbery himself, to examine our own stock of litho-fracteur. I think that was after that unfavourable report

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*Chairman*—continued.

appeared. This is Mr. Johnson's report: "Government Analytical Laboratory, Melbourne, 23 October 1873,—I have examined a new sample of litho-fracteur just imported by Messrs. Jones, Scott & Co., of Melbourne, and said to be strictly prepared from Frotzheim's patent" (that is Messrs. Krebs's patent); "I find it to be dry, not having the slightest exudation of nitro-glycerine complained of in some samples, and I have no hesitation in pronouncing it to be perfectly safe in storage, carriage or use. In point of strength it will of course have all the well-known properties of nitro-glycerine, of which it is especially composed, without the danger attached to the use of that substance when free. (Signed) *William Johnson*, Government Analytical Chemist." Mr. Newbery has been introduced as an authority on this substance, and this is his report on our undoubted samples of litho-fracteur: "Technological Museums Laboratories, Melbourne, 3 December 1873,—Report on a sample of litho-fracteur received from Messrs. Jones, Scott, & Co. The sample was enclosed in a vegetable parchment wrapper, which was quite free from nitro-glycerine. The compound itself was also quite dry when handled; no nitro-glycerine adhered to the fingers. A portion of the sample was placed for 14 days in a moist atmosphere without any exudation taking place, and if not broken up into small fragments it may be immersed in water for several days without its components separating. A further portion was exposed to a temperature ranging from 90° to 212° Fahrenheit without any change. It was exposed to the higher temperature for a period of 12 (twelve) hours; when portions were lighted at this temperature they burnt rapidly, but without explosive violence. When burnt in a thin sheet or film, the fire could be easily extinguished before the whole was consumed. The experiments show that this sample differs materially from that previously examined and reported on by me, though bearing the same name, litho-fracteur. The present sample may be handled, stored, and used for blasting purposes, without requiring more than ordinary care to guard against accident.—*J. Cosmo Newbery*, Analyst." I would beg to call the attention of the Committee to the fact that in that report which has been referred to, I believe Mr. Newbery says that it is a report on Keeps' black paste litho-fracteur. Now in this report he makes no allusions to Keeps' black composition, and I think you will see that they are two distinct things. Some few months since 400 cases of the material was sent from Germany into the River Thames; it was, I believe, black dynamite, but it was made to imitate litho-fracteur. It was shipped from Germany, and entered at the Custom House as dynamite; there were no labels on the boxes, nor any means of knowing what the contents were. The Custom House officers examined them, and seized them because they were not labelled in accordance with the regulations. The consignee in this country had labels printed with false addresses on them; he stuck them on the boxes, and got them released from the Custom House, and they were shipped on a Saturday night, after dark, on board an Australian ship as gunpowder, and they are now in Melbourne, being sold as litho-fracteur.

3550. Are you now speaking of matters within your own knowledge?—Yes.

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Mr.  
*T. T. Jones.*  
9 June 1874.

Major VIVIAN DERING MAJENDIE, R.A., re-called ; and further Examined.

Major V. D.  
Majendie,  
R.A.  
9 June 1874.

Chairman.

3551. You have heard the evidence given by members of the different branches of the trade with reference to the suggestions which you submitted to the Committee with reference to amendments proposed to be made in the existing law, have you not?—Yes.

3552. Have you any observations to make to the Committee on those suggestions?—Yes, I have several observations to make. I have very carefully considered the various criticisms of my suggestions, which have been urged with a view, if possible, to remove or meet any reasonable objection; and I wish, if the Committee allow me, to state the result of my considerations, taking the various points of my suggestions one by one, with reference to the conclusions that I have come to.

3553. Have you any remarks to make with regard to Suggestion No. 1—I do not think that any objection has really been made to this suggestion. Mr. Curtis, on behalf of the gunpowder manufacturers, appeared to think that there was no necessity for materially altering the law with regard to the manufacture of gunpowder, but I think that it was admitted that the law as to gunpowder outside the factories was not satisfactory, and even with regard to the law relating to factories themselves, I think I shall be able to lay some additional evidence before the Committee which will show that at present it is not what it should be. It has not been disputed, that the law as to nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances, is unsatisfactory; and it has been shown by the evidence before the Committee to operate disadvantageously to these substances in some respects, and I think, indeed, the witnesses who have been called on behalf of the different branches of the trade, have stated to the Committee that if enforced against them it would practically shut up the trade altogether in some cases. Take, for instance, the evidence of the gunmakers; Mr. Eley on the part of the cartridge trade, and Mr. Brock on behalf of the firework trade. I think the evidence I gave as to the necessary illegality of a large number of mine magazines under the present Act, is another point in favour of altering the law.

3554. Now with regard to Suggestion No. 2, what have you now to submit?—I do not think that No. 2 has been objected to, it being understood, of course, that any local provisions which can be shown to be useful, or necessary, would be retained.

Mr. Whitwell.

3555. We do not understand that you wish all the old Acts of Parliament to be repealed, do you?—They ought, I think, to be repealed, except those that can be proved not to be necessary. I speak of local Acts of Parliament, or provisions in the same, which refer to explosions.

3556. Take the Liverpool Act, for instance?—I would propose that, unless the Liverpool authorities could show that it was sufficient and satisfactory, it should be repealed. I may state that that Act of Parliament has no reference to anything but gunpowder; it comprehends no other explosive. If you repealed the Nitro-Glycerine Act, and left Liverpool simply with

Mr. Whitwell—continued.

the Gunpowder Act, it would be exposed to the perils of no legislation whatever with regard to nitro-glycerine. I will now, with the permission of the Committee, pass to Section 3. “A new Act to be framed to regulate the manufacture, keeping, selling, carrying, and importing of gunpowder, nitro-glycerine, gun-cotton, ammunition, fireworks, and other explosive substances, to be named in the Act.” Of course, if Suggestion No. 1 be accepted, with regard to repealing the existing Acts, this suggestion follows as a matter of course. The only question which has been raised on this point is whether the whole of the law relating to explosives should be embodied in one Act, or whether gunpowder should be treated to an Act by itself. That, apparently, is the view of the gunpowder makers at present. But that does not appear to have been the view entertained by the trade in 1865, because one suggestion which was then made to the Home Office, when a Bill was in contemplation, was that the word “gunpowder” should include, or should be used in substitution for any other explosive compound. At present the trade desires that gunpowder should be treated separately. Of course this point rests very much on the view that the legislation relating to gunpowder should be of a totally different character from that relating to other explosives. Now, I stated, and freely admitted, that it is necessary there should be considerable differences of detail in the legislative treatment of gunpowder as compared with other explosives, just as there must be differences of detail in the legislative treatment of the various groups of explosives treated one by one, but I do not consider that any sufficient reason has been adduced why there should be any difference of principle in the treatment, and on those grounds I would respectively adhere to the suggestion that any new Act should comprehend other explosive substances as well as gunpowder. The fact is, that if the same principle is adopted throughout, there is no real necessity for separation. A further result would be practically to give us two Bills instead of one, each being, in a great degree, a repetition of the other; two Bills, that is to say, of about equal length. I do not see what practical advantage there would be in that. With regard to the classification of explosives, I have considered what has been stated in the course of the examination, and I have made some slight modifications in the classification which I originally proposed. I have done that in accordance with some of the suggestions which Mr. Bell made, and in accordance with Professor Abel’s suggestions. I will beg leave to hand in a paper giving that classification in detail (*see Appendix*). I may state here that, though in that classification percussion caps would be included, they would not be included for the purpose of storage, or anything of that kind, only with regard to manufacture and as to not being kept with articles to which they would be dangerous; and the same thing applies to safety fuzes. I think the Act of Parliament should bear very lightly on all things that are not explosible *en masse*. Then we come to No. 4: “Power to be given to Her Majesty in Council to extend the Act from  
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time to time, or any part or provision thereof, to any explosive not specifically named or defined in the same." That appears to me to be really the essence of any provision which is designed to be at once comprehensive, elastic, and enduring. If we have not power from time to time to bring new explosives under the operation of the Act of Parliament, we shall have perpetually to be suggesting that new Bills shall be passed.

Then we come to No. 5, "The manufacture of explosives, and the operations connected therewith to be carried on only under a 'common' or 'special' license, to be obtained as hereafter described, except such operations as the filling of small-arm cartridges, the preparing of blasting cartridges, &c., which may be carried on without a license, but under certain precaution to secure safety." Now, I do not think the principle of dividing licenses into common and special licenses has been objected to, and with regard to the carrying on of the filling of sporting and blasting cartridges without a license, but under statutory restrictions, that course appears to have been generally approved; indeed, in the case of some of the blasting cartridges, at present so much more used in mines, it seems absolutely necessary that there should be this power; and with regard to sporting cartridges, we see, from the evidence of gunmakers, that they have taken the matter into their own hands, and made them without a license; the effect would be not to create the trade, or even to increase it, but simply to divert it from an illegal, into a legal channel, and to ensure it being brought under supervision, and carried on in safer places, and under better precautions. With regard to the practice in mining districts, which the suggestion about blasting cartridges is specially directed against, since I was last examined I have received a letter from one of the constables in one of the mining counties. I wrote to ask him what points he could speak to with regard to the practice, in the event of the Committee desiring further evidence on the point, and I think, perhaps, the extract which I will give from his letter will show the sort of evidence that he can give to the Committee; he says, "I can answer following questions: 1st. That miners generally store their powder (from a pound to a quarter cask) either in the pantry or under the bed in a down stairs room, where fires burn night and day, that they make up their charges generally sitting by the fire, and that children have access to it at any time, and often use it in play at nights; I know of no instance where the mine owners have a place for the charges to be made up, so as to prevent accidents in the dwellings of the miners; 2nd. That nearly all grocers in mining districts keep blasting powder generally stored in a shed or out building at the back of their premises, or in their cellars, where they often keep other combustibles, such as paraffin, &c., and that very little caution is taken to prevent explosions; 3rd. That grocers in the towns send out their goods in carts or wagons to the pit villages generally at night time, and the cartmen generally make, and often use, naked lights to find out each person's goods, the powder generally being made up in brown paper packages and placed in a box, sometimes as far as 300 or 400 lbs. or more being conveyed in that manner, and matches, etc., being amongst the goods; 4th. I have often at night time by gas-light

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weighed out quantities of powder and left it packed in boxes, without lids (often), ready to send out the following day. The most effective remedy for this is in my opinion to compel mine owners to have a proper magazine, and a room to make the charges up in, and supply each miner as he is about to enter the mine with his charges in a zinc case at the same time as they receive their safety lamps. Dealers would not then be required to have any dangerous quantity on their premises, and the miners' dwellings would be also entirely free from the danger." This is from a gentleman whom I named before; he was then chief constable at Richmond, but he now belongs to the Durham police. I do not think I am prepared actually to require all the mine owners to provide a magazine, though that of course would be the most satisfactory way; but I think that the combined effect of the reduction of the quantity of the gunpowder to be kept by private individuals, the increased facilities for local inspections which I propose, the readiness with which a common license could be obtained at a very small fee, and the fact of the sliding scale and the abolition of some unnecessary and inconvenient limits would really be to get nearly all the mines to have magazines. Then with regard to the making up of blasting cartridges, I should like to explain what I propose with regard to that. There are a great many operations connected with preparing explosives for use in mines; there is the preparing in some cases of the straws for firing them; in some cases there may be the drying of the gun-cotton, and in other cases there are the blasting fuzes, and so on; I propose that all operations of that kind should be allowed to be done without a license by any person who has a special or common magazine license; but he is to provide a separate place for those operations as follows: if he deals with quantities not exceeding 30 lbs. of gunpowder at a time, then I would say that the building should be separated by not less than 20 yards from any protected work of class No. 1; 50 yards from any protected work of class No. 2; and a quarter of a mile from any protected work in class No. 3, which are public buildings. Then the distances for 50 lbs. of gunpowder should be 35 yards for class No. 1; 75 yards in class No. 2; and a quarter of a mile for class No. 3. For 100 lbs. of gunpowder, 50 yards for class No. 1; 100 yards for class No. 2; and a quarter of a mile for class No. 3. As to explosives other than gunpowder, I mean the nitro-glycerine or the chlorate class, I would recommend that the quantities for the same distances should be one half. Then a person having a license and also having a workshop, and carrying on this manufacture, should be required by Act of Parliament to take certain precautions, which should be defined, and that certainly would be a very great improvement on the present illegal and dangerous making up of blasting cartridges, and so on, in the miners' houses. I would observe, in passing, that if any person wished to make his charges up in another way than the manner here described, he might always take out a license so to do; but I believe that in the vast majority of cases their convenience would prove to be sufficiently considered in this arrangement. Then as regards the filling of small arms' cartridges, the three gunmakers who gave evidence expressed their approval of the only restrictions which I would propose to impose by statute

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on such operations, namely, first, that the work shall not be carried on in a public shop or workshop. Secondly, that the quantity of powder in the shop should be limited to 5 lbs., not in cartridges. Thirdly, that no exposed fire or artificial light (excepting a lamp of an approved safety pattern, which is to be had) should be admitted. Fourthly, that due precautions should be taken throughout the process. If any gunmaker required a variation of these conditions it would be always open to him to go for a special license. Now we come to Suggestion No. 6. "No person to keep any explosive above a certain limit to be defined by the Act, without a common or special license, to be obtained as hereafter described, except a carrier carrying in accordance with the Act, and not keeping the same beyond the time actually necessary for his business, and except an importer who has explosives in his possession in the vessel which imported the same, and who complies with the provisions of the Act." I do not think that this suggestion has been criticised, except Mr. Pigou, who said, that he was anxious that the word "carrier" should be very carefully defined, so as not to include the carrying by a manufacturer about his work in this designation. Of course there would be no difficulty about this; what I intended there was common carriers. It is perhaps worth while to say that some of the witnesses have criticised my suggestions as if they were the clauses of an Act of Parliament, and had been framed with all the accuracy of language which one would have a right to expect from an Act; but they were merely suggestions, and perhaps if they had been better understood in this sense, some of the criticism would not have been made.

Then No. 7. "No person to sell or deal in explosives, unless he holds a 'common' or 'special' license to manufacture, keep, or import such explosives." That does not appear to have been objected to. Then No. 8. "No chemical explosives to be imported without a special license, other explosives under common license." That, again, does not appear to have been objected to, but I wish to call attention to the fact, that the evidence before the Committee points to the necessity of making this distinction, that chemical explosives shall, under no circumstances, be permitted without a special license, because there are certain risks and certain qualities which can only be detected by careful supervision, and, in some cases, only by a chemical examination. It is really necessary that the importation of chemical explosives should be more strictly controlled and supervised than is necessary with gunpowder. An example of that came before me to-day. The Committee will recollect that Mr. Orlando Webb, on the last occasion on which the Committee sat, produced a cartridge which he said was a very good one, and which was made from nitro-glycerine, which had been for some time at one of his quarries. I asked Mr. Webb, after he had given his evidence, if he would let me have a cartridge to be examined; he did so, and I have got some part of it; it is certainly anything but satisfactory, as much so that there are nitrous fumes from it at a natural temperature (*producing a small bottle*); the Committee will see that this has reddened the piece of litmus paper which was in the bottle, showing that it is considerably acid; that shows the necessity for

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guarding against supposing that merely looking at a thing is sufficient; either that nitro-glycerine was not originally what it should have been, or else it has become other than what it should have been; at all events, without some arrangement of this kind one of the two gates by which dangerously defective explosives, such as impure or exuding dynamite, would be left in such a position that we should cease to have control over it. The things can only come in by manufacture or by importation; it is absolutely necessary to the public safety that there should be some check, a sentry, in fact, at each of these points; in fact, this is just one of the differences of detail which I spoke of, as being necessary with regard to nitro-glycerine explosives and chemical explosives as distinguished from gunpowder explosives.

Now, with regard to No. 9. "Licenses, whether 'common' or 'special,' to be personal as well as local." One of the witnesses, Mr. Pigou, expressed an opinion unfavourable to making licenses personal as well as local. At Question 1013, Mr. Pigou was asked, "Now, coming to Section 9, with reference to licenses, what have you to say to that?" and he replied, "I am unable to say why those licenses for factories should not be local only. (Q.) Instead of being personal? (A.) Yes." But I would repeat on this point what I said when I was first examined by the Committee, that it appears to me that in granting a license, the personal character and habits of the proposed licensee on matters which may fitly influence the licensing authorities. If a man is known to be a drunkard, for example, I do not think that he should be entrusted with the conduct of manufacturing operations which may involve the lives of large numbers of persons; and that is not fanciful; I have myself experience of a factory, not a gunpowder factory, where a man at the time of my visit was quite drunk, and quite unfit to carry on that business, and I believe he still has it, and I do not know that there is any power to put a stop to it. I think it is desirable that there should be some local knowledge of the sort of person to whom this license is granted. A gunpowder factory, for instance, may change hands, but I think it should not do so in the same way as if it were a factory for the manufacture of other goods. There is a factory which has changed hands three times within a comparatively short time, and on neither occasion was there any consideration whether the party had provided a proper manager or proper people to carry on the work. That is what I wish to guard against, by making the licenses personal as well as local. Then, Suggestion 10 is, "'Common' licenses to be obtained, as a matter of course, on application to the licensing authority unless the person or premises be disqualified." I think the principle of this suggestion appears to have been generally, or I may say universally, accepted by those witnesses who have been examined. It is a suggestion of very great importance, because it is necessarily correlative of the suggestions for procuring improved local supervision. The two must go hand in hand. The facility with which it is proposed such licenses should be obtainable, and the smallness of the fee, appear to me to remove all reasonable grounds of objection. I would venture to remind the Committee that in presenting this part of my scheme at first to their notice,

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notice, I urged as one of the reasons why it should be known who stored explosives was, that by that means the danger which arises to the firemen of being exposed to unknown risk would be removed, because under a system of license or registration of course the existence and whereabouts of those stores would be known, and if the gunpowder were in a fireproof safe this danger would disappear. I gave some instances of danger of that kind. But since then, namely, on the 9th of last month, a case occurred which exactly illustrates this. It occurred in Cardiff, and the chief constable of Cardiff has been good enough to write to me on the subject. In the middle of a fire, quite unexpectedly, 50 lbs. of powder exploded, and injured three men who were on a ladder on the adjoining roof. He says, "After this explosion we had to proceed with increased caution in sending our fire brigade on to the building, not knowing whether or what amount there might still be in the building." I may add here that in a paper which I handed in (*see Appendix*), out of 94 chief constables and superintendents of police, 50 distinctly and in terms recommend that dealers should be licensed; and several more make recommendations (as to special places of storage, &c.), which amounts to the same thing; while out of the 18 town clerks, whose replies are given, every one, it will be seen, recommends that dealers should be licensed.

3557. Would you now turn to Suggestion 11?—"In the case of manufacturers, common licenses to be granted only for the manufacture of fireworks on a small scale, in accordance with certain conditions as to quantities; in all other cases 'special' licenses to be taken out." Now an objection has been made to that, or, at least, to that part of it which refers to firework manufacturers on a small scale, obtaining common licenses, by Mr. Brock, mainly on the ground, as I understand his answer, that it would give an undue advantage to the small trades, and that it would lead them to store the material at odd times in the the house, instead of in the magazine. Now, with regard to the undue advantages, really the only advantage which the small trader would get would be, that he would enjoy certain facilities in obtaining his license, and it is desirable that all unnecessary restrictions should be removed. Within the last week I was concerned in a case where the magistrates applied to me to report on a man's application. The man had got a capital site for his factory-sheds, but that man has been seven months trying to obtain his license. Had the system of common licenses been in vogue, he could have obtained it at once on writing for it, on the payment of a small fee. Mr. Brock urged, that if a man had a sufficient number of sheds to carry on a considerable business, there would be a great temptation to store in his house, and not to use the magazines; and, to use his own words, when the inspector visited the premises the house would become the magazine; but surely this state of things would exist equally well under a special license, and as a common license would be more under local inspection, there would practically be less risk. Besides, I hope that increased facilities for local inspection would prevent him keeping an illegal store in his house.

3558. Now will you be kind enough to go to

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Suggestion No. 12?—Suggestion No. 12 is, "In the case of storage 'common' licenses to be of two sorts, (a) 'common retail' license to meet the case of the ordinary retailer, (b) 'common magazine' license, to meet the case of the mine-owner or person requiring to store more considerable quantities for industrial operations." Now with regard to the suggestion, there appears to have been some misunderstanding; I think that some of this misunderstanding would be removed if I were to adopt a different designation for the "common retail" license, calling it instead, a "common house" license, as contra-distinguished from the "common magazine" license; it would then perhaps be better understood, that the "common house" license is intended specially to apply to the case of dealers who have no detached premises, and who are compelled to store in or about their houses; if a dealer has detached premises, then he would be able to avail himself of a common magazine license, and to store increased quantities up to two tons. At present, a dealer cannot store more than 200 lbs. under any circumstances, without having to go before the magistrate for a special license, after complying with all the formalities of the Act, as to posting the notices on the church doors, and so on; farther than that, if he is within a mile of a borough, he cannot get such a license at all. All this, together with the fact that 200 lbs. of gunpowder may be kept without any reference to the conditions of storage, appear to me to be unsatisfactory, and based upon no intelligent principle. In many cases it is severely restrictive on the dealer, and I desire to relieve him as far as possible, and what I propose in effect is this; to say to the dealer, "You must have a license of some sort for the storage of your explosive, either common or special; the common license you will be able to get as a matter of right on payment of a small fee, and the onus will rest on you of complying with its conditions, and on the inspectors of seeing that you do so comply with them. If you have only a house to store it in you will take out a "common house" license, which will set forth the quantities which you may store under certain conditions. For example, if you will take the precaution of providing a fireproof safe for your gunpowder, you may keep a larger quantity than if you do not take that precaution. If you have a backyard, or a detached place of storage, you may keep a still further increased quantity. If again your premises are so far isolated that you can establish a small magazine, you may obtain a common magazine license and go up to a greater quantity still; and that quantity may, under such a license, be proportionally increased up to two tons, in accordance with the degree of isolation of your magazine." I do not want to make any break between the two licenses; one will shade off into the other; the sliding scale would be adjusted from 30 lbs. up to 4,000 lbs.

3559. I wish to ask you whether those two licenses would both be applicable to the sellers?—Yes, they would both be applicable to the seller and to the consumer. Of course the details as to the quantities to be kept loose, or inside or outside a house, or at different distances from a house, would admit of discussion. But what I wish to press on the attention of the Committee is, the adoption of some kind of principle

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of this kind, in preference to the principle of the hard and fast line which is at present in vogue

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3560. Will you kindly come next to Suggestion 13?—Suggestion 13 is, “The ‘common retail license’ (or rather as we now call it a “common house” license) to be on a sliding scale, and to authorise the storage by a retail dealer up to, say, 300 lbs. of gunpowder, or 1,500 lbs. if in cartridges, and proportionate amounts of fireworks, the scale being framed according to the conditions of storage.”

3561. Do you adhere to those figures?—From the observations which some of the gunpowder makers who were examined before this Committee made, I should be almost disposed to think that I have recommended a greater quantity of powder for cartridges than is really necessary. They say, they think that 1,500 lbs. is more than anybody would want, but perhaps they overlooked the fact that in some cases they would not be able to keep so much. Take the case of a man who had 100 lbs. of powder inside the house, loose powder; then he would only be able to keep 500 lbs. in cartridges, which is not more in many cases than the man would require; however, the principle I am concerned with, is that of giving to cartridges, which are much safer, preferential facilities for storage.

3562. Now, with regard to suggestion 14, have you anything to say?—“The common magazine license to be on a sliding scale, and to authorise the storage of larger quantities up to two tons of gunpowder, or one ton of gun-cotton or dynamite, or five times the amount of gunpowder in small-arm cartridges, or 10 tons of fireworks, the scale being framed according to the conditions of storage and the distance from protected places.” Of course the same observations which I have already made with regard to Nos. 12 and 13 apply to this suggestion. But I would add this further observation, which applies to all these three suggestions. It has been objected, I think, by one of the witnesses, Mr. Keighley, that the quantity of two tons, which I propose to adopt for common magazine licenses, would not meet the case of mine owners. Now, in consequence of that observation, I thought it desirable to ask Major Ford to be good enough to draw up a paper, which I have handed in (*see* Appendix), giving the result of the inspections of 190 mine magazines, inspected between September 1872 and March 1874, in all parts of the country, Cornwall, Cheshire (a good many in Cornwall), Cumberland, Derby, Glasgow, Edinburgh, Perth, and several other places; so that those magazines may be fairly considered as representative of the requirements of the mining trade. Out of 190, there were only two where over two tons were stored, and only 15 where over one ton of gunpowder was stored. Out of 190, 102 had less than a quarter of a ton of gunpowder at the time of inspection on the premises. I believe that the quantity that is fixed here of two tons will meet the requirements of the majority of cases; but if a man is not satisfied with his two tons in one magazine, he can always take another magazine; at present he cannot. The Act says that a mine owner may only have two tons of gunpowder for the use of a mill, quarry, or magazine. I would propose to let him, for

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each magazine that is in a safe place, according to the Act, multiply this quantity as much as he pleases; that would, of course, be a very great relief to persons who require it. Certainly, it would be a great relief to persons desiring to sell it. There are cases, like Lord Penrhyn’s quarries, and Mr. Asheton Smith’s quarries at Llanberis, where very large quantities are required. I believe that as much as 20 tons of gunpowder are required in those cases; those are clearly cases for special licenses. I would particularly invite attention to the fact that the scheme for common licenses must always be read in connection with the scheme for special licenses; the special license is, in fact, the safety valve in cases where people cannot work to a common license.

3563. Now, with regard to Suggestion 15, what have you to remark?—Section 15 is: “Special licenses may be obtained for storage of either larger quantities than are allowed by common licenses, or for similar quantities under special conditions; no distances or quantities to be fixed by statute for special licenses, but to be in each case fixed by the license, and with reference to the local circumstances of the case.” I think, with regard to this point, that the remarks which I have already made will show why I think there should be no quantities assigned in the case of special licenses. These are to meet all those indefinite exceptional cases which are not covered by common licenses, and it is desirable, therefore, that there should be nothing laid down by statute in those cases as to the quantities or distances. One witness, Mr. Eley, appeared to think that even for special licenses it would be desirable that some limit of quantity, or some distances should be fixed; he said that the advantage would be, that in the case of a man wishing to manufacture he would know before he purchased any ground whether he would be likely to obtain his license. But, independently of the impossibility of assigning any satisfactory limits to meet all cases, it is obvious that he would not be sure of obtaining his license at all; though his distance may be all right, there are a great many other things besides the distance; for instance, the magistrates might think that certain conditions should be added in his factory, or they might consider that the area of the ground was not sufficient to carry all the buildings. In that case, although his distance might be all right, the license might be refused; so that I do not think that the manufacturer would obtain any real advantage. A more sweeping objection to this part of the scheme is one which has been made by the gunpowder manufacturers, who appear to desire that the existing statutory limits of quantity (or something very like them) should be re-enacted, without apparently any dispensing power (although I am not clear on that point). Now this is an important matter; I do not think that any gunpowder maker has been able to give any reason for fixing a limit of quantity other than the reason that such limitation will tend to prevent communicated explosions. Mr. Curtis, in Question 855, declined to admit that this was the object of limiting mill charges, but he failed to assign any other reason; and indeed it must be obvious that if the limit has not been imposed on these grounds it has no reasonable foundation whatever for its existence; there can be no object except to prevent communicated explosions. Or take the quantities assigned

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assigned to the press-houses, and other places. Those quantities are enough to kill everybody in the house over and over again; it must be some one outside those buildings who is here taken into account, and I therefore contend that the limitation of the quantities has been assigned with reference to non-communication of explosion. I think that this is so in the case of mill charges, is tolerably clear from the wording of the Act of Parliament itself, which says that you may mill 60 lbs. of ordinary gunpowder, but that with stronger powder you may not mill more than 50 lbs. at a time; that can only mean that because the stronger powder is likely to have more effect at a greater distance, you must have less of it in a mill at a time. I contend that the real meaning of the limitation is to prevent communicated explosions, or indefinite extension of their effects. If that be so, it becomes entirely a question of local circumstances; that is to say, a communicated explosion which might be possible or probable on the flat, would cease to be probable under other conditions. There are works that I am acquainted with, where there are mills which stand in pairs, standing quite away from anything else. On the other hand, there are three mills in one building in one factory, and in many other cases there are six in a row, without any screen between them, and without even a drenching apparatus; but the Act of Parliament says, that all those mills must adopt the same limit as to the charges, and that appears unreasonable, looking at the grounds on which those limitations were, as I believe, adopted. Then the question comes, how can this be remedied. There are two ways in which it can be remedied: one would be by assigning statutory limits, and giving a dispensing power to the Secretary of State, or some one else; and the other way would be by assigning the limits in each case on its merits, and with reference to the local circumstances. The first plan, namely, assigning the statutory limit, was the plan with which I set out; that was the plan present to my mind in the interviews which I had with the gunpowder trade. I did honestly try to work out this plan, and see how far it was practicable, but I found in effect that it was one attended not only with the most unsatisfactory, but positively the most ridiculous, results. For example, it would be necessary to include in a Bill the details of quantities for every single building, not only in gunpowder factories but in factories for ammunition, fireworks, percussion caps, fog-signals, fuzes, blasting fuzes, blasting cartridges, detonators, and, of course, also in all the factories of every other sort of explosives,—Dynamite, gun-cotton, sawdust gunpowder, and, in fact, any number of known explosives. Then again, there are all the unknown explosives; and having got this immense and unprecedented quantity of detail into a Bill, you would have to give a dispensing power which would enable every one of those details to be swept away to-morrow. It did appear to me that it would be far more satisfactory, particularly looking at the additional fact that probably some very important details would be overlooked after all, to sweep the distances and quantities out of the scheme altogether, and to consider each case of a special license on its merits, and assign the distances and quantities in every instance with regard to the local circumstances. With regard to the existing factories, the proposition which I

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have made appears to me a very equitable one; I propose that the continuing certificate to be granted in all cases should assign as limits, in the first instance, the limits imposed by the present Act. Wherever limits exist by the present Act, I propose that those limits should be introduced into the continuing certificate; the effect would be, that existing manufacturers could, under no circumstances, be worse off; but they might be better off, because my scheme would give them the power in every case to show cause why the quantity should be increased. With regard to unlimited houses, there has been a considerable difference of opinion between the manufacturer and ourselves; but I think Mr. Curtis showed the other day by the Minute which he read, that we really and truly come very nearly to the same point. I find from my report of the conversations that we had, that we proposed the limit to be assigned for the present unlimited houses should be no fixed limit of quantity, but a limit to this effect; that the quantity should not exceed what was necessary for the supply and work, and for actual use. The committee of gunpowder manufacturers proposed that the wording should remain as it is, and that provision should be made for the inspector to inquire of the manufacturers with regard to the necessity for any greater quantity than he thought requisite, and if they disagreed, that a report should be made to the Secretary of State. Notice was in that case to be given to limit the quantity, with power of appeal, and if the appeal was given against the manufacturer he should be required to observe the quantity; that is, in effect, exactly what I have proposed now. I have proposed, that except in the case of a magazine of a factory, the limit should be the limit of what is necessary for the immediate supply and work of the house, with a right at any time to challenge that limit as imposed by any particular manufacturer. I do not propose that the Act of Parliament should fix a limit, or that the continuing certificate should do it; but that it should be clearly defined in the case of each factory by the manufacturer, and that the quantity should be fixed for each house; and if from any unforeseen circumstance the manager should deem it necessary to take temporarily any increased quantity, it should be open to him to do so, provided he did it on each occasion in writing, and any dispute would be settled by arbitration. Now, with regard to magazines in powder factories; there again, I think there is more agreement than at first sight appears between myself and the manufacturers, because I find among the recommendations which the trade made to the Home Office in the year 1865, when the matter was under consideration, this one: "The store magazines not to be interfered with, as they are considered sufficient to ensure perfect safety. The limitation of quantities must vary according to the circumstances of the factories; it is therefore suggested that the inspector appointed by the Home Office should have the power to define the quantities to be kept in an ordinary establishment, having due regard to the quantities required by the trade." I now propose something which I should have supposed would have been more satisfactory, namely, that the limitation shall be the capacity of each magazine at a given past date.

3564. Now will you go to Section 16?—Section 16 is: "Special licenses for manufacture, storage, and

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and importation to be granted by the local authorities, upon the report of an inspector in every case, and subject to such conditions as to area and description of licensed premises, quantities, distances, and precautions, as the inspector may recommend, and subject also to any bye-laws and rules made under the Act." There has been no special remark on this point, and I do not think that it has in any way been disapproved.

3565. Now take No. 17?—With regard to Suggestion 17, no question has, I think, been raised with reference to that paragraph directly. I was asked by one of the honourable Members of the Committee whether I intended the licensing authority in Scotland to be the quarter sessions or the sheriff; I said, either. To that I adhere, but I would add that I think this is a point which would be best decided by the Lord Advocate; probably the sheriff would be found the best licensing authority.

3566. Now will you take Section 18?—Section 18 is as follows: "An appeal to lie to the Home Secretary against the refusal of a special license, or the imposition of vexatious restrictions." This question of appeal is, as I pointed out before, a difficult one. There ought to be an appeal unquestionably, but that appeal should be to as independent a tribunal as possible, and at the same time, as it is an appeal on technical points, it ought not to be, in my opinion, to a mere court of law. Under the old Gunpowder Act of George II., the appeal was to the Court of Queen's Bench, which does not seem a satisfactory tribunal for this purpose. In 1860 the appeal was altered to the Secretary of State; and I would here remark, as to a question which was asked me on my last examination, as to whether there was any precedent for giving an appeal from such a court as the Court of Quarter Sessions to the Secretary of State, that such an appeal from the Court of Quarter Sessions was actually given in the Gunpowder Act of 1860; it is true that the licensing authority subsequently, in the Act of 1861, became the Petty Sessions, but that was for an entirely different reason; the principle is to be found in the Act of 1860.

3567. Now will you turn to Suggestion 19?—Suggestion 19 is: "Common licenses to be granted for a limited term to be fixed by licensing authority, and not exceeding five years, but without prejudice to grant of new license at end of that time." I do not think that that suggestion has been criticised. Of course the five years limit is entirely a question of detail; any other limit almost perhaps would answer the purpose; all I desire is that a common license should not be granted for an indefinite period; it would not involve any considerable outlay of capital, as the largest quantity of gunpowder for which a common license could be granted is two tons, and it need not be a very long one.

3568. Now, have you anything to say on Suggestion 20, with regard to special licenses?—Suggestion 20 is: "Special licenses to be granted either (1) for a limited term, to be fixed by licensing authority, and not exceeding 30 years; or (2) for such term as a surrounding danger-area, to be defined in the license, is kept free from houses, but without prejudice in either case to an application for an extension or renewal of the license." Here the objection has been made that the limit assigned of 30 years is too

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short. That, again, is purely a matter of detail I should be perfectly willing that the limit should be fixed at 40 years, or 50 years, or any other term which may be thought reasonable. Indeed, if thought desirable, no limit need be laid down by statute, but the magistrates should be required in every case to assign some limit; but at the same time, I think it might be to the advantage of the applicant that the Act of Parliament should indicate the sort of limit that was thought reasonable, or else they would be often tied down, very likely, to too short a term. Then, as regards the alternative mode of limiting the license, namely, by the period during which a danger-area might be kept free from houses. It does not seem to have been clearly understood that this was intended as an alternative limit; that is to say, that it should be open to an applicant to ask for, and for the authorities to grant, either a license limited by a certain duration of time, or limited by no duration of time, but by those circumstances upon which safety would depend. Thus, supposing a man erected his magazine within a sufficient danger-area belonging to himself, I would allow him to obtain an unlimited license as to time, the only limit being that if he let houses come on it, that license would cease to exist. It certainly appeared to me that it would be an advantage to the licensee to obtain a license where he has freehold, or other means of keeping the place free from buildings for an indefinite time. I wish to observe particularly that in both cases the license is to be granted without prejudice to its renewal, when, by lapse of time or by approach of houses, it becomes determined. My only object is to prevent a license being granted for all time, without reference to the possibility of an alteration of local circumstances, and that it should be done in the way that would be least inconvenient to the applicant. With regard to existing factories, I have already explained that, where they are not limited by the existing license, I would propose that the continuing certificates should be of permanent duration. This limitation would apply only to new factories.

3569. The next is Section 21, I think?—Section 21 is: "Powers of compulsory purchase of clearance rights for the purpose of maintaining the danger-area free from houses, to be given to special license, subject to the approval of the Secretary of State." I do not think that this suggestion has been objected to, except in so far as it appears to have been assumed by Mr. Pigon that what I propose is that any person who did not exercise this right, would be liable to be immediately encroached upon. It is important to clear that point up. In Question 1025, you will see that Mr. Pigon says: "We are not much troubled by builders at present, but if they knew we must buy them out, speculative builders would trouble us very much." I do not think that that would be so; because it would be entirely a voluntary act on the part of any licensee to acquire those powers, and put them into operation. There would be no compulsion on him whatever to exercise those powers. I thought it would be an advantage to them in cases where they obtained a license of unlimited duration, to have the power to ensure that that duration should practically be unlimited by acquiring those rights; but, of course, that can be very easily met with regard to existing rights, by not extending the power

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power of compulsory purchase to existing factories. I am now strongly inclined to say that as existing factories would obtain continuing certificates without any reference to surrounding circumstances, I see no advantage in giving them those powers, but to some new factories it might be of great advantage. I think also that it would be proper, with regard to these compulsory powers, that it should be within the discretion of the licensing authority to introduce a condition into the license, disabling the licensee from putting the powers of compulsory purchase into operation, if they thought it would be specially disadvantageous to the neighbourhood. I would, for example, not propose that every small firework maker should have powers of this kind.

3570. Have you anything to say with reference to Suggestion 22, "All premises licensed for the manufacture or storage by special license, to be passed by an inspector before use"?—That has not been objected to at all.

3571. Will you now proceed to Suggestion 23?—"The Secretary of State to have power to grant permission to a person having a special license for a factory or magazine, or for importation, to vary the conditions as to matters of technical and internal detail, but not as to extension of area of licensed premises, alteration of distance of buildings from any protected work, increase in the amount of explosive to be manufactured, or any substantial alteration in the nature of explosive to be manufactured, kept, or imported." The only objection which was made with regard to this suggestion was that it was not wide enough. Mr. Pigon, at Question 1026, appears to think that the Secretary of State should also have power to extend the area. Now, I think there is a clear principle involved in the distinction which I have drawn, the distinction being that the Secretary of State should have power in matters essentially technical, while the licensing authorities are the proper persons to determine the suitability of a given area. Where local interests are affected, I think the local authorities should be consulted, and all persons locally interested allowed to urge their objections, which would not be the case if it were open to the Secretary of State to extend the area. On the other hand, it is desirable that he should have the power of varying matters of technical and internal detail, which would not compromise the public safety or local interests. So I beg decidedly to adhere to this suggestion as it stands.

3572. As to Suggestion 24 have you any fresh remarks to make?—Section 24 is as follows: "The destruction of a magazine by explosion to determine the license, and a magazine existing under a common license and so destroyed, not to be again licensed except by special license." This has been strongly objected to, but I think on insufficient grounds; it has been urged that in some instances the effect would be that the licensee would frequently suffer for the negligence of his servants; on this I would observe that I believe a person is at present responsible for the acts or negligence of his servants, and is liable to suffer for it; therefore there is no new principle here. And further, it does appear to me that it is desirable that a servant having so responsible a charge as an important gunpowder magazine, affecting, it may be, the lives and

*Chairman—continued.*

property of a large number of people, should be very thoroughly looked after, and that, indeed, he should be a very careful, responsible man. Besides that, I do not propose that the licensee should be prevented from obtaining a new license; but I think, if the blowing up a magazine appears to result from very great carelessness on the part of the licensee, it is right that the onus ought to rest on the manufacturer of showing that it has not been his carelessness. If it is thought desirable to say that, instead of the license being determined, it shall be suspended, it would come very much to the same thing. All I desire is that the circumstances of the explosion should come under the notice of the licensing authority before the person is allowed to resume storage there. I would here recall, with regard to cases of magazines being blown up by some act on the part of people breaking into them, that it was said that it would be very hard to destroy the license if some one broke into the magazine; but I really think it would not be so at all, for the owner of a magazine is surely bound to protect his magazine against unlawful entry. I have had in many cases to call the attention of the magazine owner to the very insecure condition of the magazine, and in many cases my remonstrance has had no effect whatever. For example, in the case of a magazine containing a quantity of powder, and having only an ordinary slate roof, there is nothing to prevent a man from taking a slate off the roof, getting into the magazine, and taking home the powder, which he probably does at night, it may be, with a light; he may easily blow up the magazine, but the fault in a great degree rests in this case on the magazine owner, especially if his attention has been previously called by the inspector to the insecurity of the magazine. There was one magazine I know well where I have represented the state of the case, yet nothing has been done, and the same state of things continue. The Dolcoath magazine was cited as a case in point. That magazine consisted of a number of lockers under an open roof, without any door or walls, and to which children and others had free access, and where the gunpowder was frequently lying about in little heaps. Surely in that case there was great carelessness on the part of the owner of the magazine. However, I am quite willing, if the Committee think it desirable, that instead of an explosion determining the license, it shall be merely suspended; but in every case where a magazine is blown up, there ought to be an inquiry with regard to the fitness of the licensee to continue it, and this suggestion appears to me to go hand in hand with my suggestion to give existing magazines, many of which are in unsafe and improper positions, and some of which are at present of insecure construction, continuing certificates of unlimited duration.

3573. Now, will you come to Suggestion No. 25?—Suggestion 25 is with respect to the power to forbid re-erection of more than one building where two or more buildings are destroyed by explosion, except with the written consent of the Secretary of State, or under conditions as to mounds, &c., which he may impose. I do not know whether it is quite clearly understood that it is only to apply to cases where two or more buildings are destroyed by an explosion; in such cases it is, I think, clear that the onus should rest on

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the manufacturer of disproving undue proximity. For example, if it should appear that a building at a distance had been exploded by a projected piece of burning debris, that could not be properly regarded as establishing undue proximity; but where two buildings had been destroyed by the blast of one explosion (as in the case of the three magazines at Stowmarket), surely that would prove undue proximity; and then the question would arise, should the buildings be re-erected, or, if re-erected, should they be screened in some way? There is the case of a factory where two buildings blew up together a few years ago. I had been repeatedly hammering away at

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the proprietors to get them to alter the buildings, and at last they are going to do it, but that is only after three years of frequent remonstrance; and during those three years they have had another accident, only on this occasion there was very little powder in the building, and only one building blew up. I may here say that I think this suggestion with regard to non-erection should be considered together with the suggestion as to the granting of a continuing certificate of indefinite duration to all existing factories, however they may be circumstanced or situated; and some of them being, as we know, unsatisfactory in regard to the isolation of the buildings.

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Friday, 12th June 1874.

## MEMBERS PRESENT :

Mr. Dillwyn.  
Sir John C. D. Hay.  
Mr. Hick.  
Mr. Knowles.  
Mr. M'Lagan.  
Colonel North.

Mr. Edward Stanhope.  
Mr. Stevenson.  
Mr. Vivian.  
Mr. Whitelaw.  
Mr. Whitwell.

VICE ADMIRAL THE RIGHT HON. SIR J. C. D. HAY, BART., C.B., IN THE CHAIR.

Major VIVIAN DERING MAJENDIE, R.A., again re-called; and further Examined.

*Chairman.*

3574. ON the last occasion of our meeting you were making some remarks on the summary of suggestions, and we had arrived at Section 25, and were on the point of going to Section 26; have you any further remarks to make on Section 25 before you go on to the next point?—Yes. I referred, in my answer on Tuesday, to one example of the undue proximity of buildings where I thought this power of preventing re-erection in case of accident might be usefully exercised, but this is by no means a solitary case; for example, there is the case more than once referred to of three stoves, capable of containing between 20 and 30 tons, all close together, and within only 70 feet, in some cases, of other buildings, and within 70 or 80 yards of other buildings. That is a case of undue proximity, and if an accident occurred it would be most improper, I think, that these stoves should be re-erected. I may notice in passing, with regard to the stoves, a question that was put to Mr. Curtis, who appeared to think that this was not objectionable, because he said that a steam stove is generally considered a very safe building, but I may state that there have been two explosions of steam stoves, and also that there are sources of danger in stoves quite independently of the steaming process, which are not always eliminated. For example, in one of the best conducted powder factories in the kingdom I found a quantity of oiled cotton waste in a stove, and the proneness of that to spontaneous ignition, at even a moderate temperature, is well known, and I consider that that was very risky. The ground on which it is said the stoves are not themselves dangerous is because not much handling of powder goes on there, but, as a matter of fact, there is very considerable handling of the powder in a stove; as distinguished from the mere making of powder, there is, perhaps, more handling in the stove than in any other building. There are six distinct operations of handling going on there. If Mr. Curtis is right, that the less we handle powder the less is the risk, it follows that a stove is very much the reverse of a safe building. There

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are other instances of stoves in close proximity to each other. In one case they are only four yards apart, and in another case they are only 44 yards from the glazing house. In another, they are only 33 yards from the glazing house. There was another case, which Mr. Curtis admitted was objectionable, where the stove and the glazing house were almost contiguous, the stove being made of wood. There are other instances of buildings being unduly near one another; and there is one factory where I may say nearly the whole of the buildings are in very unpleasant proximity to one another; now, what I ask for under this suggestion is, that when those buildings prove by blowing each other up that they are unduly near, the matter at all events should be considered before re-erection. I think I must add, that an exception might be made in the case of the explosion of one incorporating mill by another; that is a fair exception.

3575. Which is the next section on which you wish to make any observations to the Committee?—Section 27. "All explosives carried to be duly labelled and declared, and no explosives (except small quantities for sportsmen) to be carried in public vehicles, omnibuses, &c., or as cargo in passenger ships (except by permission of Board of Trade)." I do not think that this has been much commented upon. There was a suggestion that persons should be allowed to carry 50 lbs. of dynamite in an omnibus, but I do not think that that is a suggestion to which the Committee will attach very much importance. At all events it is desirable for the public that that portion of the suggestion which applies to the labelling and declaring should be enforced by heavy penalties. The evidence with regard to sending large quantities of dynamite as slate, in Wales, and the carrying of nitro-glycerine, as much as 10 lbs. in a passenger carriage, is exceedingly unpleasant, and discloses a very unsafe and unsatisfactory state of things.

3576. Now Suggestion 28, what have you to say upon that?—"Harbour authorities to have power to make bye-laws, as in present Liverpool

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Gunpowder Act, to regulate the navigation and place of mooring of ships, safe stowing and safe keeping of explosives on board, regulating the kind of ship, barge, &c., licensing the same, fixing the place, time, and mode of shipping explosives, the precautions to be taken, and so on." This suggestion, I would repeat, is merely an application of the broad principle already embodied in the Liverpool Act, and with regard to that I may mention the gunpowder trade in the year 1865 did recommend that there should be a power to appoint proper places to ship explosives. Their recommendation was "That certain places should be defined in the river where it might be safe or unsafe to ship gunpowder." I am anxious that there should be some power generally vested in the local authorities to enable them to control this trade within their respective jurisdictions. In some cases those powers are quite inadequate. Since I was examined before I have taken the opportunity of obtaining some further information with regard to the shipment of explosives in the Thames, which I could lay before the Committee, and the harbour master of Gravesend can speak, if required, to the urgent necessity of having further powers there.

3577. Will you be kind enough now to come to Suggestion 29?—"Railway and canal companies to have power to frame bye-laws for regulating the carriage of explosives over their rail or canal, the place and time and mode of leading, amount to be carried, and so on." This suggestion does not give the railway companies any extra power, but it would tend to ensure the making of proper bye-laws. There has been some anxiety expressed that railways should not be limited to any specific quantities in any one train; I have not made any recommendation to this effect. There was a recommendation of that kind in my original report, but I saw reason to modify my views. That recommendation was pressed upon me by the railway companies themselves, and at the meeting which I had with the Clearing House Committee on the 11th of March 1872 the sub-committee suggested "that not more than 10 tons in two trucks be conveyed in any train, one truck to be at about the centre, and the other truck towards the end of the train;" but I think it would not be desirable that that should be generally adopted. There might, no doubt, be some cases where it would be desirable to limit the quantities, but in many cases I can conceive that, with properly guarded arrangements, or by making a gunpowder train a special train, it might be safer to have larger quantities under proper and specified precautions. At present it seems to be the practice to despatch powder in ordinary goods trains without any special precautions or any restrictions with regard to the quantity, and that appears to me decidedly unsatisfactory.

3578. The next is Suggestion 30, is it not?—"All bye-laws made as above to be confirmed by the Secretary of State (or Board of Trade), and the Secretary of State (or Board of Trade) to have power to enforce the making of bye-laws, or where not made to make them, in any place where it may be deemed necessary." That principle is merely embodying for general purposes the principle that has been adopted in the Liverpool Magazine Act, 14 & 15 Vict. c. 67; but I do not think it has been well understood that that is not a new principle, but only the expansion

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of an old one. The next is Section 31: "Harbour and conservancy authorities to have power to provide ships and barges for the carriage of explosives, and to provide magazines (to be licensed by special license in usual way) for safe deposit of explosives; urban sanitary authorities to have the latter power." I have nothing to say about that. Then the next is 32: "'General rules' for the manufacture, storage, packing, and carriage of explosives to be laid down, either by Statute or by Order in Council, subject to veto in Parliament, and to be observed by persons manufacturing, storing, and carrying explosives; these rules to be variable only by Order in Council, subject to the like veto." I think this section, taken in connection with 33 and 34, which refer to the making of special rules, and the confirmation of special rules by the Secretary of State, has been misunderstood; I really believe that substantially there is an agreement between the trade and myself on that point. What I propose is this: only to lay down by Statute, or by an Order in Council, those rules which would be generally and universally applicable; those would be the general rules; and then the special rules would be framed by particular manufacturers, and they might be submitted for approval to supplement the general rules in particular factories. And here again I may state that this is so far agreed to by the trade that what they formerly said was, "Manufacturers to make rules for the safe working of factories, to be approved by the Home Secretary, and enforced by the manufacturers;" there is, therefore, I conceive, no substantial disagreement on that point. That disposes of Sections 33 and 34. Now the next is Section 35: "Fit persons to be appointed inspectors under the Act by the Secretary of State." Some of the witnesses were naturally anxious on this point; that is to say, with regard to the construction which may be put on the words "fit persons." I can only say that if any words can be introduced which will have the effect of rendering the appointment of unfit inspectors impossible, it would be so much the better; but I do not see what words can be laid down, or in what respect the Secretary of State's authority can be fettered, otherwise than it is fettered, by the use of the words "fit persons," and otherwise than it is fettered in the Mines Act, the Factory Act, and other Acts of Parliament under which he has the power of appointing inspectors. That part of the scheme which provides for reference to arbitration does in my opinion afford a very great safeguard against an inefficient or capricious inspector, or at all events against his continuance in office; for if he was often upset on arbitration the Secretary of State would probably consider that he was not a very eligible person for the post. It has been assumed that this scheme, if carried out, would entail a very large additional number of inspectors being appointed; now, I do not believe it would have that effect at all, because a good deal of the work which is now done by them, if done at all, would, as I propose, be done by the mines inspectors, the inspection of magazines connected with mines; there would be no difficulty whatever in instructing the mines inspectors, so far as might be necessary for the inspection of those magazines; that would relieve us of an enormous amount of work, and it would relieve us of an enormous amount of travelling,

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velling, and leave us substantially merely with the special places to deal with. Further, I may say that the inspection of a magazine is not a thing that has to be very frequently repeated; if it is once properly constructed, and put on a proper footing, it goes on by itself almost; particularly if you get, in the first instance, a good system established; there is very little necessity for frequent inspection. As to Suggestion 36, I have nothing to say with regard to that.

3579. Have you any remarks to make with reference to Section 37?—Sections 37, 38, and 39 are the sections to which the strongest objection has been taken by the trade; they constitute in fact the inspection clauses, and the two last of those have been very strongly opposed by the manufacturers, especially the gunpowder manufacturers; and as those clauses do ask for certain additional powers, I have thought it right to set before the Committee further evidence to show that some increased powers of this kind are absolutely necessary. I do not understand that there is any objection to inspection *per se*; on the contrary, several manufacturers have borne what I must call generous testimony to the value of inspection; but they do object to the inspectors having the power to require a thing to be remedied, or to have it referred to arbitration, and they most especially object to the power of requiring a thing to be remedied forthwith. Now, with regard to these increased powers, the objections of the trade are these, namely, that any such powers are unnecessary because the inspector's suggestions would be attended to in almost all cases, and that they have in fact so attended to them. The second objection is that such a power might be exercised to the grave disadvantage of the manufacturer, who would be placed almost at the mercy of a capricious or incompetent inspector. Now the argument that this power is unnecessary, because the suggestions will always be attended to, really forms the foundation of the objections which have been made on this head. I have, therefore, thought it desirable to lay before the Committee that table which is given in Appendix 13, in which I set forth certain instances of non-compliance with my recommendations. I believe it is not necessary for me to go into the question of mine and store magazines, because I understand it is practically conceded that some such powers may be necessary there; but in order that there may not be any doubt about this, I would ask the attention of the Committee to a table which is given in Appendix 7, in which I have set forth a quantity of elementary defects in store magazines visited in 1873-74. For example, it is an elementary defect when a man enters a store magazine without any magazine shoes, or where the magazine has exposed iron in the interior; I mean metal fittings of iron and not brass; or where there are no wood linings and no rules. It appears from that table that speaking of the magazines visited for the first time (and it must be recollected that those had all received printed recommendations on this point before the first visit), out of 51 so visited 33 had no magazine shoes, 38 had exposed iron, 23 had no wood lining, and 33 had no rules. On our second visit we found there was some improvement, but still out of 34 15 had no shoes, 22 had exposed iron, 15 had no wood lining, and 25 had no rules. On the third visit they had all magazine shoes, but two had exposed iron, one had no wood lining, and two had no

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rules. That shows, I think, that with regard to those magazines the absence of any power to enforce even those elementary precautions is to be regretted; in the case of mine magazines I can only say it is much worse. Then we come to the gunpowder factories themselves, and here I would refer the Committee to Appendix 13. With regard to that table in Appendix 13, I have prepared it by looking through my notes, and then setting down the various instances in which recommendations have not been complied with. In some cases no doubt they have been since complied with; in some cases they have not been so complied with, but in every instance there are set down the recommendation remained uncomplied with till one subsequent inspection at least, and sometimes for more than one. Now, you cannot make inspections so frequently as to insure these things being rectified promptly if they are to be left unaltered until even the next inspection after the recommendation is made; generally something like a year intervenes between my inspections of any given gunpowder factory. But the Committee will see from the first page that there were 89 cases in which the recommendations were found on re-inspection not to have been complied with. I cannot say how many have since complied with the recommendations. However, it will be better now to go into detail. An objection has been made to my giving those particulars by number instead of by names. I did that because I thought there was no necessity for mentioning the names of particular factories, but I have got the names. I believe they were handed in, or at all events they were handed to Mr. Curtis on the last occasion. I am quite prepared if the trade wish it, and if the Committee think it desirable, to hand in those names again. For the present I will continue to indicate those factories by the numbers only, unless the Committee wish otherwise.

3580. (To Mr. Curtis.) You gave your assent (on the last day on which you were examined), in answer to Question 3367, to the names being given of the gentlemen in the gunpowder trade who had neglected to attend to the recommendations of the inspectors; do you still adhere to the statement that you would rather have the names than the numbers given by Major Majendie?—I have spoken to one or two members of the trade, who have no objection to their names appearing against the charges brought against them.

3581. You prefer that the names should appear, do you?—Yes, I think it better that the names should appear.

3582. (To Major Majendie.) In the evidence which you are now about to give to the Committee, will you please give the names instead of the numbers of the manufacturers who have neglected to attend to your recommendations?—Before taking the factories *seriatim* I have two observations which I wish to make to the Committee; one is, that I find one mistake in my return, which appears at page 3, Appendix 13, low down, under Head B. I there state that I had recommended that a lightning conductor should be provided for an expense magazine in a factory, close to the road, and that it was not done in 1873; but I now recollect that it was done in 1873. The only other observation I should like to make is this: There appears to have been considerable misunderstanding with

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regard to this return, and what it is intended to prove. It does not by any means follow, and I am most anxious that the impression should not remain on the minds of the Committee, that because a definite factory has omitted to adopt some special recommendation, therefore the condition of that factory is necessarily generally unsatisfactory. Many of those factories on the contrary where recommendations have not been complied with are, taken as a whole, exceedingly satisfactory, and yet in some cases there are things which are very objectionable, and very big explosions may result from apparently very small causes. Take the case I have already cited, of cotton waste existing in a stove which was at a temperature of 130°. That is a most objectionable thing, but that factory generally is in a very satisfactory condition. And so I might say, with regard to a great number of them. But I will now take them *seriatim*. The first factory, No. 1, is the Roslyn Gunpowder Factory. Now, with regard to that factory, we commend generally the condition of that factory, but we complained in the year 1871 of the quantities in the packing room being largely in excess of what was necessary. We found the same thing on the 13th of October 1873. Then as to the non-exclusion of grit we carefully explained in our letter of 1871 the necessity for adopting a different mode of using the magazine shoes and for keeping out grit; but the same difficulty was found in 1873, and we again called attention to it; then with regard to exposed iron work, that is a point which we had insisted upon in the printed suggestions issued in 1872, and we found it uncorrected in 1873; then with regard to providing clothes without pockets in them, that was recommended in the suggestions; it is also a point on which I may say the trade themselves are quite agreed generally with reference to the working clothes; but in the packing room, in 1873, we found that the women had pockets in their clothes; then the general condition of the packing room was remarked upon by us on the first occasion, and yet it was found to be thoroughly unsatisfactory in 1873; now, I will turn to our letter, "There are, however, one or two points (this is the first letter of 1871) which though not defined by any legal enactment appear to us to be worthy of notice as requiring amendment, and we therefore do not hesitate to call your attention to them, believing that you will be glad to be informed of them; in the first place, the distinction between the clean floors of the gunpowder houses, and the gritty or dirty floors of the porches or entrances did not seem to us to be as clearly and sharply marked as it should be; it is true that all who enter the powder houses wear magazine shoes, or at least, shoes or boots into the construction of which no iron enters; but we observed that in some instances men stepped outside the buildings in their magazine shoes, or on to the parts of the floor or porch which are not kept clear from grit or dirt; the consequence of this is that the floors of the powder buildings cannot be absolutely free from grit of some description; now, the object of magazine shoes is clearly twofold, 1st, to guard against the risk of any iron coming in contact with the floor, and 2nd, to guard against the admission of any particles whatever of a gritty, gravelly, or dirty nature; it is certain that severe friction against any particle of a very hard substance may generate heat

Chairman—continued.

enough to ignite powder, even though (as in the case of iron) no actual spark is produced; we are therefore strongly of opinion, 1st, that you should adopt some fixed and rigid boundary in every house in which powder or its ingredients are either stored or handled between the clean floor inside and the dirty floor or ground outside; and 2nd, that the magazine shoes used in each house should never be allowed to be taken outside this boundary except for repair, and that no person whatever should be allowed to enter until he has put on the shoes kept within this boundary. This arrangement can be best carried out by means of footboards stretched across each doorway, outside which should be a mat on which to deposit the ordinary walking boots of those who enter, and inside which should be kept the magazine shoes, without which no one should be allowed to enter." This point, on which we had thus so strongly insisted (and it really is an elementary point in a gunpowder factory), we had occasion to call attention to when I revisited the factory. We found on a second visit to the factory several violations of the provisions of the Act, and I obtained the sanction of the Home Secretary to take no proceedings in this case, provided they would give an undertaking not to repeat those violations, and that they would also carry out certain points which otherwise we might not have been able to enforce. Among those points was the one, "Regulations as to clean floors to be strictly observed." Another point was to forbid the women employed in the packing room to wear pockets, that having been one of the rules which were included in the printed suggestions issued in the year 1872. I come now to No. 2 factory. This is one of Messrs. Curtis's factories on the Clyde. I have already corrected the error with regard to the lightning conductor on the expense magazine of that factory. Now here I would say that that is a factory where there has been great readiness, as there has been with regard to Messrs. Curtis's factories generally, to adopt suggestions, but we are here and elsewhere at variance on certain points, and I think that in some cases I shall be able to show that the points are of importance. Now what I ask for is not that there should be power to force Messrs. Curtis to adopt any suggestions in certain things, but that there should be power to have points of difference referred to an independent arbitrator, and that Messrs. Curtis should not be the arbiters themselves on points on which we are at variance. Now I will take this No. 2 factory. One of the suggestions which has not been adopted here is an important one I think. It is a factory that I have always had occasion to commend generally for its condition. But there appeared to me to be one or two points which called for notice. The first is the position of the store magazine. "Although," we say in our letter, "this magazine technically fulfils the provision of the Act with regard to the distance from powder buildings, it is, in our opinion, too near some of the other workshops and dwelling houses. For example, it is only about 83 yards from the saltpetre refinery, about 104 yards from the weighing houses, about 110 yards from the sulphur mill, about 60 yards from the foreman's house, and about 70 yards from some labourers' cottages beyond the walls. We are strongly of opinion that no efforts should

*Chairman*—continued.

should be spared to obtain another and more suitable site for the magazine. The second point on which we deem it our duty to remark is the absence of footboards at the doors of the houses, and the consequent absence of any clearly defined boundary between the clear floor inside and the gritty sill of the door or porch. Without footboards it is almost impossible that the full object of magazine shoes, the scrupulous exclusion of grit, can be satisfied, and it was clear to us that this object was not invariably fulfilled in your factory." Now, I may state as a fact that the magazine still stands where it did. I believe that Messrs. Curtis are alive to the fact that it is in an unsatisfactory position, but as yet the magazine has not been removed. Then with regard to the shoes, I inspected this factory again in 1872, and I find this passage in a letter of that year, "I do not observe that any improvement has been effected upon a point about which Captain Smith and I made some observations on the occasion of our last visit, namely, the proper use of magazine shoes. Shoes are worn, it is true, but they are not so worn as to fulfil the important object of excluding grit. The footboards, which Captain Smith and I recommended in our Report of 5th October 1871 (and which, if I am not mistaken, are in use in your other factories), have not been adopted at Glenlean, and the consequence is that there is no clear definition or boundary between the clean floor and the gritty exterior; indeed, the men in some cases appear to change their boots on the 'clean' floor; thus grit is unavoidably introduced into the working buildings." That is a factory which I say is generally in a very satisfactory condition, but this point did remain unaltered, at any rate for a whole year. Then, again, take this passage: "I was struck with the exposed situation of your stores in relation to your glazing house; the distance between them is only 44 yards, and there is no natural or artificial screen or partition between them. I cannot but regard this as a case of undue proximity, for it is very unlikely that an explosion could occur in either of these buildings without extending to the others. I think that some sort of screen or traverse ought to be erected between the glazing house and the stores; and it would be desirable at the same time slightly to raise the bank below the glazing house, so as more effectually to screen it from the powder buildings which lie immediately below it." I found, on inspecting this factory again last year, that that had not been done. I do not say absolutely that it is necessary it should be done, but I believe it is. Messrs. Curtis have had great experience, and they have differed with me on this point, but this is exactly one of those matters which I should like to see referred to arbitration. Now we come to No. 3 Factory, that is Kames; that is the factory which was stated the other day by Mr. Curtis to have adopted all my suggestions except one, which they wished to talk over; I can only say that they certainly had not adopted them last year, when I inspected them for the third time, and I have not received any acknowledgment of a letter which I wrote to them on the 9th of September 1873, which contained 10 suggestions. I should like to read extracts from three letters which I have addressed to them. Here is a factory again which is generally in a good condition; but these are, in my opinion, points which call for rectification: "We could

*Chairman*—continued.

not fail to be strongly impressed with the objectionable position and construction of the stoves, one of them being contiguous to some work houses, and close to others, while the second was merely a wooden building, close to an engine and boiler house." Now we will follow that point up; this is the next inspection: "The position of one of your stoves is still open to the objection which Captain Smith and I made to it on the occasion of our last visit, namely, that 'it is contiguous to some work houses and close to others.' The house to which the stove is contiguous, or from which, at least, it is separated only by two walls, is a glazing house; and this proximity of two important powder buildings is open, in my opinion, to the very gravest objection." Then we come to the last inspection, which took place in the year 1873; I found that several suggestions had been adopted; I only enumerate those that had not been adopted. The general condition of the factory was satisfactory; but among those suggestions which had not been adopted was the increasing of the distance between the stoves and the glazing houses. I do not know whether that has been altered since 1873; but this letter, which contains eight suggestions, in addition to three repeated once before, has not yet been acknowledged; if they have since altered those things I am very glad to hear it, but it is the first I have heard of it.

3583. As it might be troublesome to you to go through all these cases in full, perhaps you could give the Committee a specimen case or two of actual infractions of the existing law, and a specimen case or two of those cases in which the inspectors and the manufacturers differed as to whether there was any necessity for the inspector's recommendation?—With regard to infractions of the law, the best thing I can do is to say that we have proceeded against nine gunpowder factories, or at least that there have been nine cases in all, because some have been proceeded against twice over. There have been nine prosecutions, and some of the factories have been prosecuted for more than one offence. I think I am right in saying that in every instance we have obtained convictions. We proceeded against Black Beck in the year 1871, for working excessive charges, and we proceeded against the same factory again in 1872 for working excessive charges, and we obtained convictions in both instances. We proceeded against Loch Fyne in the year 1872, I think for three offences, and they pleaded guilty. We proceeded against the Melford factory in the same year for three offences, and they pleaded guilty.

3584. Were those prosecutions for excessive charges?—Some of the cases were for excessive charges, and some for excessive quantities, in the limited houses, and some for other things.

*Mr. Whitwell.*

3585. Is the Melford Company discontinued?—Yes, the Melford Company has been discontinued. As to that company I may here state, that on inspecting it again last year I again found certain offences committed against the Act on that occasion, and I obtained permission of the Home Secretary to call upon them to make certain alterations, and to suspend the prosecution on condition of certain changes being made, and the alterations were carried out as far as practicable

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Majendie,  
R.A.  
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Major  
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practicable. We proceeded against the East Cornwall Powder Company in the year 1872. That is a company which I should say, when we first visited the factory, was in a most unsatisfactory condition. But it is fair also to say that I know of no factory where so much has been done, and so many things carried out, in compliance with our suggestions. In fact, at my last inspection, I do not think I found one single thing which they had not adopted. In regard to the prosecution of this company, I should state that there were five charges, and we obtained convictions on four of them. They appealed to the Court of Queen's Bench on the fifth, and obtained a reversal of our decision with regard to a lightning conductor on a magazine, as to whether the powder should be forfeited. The prosecution was on the 15th March 1872, and they appealed in the same year. The case was not argued on the part of the Crown, owing to an oversight. The Plymouth and Dartmoor Gunpowder Factory is a remarkable case; it is referred to in the last paragraph of the Appendix which is now under the Committee's consideration. This factory is No. 20, in Appendix 13, clause 5. The factory was reported to be in a very unsatisfactory state in the year 1871, and proceedings were taken against them for three offences, I believe. They were convicted, and we consented to mitigate the penalties on condition of their carrying out a number of alterations in the factories, which were set forth and agreed to. Most of them were alterations of an elementary description. The factory was inspected again in the year 1873, and considerable improvements were found to be effected, but still we found it necessary to call their attention to the fact that they had, up to that time, not complied with the whole of the engagements which they had made, and they promised it should have their prompt attention. On visiting that factory again in October last year I found the Gunpowder Act violated again in some particulars. That did not so much surprise me. But I certainly was surprised to find that out of 14 of the conditions which had been imposed on the factory seven had not been complied with, some of those seven being of the most elementary description. Perhaps I might be allowed to read them as an illustration. "The alterations which were included in your original undertaking, and have not yet been complied with, are as follows: (a) The condition 11 of the undertaking was as follows, 'exposed iron work (as in standards of press) to be covered with canvas or leather.' This important condition" I call that an important condition, because it is one that is generally adopted in the trade. If the Committee have seen any well-conducted factory, I am sure that they have found that condition strictly observed—" This important condition has not been complied with. (1.) The standards of the press are not covered in any way; the head of the press is in a state of rust and dirt, such as I have never before witnessed in a gunpowder factory. I think you can be hardly aware of the dangerous condition of your press, which is thickly coated with large scales of oxide of iron, which peels off at the slightest touch, and, falling on to the ground, constitutes a peculiarly dangerous description of grit, which is liable to become mixed with the semi-manufactured powder. I believe it would not have been difficult to have peeled

Mr Whitwell—continued.

off some pounds weight of this oxide." In case any question should arise on this point I have brought up with me a sample of some of the stuff, of which, I believe, I could have picked pounds weight from the press. I am sure that any gunpowder maker who is here would say that is a thoroughly unsatisfactory state of things (*handing in the sample*).

3586. What was the offence for which they were prosecuted?—One of them was an offence which was repeated on the second occasion, and that was having an excess of powder in the press house; I do not recollect the other; I will now proceed with the letter: "2nd, The hoops of the glazers also are of iron uncovered; 3rd, The nails and screws of the sifting machine are of exposed iron; 4th, The metal work of the barrows used for conveying the powder and charges are of exposed iron; (b) condition 7 says, 'Iron and steel articles to be excluded from danger buildings;' your press plates are of tinned iron, and the tin having worn off many of them, they are practically iron plates, and the edges very brittle and rotten (*handing in a sample*); I found no difficulty in breaking off small pieces, such as would have constituted serious danger if they had found their way into the powder; the weights in the mixing house are of iron; (c) condition 6 says, "People to wear clothes without pockets;" I found a man in the corning house and one in the sifting house with pockets in their clothes; (d) condition 8 says, "Houses to be lined to at least 8 feet." This has not been done in (1) The sifting house; (2) The hand sifting house; (3) The store magazine; (4) The packing house, all of which buildings are still unlined; (e) condition 2 says, "The buildings to be kept clean, not merely from unnecessary accumulations of powder dust and powder incrustation, but from grit;" this is not strictly or literally attended to. The buildings were certainly cleaner than when I first inspected the factory, but there is still room for improvement in this respect, and I called the attention of your manager particularly to the state of some of the mill floors, and some of the shelves of the charge house, while as regards the exclusion of grit, there is no clear line of demarcation between the mixing house floor, which should be "clean," and the saltpetre store, the floor of which is not kept clean; (f) condition 12 requires a "copper lightning conductor to be provided for the store magazine; this has not been done; (g) condition 13 requires the provision of 'copper or brass keys (instead of iron) for all the powder buildings; this condition has not been complied with in the case of the store magazine, and if I am not mistaken the keys of the mixing and charging houses are still iron. You will thus observe that out of 14 conditions contained in your undertaking 7 remain uncomplied with." Then I was unwilling to take public proceedings if it could be avoided, though I thought the case was a very bad one; I obtained the Home Secretary's permission to give them a certain period, viz., 2 months, within which to carry out those alterations. I wrote on the 8th January 1874 to remind them that the time would be up on the 10th January, and that we should then require to be informed if the suggestions had been complied with; I got no answer to that letter, and I wrote again on the 20th January, and I then received this letter,  
dated

Mr. Whitwell—continued.

dated the 23rd January: "I can assure you that everything has been done, and is still in course of progress towards completion as you directed, and it is impossible to do more, even at the risk of a Treasury prosecution. Possibly neither yourself nor the Secretary of State know all the difficulties in the way of carrying out alterations and improvements at a short notice" (now this had existed from 1872 to 1874) "on such a portion of Dartmoor as our works are situate; if so, I think it probable that a little more consideration would be shown than has fallen to the lot of the Plymouth and Dartmoor Gunpowder Company." Upon that I wrote this reply, dated the 27th January 1874: "I have the honour to acknowledge the receipt of your letter of 23rd January 1874, in which you inform me that in consequence of the difficulty of getting workmen and of the bad weather, the whole of the alterations which the Secretary of State required should be carried out within two months from the 10th November last have not yet been completed, but are now in progress. In reply, I beg to state that if you will name a reasonable time within which you will undertake that the whole shall be completed, I will lay your proposition before the Secretary of State, with a recommendation that the period of grace originally accorded may be extended as desired. I regret, and must at the same time express my surprise, that you should be under the impression that there has been any want of consideration on the part of this department towards your company. It appears to me that the circumstances of the case must have escaped your memory, and particularly the facts (1) that nearly the whole of the alterations which form the subject of the present correspondence were alterations which you formally undertook to carry out so far back as the 13th March 1872, in consideration of a mitigation of penalties to which the company had laid itself open. (2) That your attention was again called to some of these non-compliances with your undertaking on the 2nd January 1873. (3) That you promised on the 9th January 1873 that these matters should have your prompt attention. (4) That notwithstanding (a) the continued non-compliance with the terms of your undertaking, and (b) the repetition of the offence (of having an excess of powder in your press-house, which I found on the occasion of my last inspection, 20th October 1873), the Secretary of State consented to forego proceedings if, at the end of two months, you should have done what you had undertaken to do about 18 months before, and adopted certain precautions which prudent manufacturers are usually only too glad to adopt of their own accord." I obtained no reply to that letter, and on the 7th February I again wrote to them, and on the 26th February I again wrote to them. Ultimately, I think in March, the whole of the things were carried out. I mention that factory specially, because it will show to the Committee how much or how little chance we should have had if it had not been for the circumstance that they laid themselves open to these proceedings, of getting these things carried out. The manager of the factory, the last time I visited it, thanked me for what had been done, and he stated that he felt very much safer and more comfortable than he did before. I have one other factory which I should like to refer to, because reference was made to it by Mr. Curtis the other day. That is the Elterwater

Mr. Whitwell—continued.

factory, which is No. 7 on the list. The first extract which I will read, with regard to that factory, is an extract from a letter dated the 19th of August 1872, in which I made a report to the Home Secretary. "This report discloses a very unsatisfactory state of things; not merely is the law violated in some important particulars, but the general condition is bad, and no marked improvement is apparent in the management of the factory, nor have any suggestions which Captain Smith and I made on the occasion of our last visit been carried out. I should state that when we inspected the factory last year we found great fault with many of the arrangements, and spoke very strongly to the manager. But he gave us to understand that the points to which we took exception would be remedied; and we did not, therefore, think it necessary to recommend that any proceedings should be taken, hoping that our representations to the manager would have the desired effect. This expectation has not been realised, and, as it is necessary that the law should be enforced (as well as the general condition of the factory improved), I have the honour to recommend that proceedings be instituted for three of the violations of the Act named in Captain Smith's report." Proceedings were taken on this report, and I think I am right in saying there were convictions obtained on all points. No, I see there were five informations laid, and one was withdrawn, because the Court found that it had no jurisdiction, and one information was decided in the defendant's favour. There were two convictions, and one information contained a technical error and was withdrawn. Now I will proceed to read the letter which I wrote to the company on the 8th October 1872: "Captain Smith found in the old store magazine seven kegs containing breech-loading ammunition for Snider rifles. On the occasion of our joint visit last year we called your attention to a similar report of breech-loading cartridges, containing their own means of ignition, in the same building with powder. Such a practice is fraught with considerable danger on account of the liability of those cartridges to be exploded by concussion. I have had official cognizance of several instances of these cartridges exploding in this way; and the War Office rules strictly prohibit the depositing of such cartridges within 'the same masonry compartment' as powder. This rule is quoted in the Government magazine rules at page 19 of my printed suggestions (Rule 67). It is also embodied in the Auxiliary and Reserve Forces Circular, 28th May 1872, section 20, clause 13, and it has lately formed the subject of a special Order to volunteers, dated 3rd September 1872. (2.) Captain Smith reports that the floors of your powder buildings are not kept technically 'clean,' in the sense of being rigidly secured against grit and other foreign bodies which may be introduced by the foot. Last year we called your attention to this omission, and pointed out that it is not sufficient to enter the building in shoes without any iron in them, but that it is necessary for the safety of the buildings to prevent a boot, which may have contracted grit upon its sole, from touching the floor of the buildings. The mischief of introducing grit can be accomplished by a dog, or by a person running from building to building with bare feet; and we observed last year that you permitted a dog to accompany you into your powder buildings,

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and that you appeared to consider that the removal of the shoes is all that is necessary. I beg to call your serious attention to this point, in the hope that you will adopt the practice of the Government and the leading private powder factories in this matter, and fit a foot-board across each doorway over which no particle of grit should be permitted to pass. (3.) Your corning house, which is of stone, is unprovided with a wood lining." Now with regard to the corning-house, which is of stone, the manager of the factory afterwards asked me whether, considering the age of the building, I really thought it was prudent to fit in a wood lining. I referred the matter to an inspector of works of the Royal Engineers, and his opinion, in conjunction with an engineer officer of Waltham Abbey, was that perhaps under the circumstances there would be less danger in letting the building continue without a wood lining than in attempting to fit one; that was a case in which there was a reference to arbitration, and it shows, I think, that where an objection proves a valid one, there is no undue disposition on my part to press the suggestion. But now with regard to those shoes, that was my second inspection, and here is the report in 1873: "I found that no apparent improvement has been effected since the first inspection, which inspection the late Captain Smith and I made of your factory in 1871, in regard to the exclusion of grit from the powder buildings, and the observance of 'clean' floors. On the occasion of our first inspection we called your attention to this point; and again in a letter which I had the honour to address to you on 8th October 1872 (after Captain Smith's second inspection), I remarked strongly upon the neglect of this most important and generally recognised precaution. I regret to find that it is still the practice to permit the men to walk into and out of the powder buildings without removing their shoes or placing on overshoes, thus necessarily introducing grit into the buildings, and entirely violating a principle which is, I may say, almost universally accepted throughout the trade. I feel it my duty to remonstrate earnestly with you on this dangerous practice. It is one which may easily lead to a sad loss of life and property, and I beg to record my opinion that by allowing this practice to continue, an extra and very serious risk is unnecessarily introduced into the factory. The clean floor system should be at once enforced in all your powder buildings, including your 'black mill,' where the floor is at present not even nominally kept clean." Again, "It appears to be your practice to provide your workmen with pocketless jackets, but (with the exception of the millmen) to allow them to wear trousers with pockets. It is further the practice to allow the men to go home in their working clothes, while no system of search appears to be enforced to neutralise the danger which these practices necessarily entail. I venture to press upon your most serious consideration the importance of (a) forbidding any pockets to be worn in the clothes of the workmen; (b) requiring the men to change their clothes inside the factory; (c) making some foreman or other person responsible that these regulations are strictly and invariably complied with." It is perhaps hardly fair to stop here, because I might be conveying an impression that these factories, which certainly have given a great deal of trouble, are typical cases, but I do not give them as strictly representative of

Mr. *Whitwell*—continued.

the trade generally with reference to their present position or their resistance to the suggestions; but even in factories so well regulated as Mr. Curtis's and Messrs. Hall's, there have been, and so far as I know and believe there are at this moment, points which they will not consent to alter. Mr. Curtis the other day read to the Committee two memoranda which I had written with reference to two points, one was the reduction of the number of workmen in the packing-room, and the other was the limitation of the quantities in the dusting and glazing houses. I may be quite wrong on those points, but at all events I was so far impressed with the importance of them, that I thought it my duty to remonstrate in this formal manner with Messrs. Curtis, and what I should have done if I had had the power, which I desire to have, was to refer it to arbitration. At present there is no such power, and, so far as I know, things are still in the state in which they were when I first called attention to it; but of course you would not find in Messrs. Curtis's, or Messrs. Hall's, or Messrs. Wakefield's factories those dreadful things that I have brought before the notice of the Committee; yet even in those cases sometimes we are unable to have our own way, because there is no arbiter except the manufacturer himself. Now to pass from this point and to proceed with these three Clauses 37, 38, and 39, I do not think it necessary to say anything about factories other than gunpowder factories; it has not been disputed that in many cases they have not agreed to recommendations of the most elementary description; but I should like to give the Committee one example of the kind of way in which the suggestions have been disregarded. Here is a cap factory, and as the cap trade have not asked for names I will not give that of this cap factory. When I went into it in 1873 it was the third time I had inspected the factory, and this is the report which I made in 1873 to the Home Secretary: "The infringements of the Act have (with one exception to be presently noticed) been remedied; but the generally careless handling of the detonating compositions (which is not the subject of any legal enactment) remains. When I visited the factory about a year ago I took the trouble to call on the proprietor at his private house, and earnestly to direct his attention to certain details which appeared to me fraught with danger. I do not find on inspecting the factory to-day that my remonstrances have had the slightest effect. The fulminate and cap compositions are dried and mixed with a disregard of precautions which appears to me simply amazing. In other factories, at least in those factories where regard is had to the safety of the workpeople, careful attention is paid to the exclusion of iron, to the covering of the benches and floors with soft material, to the scrupulously cautious handling of the fulminate and composition; but at this factory the floor is naked brick, with no attempt to keep it clean, the women employed never change their shoes on going into the buildings to work, a rule ordering sawdust to be laid down is not attended to, the composition is mixed on small tables covered with oilcloth, and without any edge, so that there is a frequent falling of particles on to the brick floor, the fulminate is weighed out with iron scales and weights, on a wooden bench put together with iron nails, and the forewoman handled a mass of the fulminate and the cap composition



Mr. *Whitwell*—continued.

composition with a roughness and apparent ignorance of its dangerous sensitiveness which I could not have believed had I not seen it." I said as there was no power to interfere perhaps a recommendation made to the bench of magistrates would have some effect, but the Home Secretary said in reply that as I had no power to compel the observance of the precaution suggested in this case, and as the proprietors had been fully warned as to the danger of neglecting them, Mr. Bruce was of opinion that matters must be left as they were, until further powers were acquired by fresh legislation. So much with regard to the power which I have asked for, and which is a power which we find in the Mines Act, namely, the power to require a thing to be referred to arbitration, if objected to. But there is another power not in the Mines Act which I believe is the power which the trade most strongly object to. I do not know that they object quite so strongly as appears by some of the evidence which has been given to the reference to arbitration, but they do object that we should have the power to have a thing remedied forthwith. What they appear to mean is, that there is nothing to prevent the inspector assuming that everything is a case to be remedied forthwith, and that he might in that way exercise a most arbitrary and despotic power. Now that is a very good point, and a point that is worthy of a good deal of consideration. I would first state that, even as the suggestion appears here, I did propose only that I should have that power to interfere forthwith, under a very peculiar combination of circumstances; for example, first, the thing must be dangerous or defective; secondly, it must be unnecessarily so; thirdly, it must be dangerous to the personal safety of some one; fourthly, it must be the opinion of the inspector that it is an urgent case. Still it might be thought that under that power an inspector might interfere with the premises, or the machinery, or as to some practice common in the trade, and, therefore, I would propose to guard that power still further by saying that if the manufacturer could show that such was the usage of the trade, or that the practice was not contrary to the usage of the trade, then the order to remedy a thing forthwith should not hold good, and further, that the order should not in any case extend to premises or to machinery. That would limit it to the sort of practices which I desire to have the power of stopping at once, and of which I will give one instance. Two years ago, at an ammunition factory at Greenwich, I found them engaged in breaking up some chassepot cartridges. There were more than 30 women at work. They were employing pointed implements to pick them to pieces; if the implement had slipped into the cap there must have been an explosion, and probably several of the women must have been killed.

*Chairman.*

3587. Do you mean to say that they were using pointed metal instruments?—Yes, some were using knives, some were using pointed steel, and others were using pointed pieces of wood. In that particular case we had some sort of power of interference, because the maker had committed an illegal act, and acting, I believe, rather beyond my powers, I gave them an order to discontinue the use of those instruments.

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*Chairman*—continued.

3588. You mean that there was an act of illegality in another direction?—Yes, but this act was not in itself illegal at all. The owner of the factory wrote and said that he would accept my direction, and that he discontinued the implements. But somebody most improperly renewed the use of those instruments the following day or two days afterwards, and there was an explosion, which was proved to have occurred from their use. The manager was killed and five or six women were very badly injured. Now, if there had not been the original illegality, I should not have had the power even to speak to them about it. But I think I ought to have power in a case of that kind to say at once it shall not be done. It was clearly contrary to the usage of the trade; it did not refer to machinery or to premises, and there was urgent danger; I therefore recommend that this suggestion should be so far modified as to include words that where a case is dangerous and unnecessarily so; where it is likely to lead to some personal injury, and where it is urgent, and where it is contrary to the usage of the trade, the inspector should have the power to interfere forthwith, but that that power should in no case extend to the machinery or to the premises.

3589. Have you anything to lay before the Committee now with reference to Clause 40?—Only this, that it is not intended to give the searchers such power as is given to the inspectors; it is not proposed to give the searcher any power of going outside the Act in any way; he may see that a man who has a common license has his magazine in the place where it is licensed to be, and also that he keeps it in such a manner as the Act may prescribe. I think that point was raised by Major Beaumont's evidence.

3590. I suppose the same remark applies with reference to Section 41?—With regard to Sections 41 and 42, Mr. Curtis's objection was to the effect that it might expose him to having a common policeman entering his factory; but this is not intended to hit the licensed factories at all. I do not certainly see how they can be specially exempted, but this is to meet the case of illegal storage, illegal manufacture, and so on. Mr. Curtis lost sight of the fact that they are already exposed to the chance of entry by a common policeman under a search warrant. All I propose is, that in very extreme cases, and where a search warrant cannot be obtained in time, a policeman should be authorised to enter by some authority less than that of a search warrant. Such cases will not of course arise at the Hounslow factory, but there is nothing new in the provision itself.

3591. Have you anything to say with regard to Clauses 43 and 44?—No, I have nothing to say with respect to those sections.

3592. Now, Section 45?—"Accidents in any licensed premises, or in any vehicle, or vessel carrying an explosive, to be reported to the Secretary of State." Some of the witnesses expressed an anxiety that minor accidents and accidents in incorporating mills should not be reported unless attended with loss of life or personal injury. I will now state precisely what I propose: I propose where there occurs on any licensed premises, or in any vehicle, barge, or ship carrying above a certain amount of explosive material, to be defined by the Act, any explosion or any unusual circumstance which nearly resulted, or was likely to result in an explosion, or

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in any licensed factory, or licensed magazine, if there occurs any fire, or unusual circumstance likely to produce fire, then that the case should be reported; so the effect would be that all explosions or narrow escapes from explosions, and all fires and narrow escapes of fires should be reported, but the latter only when they occurred in a licensed factory or magazine; there are floating magazines where a fire might occur.

3593. Would it meet your views in the case of gunpowder factories if, where any loss of life, or serious personal injury occurred by reason of an explosion, or where loss of life or serious personal injury occurred from any other cause that were reported?—I think it is undesirable to limit the reporting of accidents to cases where there is loss of life or serious personal injury, for the reason that many accidents are much more instructive where there are survivors than where everybody is destroyed. With regard to the object of obtaining information, it is not to impute blame, but merely to investigate, in order to arrive at the cause of the accident if possible, and, if possible, to avoid that cause for the future. I think we should fail of our object if we limited it to cases where there was personal injury or loss of life. I would certainly limit it to cases of explosion, or fire, or to cases of narrow escapes of explosion or fire; I would not have a report in the case of a cut finger, or of what I may call an ordinary non-explosive accident, but in the case of explosions, and even in the case of explosions in incorporating mills, I think there should be some report made upon them. It would have been of the greatest value to us now, if we had had statistics before us of the cases of explosions in incorporating mills, and particulars with regard to the size of those mills.

3594. But you think the reports would not be sufficient if they were made in gunpowder factories, where any loss of life or personal injury occurred by reason of any explosion, or where any loss of life or serious personal injury occurred from any other cause?—No; I think every explosion should be reported, whether there is loss of life or personal injury or not.

3595. Now, to go to Sections 46 and 47; have you anything to say on those sections?—No, I have nothing to say with reference to those sections.

3596. Now, Section 48?—The only suggestion made there was the one which was made by Mr. Pigou, that the word “wilful” should be inserted for the word “substantial;” now it reads, “Heavy punishments to be imposed for a substantial departure from any important condition of the license, or for making, or storing, or importing an explosive without a license (where a license is required), or otherwise than in accordance with the terms of such license, or for wilful neglect, or wilful act tending to endanger life or limb, with power, if the case is tried on indictment, for the court to forfeit a license, except in the case of magazines and factories lawfully existing at the time of the passing of the Act.” I do not think it would do to introduce the word “wilful”; it would throw on the prosecutor the onus of showing that it was wilful, which is a very difficult thing to do. It will be noticed I am here talking of *substantial* departures from some *important* conditions of the license, which a man could hardly make except wilfully, or except by very culpable carelessness, and I think it ought

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to be sufficient to show that he did that in order to constitute an offence; if he could show that it was done through no fault of his that might go in mitigation of penalties; and I would recommend the insertion of a clause in any new Bill to enable the licensee to take proceedings against a manager or workman, if he was of opinion that he, and not the licensee, was the actual offender. I think in all such cases that question should be tried before the charge against the licensee, and the conviction of the manager or workman should clear the licensee, I think.

3597. Now, passing on to Section 50, what have you now to say upon that?—“Vested interests to be specially guarded and provided for”:—The only thing with regard to vested interests is this; I do not think that this Clause 50 has been expressly objected to *per se*; the general objections which have been made by the trade apply to this clause, no doubt, but I would call the attention of the Committee to the fact that it is not proposed that, under any circumstances, any existing factory should be required to remove any building which had a legal existence; and further, that with regard to quantities, except with regard to unlimited houses, no factory is to be placed in a worse position than it is in now by the Act. I propose, practically, to give a continuing certificate to every factory to run on exactly on its present footing; not only that, but I also propose that there should be the power, in the event of any particular manufacturer desiring it, or even the trade generally desiring it, hereafter to give them greater quantities than those which they now have for particular buildings, and not that they should be placed in a worse position than they are now in, under any circumstances (and that is an important point); but there would be the power of placing them in a better position with regard to quantities. The only two cases which they can complain of are the cases of unlimited houses and the magazines. With regard to unlimited houses, I have already pointed out that I would only propose to make each factory assign a limit with regard to its own immediate requirements for the supply of the works, and as to the magazines, that they should be limited with regard to their size and capacity on any given date. Passing to suggestion 51, it was stated by one of the witnesses that the magazines, generally throughout the Kingdom, were in as good order as the Government magazine, and therefore that there was no reason for exemption; I wish to state most positively that there is no comparison between 90 per cent. of the store magazines in the country and the Government store magazines.

3598. Are there any other points on which you desire to make remarks?—None in connection with my scheme, but there are one or two points with regard to other explosives, and as to explosion by percussion; it seems rather to have been assumed by some of the witnesses that in the case, for example, of nitro-glycerine preparations or guncotton, or chemical explosives, they are so much more dangerous, because they can be exploded by a blow, while gunpowder cannot, or something to that effect. Now I wish to point out that this risk is common to all explosives, only it is a question of degree. I would quote here, as showing that gunpowder is sensitive perhaps in a higher degree than is generally supposed,

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supposed, some experiments which were made in the year 1872, in which we wanted to see how far gunpowder could be exploded by a blow without a spark at all. For that purpose small quantities of powder were wrapped in tinfoil and placed between two plates; in the first instance we began with two steel plates; a 25 lbs. weight was allowed to fall two feet; that experiment was repeated 10 times, and we obtained an explosion every time; then substituting one brass plate for one of the steel ones, we got four explosions out of ten; then with both plates of brass we obtained two explosions out of ten. When we went to lead, we could not get an explosion at all, even up to 40 feet. Dynamite and guncotton, no doubt, will explode under rather less favourable conditions, that is to say, a smaller blow will suffice to explode them.

Mr. Whitwell.

3599. The powder, in each case, was within tinfoil, you say?—Yes; that was merely to exclude sparks. There are many cases known to artillerrists of exploding powder by friction; for example, the original shrapnel shell had to be given up, because the shock caused on the explosion of the gun generated sufficient heat between the bullet and the inside of the shell to explode the powder; and so also if shells are partially filled there is very great liability to premature explosion from the same cause; so it is really a question of degree and not of entire difference in the behaviour of the substance. There is another point with regard to the question of degree. If you fire a bullet through the powder itself, you will not explode it unless the powder is against anything, whereas if you fire it through dynamite you will explode it. The same if you fire through dry guncotton, you will not explode it. I have here some guncotton perforated by bullets in that way. Then, with regard to the question of exudation, of course the evil of exudation is this, that it gives you a substance still more sensitive to friction or percussion. There is no doubt that some nitro-glycerine preparations are liable to exudation, and therefore it is most important that their quality should be carefully watched, and that there should be a special treatment of those substances on that account. But it is in a great degree a question of package, no doubt. I believe that all nitro-glycerine preparations are more or less likely to exude under the effect of wet. The nitro-glycerine becomes displaced by water, and runs out, but if that can be controlled by package, you, in a great degree, get rid of that evil—at any rate in transport. Mr. Nobel explained that very serious case of exudation (and it was a most serious one) which was discovered by Major Ford, at Holmes Colliery, by saying that the cases had got wet. I think it is quite possible, because it was so very exceptional; but, at the same time, it showed that we must very narrowly watch those explosives and their mode of packing. With regard to that particular risk, I am disposed to recommend that in any new legislation there should be a clause to say that those substances should be packed in waterproof packages, except where specially exempted by the Secretary of State, and it would rest with the inventor of anything new to show that it was not affected by water. Of course guncotton is free from that defect, but you

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have with guncotton the evils of possible impurity which is common to all these chemical substances. Another point has come before the Committee. I mean with regard to the storage of gunpowder in salt mines. One of the witnesses spoke to that. I would only say, on that point, that there is no clause in the present Gunpowder Act which in any way prevents a man keeping gunpowder in mines. It is in the Mines Act, but it is not in the Gunpowder Act at all.

3600. Are salt mines usually wet mines or dry mines?—I believe they claim as one of their main advantages that they are so beautifully dry and clean; the one I went down was not at all wet. The only other point is with regard to some accidents which have occurred during the sitting of the Committee with reference to dynamite. I may state that I have got the best information that I can get with regard to these; one of those accidents occurred near Durham; not being able to go up myself to make inquiry, the Inspector of Mines was good enough to inquire into this, and I got from him last night his report; I have been also in communication with the chief constable; I confess that the matter is left in very considerable obscurity even after inquiry, but these facts certainly do appear. He has sent me a plan to scale of the scene of the accident, and as the Committee appears to have taken an interest in the question, I thought it desirable to bring the plan here (*producing a plan*). There was a platform at the mouth of the shaft, and there was a cabin at one part of the platform which contained some gunpowder, some dynamite, and also some detonators; then hanging up by the platform were a number of dynamite shot ready prepared, and, I think, with fuzes and detonators in them, outside the cabin; then at the other end of the platform, within about 10 feet of it, was a small raised place, and on that was a box containing some dynamite; between those two was a brazier containing what is described as a very hot fire; as to the dynamite in the box, they say the lid was on the box; the man himself is most positive about that; it appears that both the dynamite which was in the box and the dynamite shots that were hanging up outside the cabin were exploded. The dynamite inside and the gunpowder inside were not exploded, though the cabin was destroyed; but all the outside dynamite was exploded; but it is entirely uncertain, so far as the evidence goes, whether it occurred first in the box or whether it occurred first in those shots hanging up; that they both went off I think there can be no doubt whatever, but none of the witnesses can speak positively to where it first occurred, which of course leaves the question how it first occurred, in obscurity also. Whether it occurred, as the Inspector of Mines seemed to think at first, from the shots hanging up catching fire and going off, or whether it occurred from the dynamite in the box being heated up by the fire, which seems to have been between three and four feet from it, nobody knows; that is all the evidence that I have been able to obtain on the subject.

Mr. Vivian.

3601. With regard to No. 5 suggestion, I should like to ask you a question or two; are the same conditions to be observed by private persons

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persons filling shot and gun cartridge, as by a gunmaker or dealer?—No; where they are not made for sale I do not think that you can control it at all.

3602. You would not attempt to control private filling?—No, I think not; a person should not keep without a license more than a certain quantity, but if within that quantity, he could carry on filling for his own use he might do so.

3603. With regard to blasting cartridges for mines, is any person to be allowed to make them up?—Any person who had a license to store the material and wished to make them up, could do so.

3604. Do you mean with the same license?—Yes, they need not have a separate license.

3605. That is to say, a mine magazine license would cover that?—A mine magazine license would cover that, provided he complied with the conditions which I have specified.

3606. Then, in the event of a son succeeding to his father's business, who was in possession of a license, would he require to get a new special license?—There should be provision made for the transfer of licenses. I propose to make provision for the transfer of licenses in all cases.

3607. You have stated that, with regard to No. 14, there are 190 mine magazines inspected?—No; there were many more than that inspected. I only took the last 190, which we have inspected, as examples of the amount of powder that the magazines contain.

3608. How many of them contained over two tons of gunpowder?—Only two out of 190.

3609. I think you stated that, in the event of a mine requiring more than two tons, there would be no objection to a second magazine being built consistently with the requirements of the Act of Parliament?—Certainly; we consider that that would be a great advantage to the mine owner over his present position. He may now have only two tons of gunpowder; but, under these proposals, he might, if he had a proper district for it, and if he could place his magazines sufficiently far apart, have as many as might be necessary.

3610. In the event of black powder and dynamite being used in the same mine, would you allow the dynamite and black powder to be stored in the same magazines?—I would, as I said last time, but most reluctantly. I would much rather they did not, but I am afraid that it is often very inconvenient to the mine owner to have separate magazines, though I do not think that it is altogether a satisfactory arrangement for him to have his dynamite and powder together.

3611. Then, with regard to Suggestion 35, with reference to the appointment of fit inspectors, I distinctly understand from you that, with regard to mine magazines, you would consider that the inspectors of mines be themselves sufficiently qualified?—I think that is absolutely indispensable, otherwise you would have to increase your inspectors' staff to an enormous extent; I think that could be easily done.

3612. Then, with regard to Sections 37, 38, and 39, what would you look upon as absolutely requisite for mine magazines: that they should have shoes, wood lining, and no exposed iron; would that meet all your requirements?—Yes; with a good set of rules, I think that would meet all the requirements. Of course, we start by assuming that the magazine is properly built, and

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with proper doors and locks to it, and that it has no openings through which things could be easily thrown in. But, with regard to the internal arrangements of the magazine, that would be all.

3613. No. 22 of that list referred to Kennal; was there an infringement of the rules in that case, or was it a disregard of the suggestions?—Kennal was a factory where, when we first visited it, we found many things to complain of, and we found also some illegalities. We found some violations of the Act of Parliament, and we there, as we have done in several other cases, refrained from prosecuting, using that as a means of persuading them to adopt certain things outside the Act. The effect was certainly good; that is to say, there was a very great improvement, but still there were a good many points left unremedied, and when I visited the factory last year I thought it my duty to call attention to a good many things.

3614. Are you at present satisfied with the way in which that factory is conducted?—This was my last inspection, and I was not satisfied.

3615. Have there been any accidents at all there?—Not since I have been carrying on the inspection.

3616. How many years has that been?—For three years.

3617. You are not aware that any accidents have occurred there at all?—I am sure that there have been none during those three years.

3618. But before?—I do not know anything about that.

3619. I think you said that the East Cornwall Company, though at first when you visited it it was in a very bad condition, had been carried on very properly?—I consider that the East Cornwall Company has probably done more than any factory in the Kingdom in the way of putting themselves on a proper footing; I think on my visit last year, except one slight point, things were very good indeed.

3620. Before what court were those prosecutions conducted?—The East Cornwall Company was proceeded against at Liskeard when Lord Vivian was chairman.

3621. Do those prosecutions come generally before the court of quarter sessions?—No, they come before the petty sessions.

3622. Are they ever referred —?—No; the only case was the East Cornwall case, and they carried the ruling of the magistrates to the Court of Queen's Bench.

3623. That was a case which was given in their favour, was it not?—Yes.

3624. I think you stated that the prosecutions generally are for excessive quantities?—Yes, generally so; in fact, they have almost always been for excessive quantities, or for working excessive charges. I thought it was not fair on the trade generally and on those makers who were limiting themselves to the legal charges that other people should be getting the advantage of working illegal charges; and that is why we were rather down on those people.

3625. In case No. 22, was that a case of excessive quantities?—I think they were working illegal charges, and that there was some other illegality.

3626. Is it water power there?—Yes, all water power. There were three illegalities on the first occasion, namely, excess in charge, excess in the breaking house, which we looked upon as the corning

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coming house, and then we considered that the quantity in the sifting house was largely in excess of what it should be.

3627. Were those things remedied?—Yes.

3628. Have you been there since?—Yes, I have been there since. We did not find the same illegality when we went again.

3629. With regard to Suggestion 40, namely, the appointment of searchers, would you propose that the searcher should be an official under the Government?—No, I think he should be an official under the local authorities.

3630. A constable, for instance?—Whoever they might appoint. I think in many cases it would be the inspector of nuisances, as it now is at Birmingham and elsewhere. In Liverpool they appoint constables.

3631. With what power?—Only power to see that the provisions of the Act are observed; he has nothing to do with the special licenses at all, only the common licenses; that is to say, he would have nothing to do with any factory, excepting some of the small firework factories.

3632. All factories would be excluded from the operation of the searchers?—All factories would be excluded from the operations of the searchers, except from the operation of special authorised searchers in extreme cases, such as those indicated in Sections 41 and 42.

3633. But with regard to the searchers' clause in Suggestion 40, that would not touch factories?—Just so; speaking broadly, he would only search small firework factories and other places under common licenses.

3634. Would he have any right to investigate mine magazines?—I would propose that he should have the power to do so if directed to do so by the local authority.

3635. You do not mean if he were directed by the inspector of mines?—That might be so, but it might bring about some conflict of authority. I think you might exempt mine magazines, where they are under the inspection of the inspector of mines.

3636. It appears that otherwise they would be under two inspectors?—Yes; that exemption might be reasonable. I was thinking of that the other day. I think if a mines' inspector undertakes the inspection of a mine magazine that would be enough. Of course there would be a number of common magazines still to be provided for, and there are the sellers' magazines. I anticipate that under any new Act of Parliament there would be a considerable multiplication of small magazines of this kind, and, of course, it is necessary that some one should look after them. You cannot make the mine magazine inspector look after them. With regard to mine magazines, I am quite prepared to say, if it is thought desirable, that the inspection might be quite as effectively made by the inspector of mines.

3637. Then, with regard to Clause 45, as to reporting accidents to the Secretary of State, I suppose the regulations on this head, which stand in the Coal Mines Regulation Bill, would not meet your views?—No, not altogether. I think the Coal Mines Regulation Bill only applies where there is injury. I contend that we ought to know of all explosions, whether there is injury or not. For example, take a magazine of gun-cotton, it might blow up in the night, when nobody was in the magazine, and not hurt anyone; but we certainly ought to know of it.

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3638. Do you think it is necessary to include narrowly-escaped explosions?—I think so; because, in the first place, with regard to chemical explosives, it must be exceedingly instructive, if we found a quantity of material in a state of active decomposition with time to arrest it before exploding. Then, with regard to gunpowder, the value of narrowly-escaped explosions is, that they testify to the efficiency of the precautions; therefore, unless there is any very strong objection to reporting them, I think it would be advantageous to have them reported.

3639. Take Section 51. I see there that the Government establishment are exempted; is there any objection to their being included?—I am following there the old Acts of Parliament and all other Acts that have ever been passed on gunpowder. I do not know that there is any very strong specific objection to their being included, but it would give a great deal more work to the inspector, which is undesirable, I think, and I do not think that it is necessary. It is only bringing the Government officers of one department to inspect the work of the Government officers of another department.

3640. But any exemption is to be deprecated if it can possibly be avoided, and as the Government factories are so well conducted it would hardly cause much trouble to inspect them, I suppose?—I, personally, should have no objection to Government establishments being included, but I do not think it is necessary to recommend it, and it would add greatly to the work, as the Government magazines are very numerous indeed.

3641. The Committee have had some evidence on railway accidents, in which it was stated that a cask of powder might positively be broken up and fall in front of a train, and it was stated to us that that was not likely to cause an explosion; now I should like to hear your opinion, whether simply passing the wheels over that powder would cause it to explode or not?—I think it is almost a certainty that it would cause it to explode; I think that there can be no question about it.

3642. Then with regard to your remarks about mine magazines, underground, would the effect of an explosion under those circumstances underground be greatly intensified or not; I mean, of course, taking the same quantity of powder?—Yes, the effect would be far greater; we should have not only the effect of the immediate action of the powder in destroying the lives of those who might fire it, but also the secondary effect of releasing a large quantity of very poisonous gas. Major Ford was good enough to make a calculation some time ago of the effects which would be produced, and the result is that the poisoned air may be taken as rather more than 1,000,000 cubic feet for every ton of powder; so that there would be that effect to be considered; and that effect is not one that can be disregarded, because in the Forest of Dean, two years ago, there were four or six men poisoned and killed in that way at a blasting; they merely met the poisoned air. There is also another point to be considered, namely, the injury to the mine, which may have the effect of closing up the means of escape. Therefore, in every case with regard to storage of gunpowder underground, some very strong cause should be shown in favour of it before it should be allowed.

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3643. Therefore, you would be very much opposed to magazines underground?—Yes, I should be very much opposed to it, unless the individual owner could show that the circumstances were such that it would certainly be less dangerous than above ground.

3644. You would require special leave to use it to be given in every case?—Yes, a special dispensation in every case for storing large quantities of gunpowder under ground.

3645. With regard to the explosion of dynamite in the north, which you have referred to, was not the practice of having detonators in cartridge stored a most dangerous practice?—It is altogether wrong, and it is altogether contrary to the conditions of the licenses we have issued, which most distinctly lay down that detonators are not even to be in the same magazine.

3646. It is most exceptional, is it not?—Yes.

3647. Did you ever come across such a thing before?—No, we have never come across anything of that kind; we have come across detonators in magazines, but we never came across detonators in the same box, and I should have thought it my duty to recommend proceedings to be taken against them had I known it.

3648. The box was kept within four or five feet of the fire, was it not?—Yes.

3649. That was a dangerous position for any kind of explosive, was it not?—Yes, it was a very improper position indeed for it to be in.

*Mr. Whitwell.*

3650. I think you say that gunpowder, as well as nitro-glycerine compounds, is liable to explode by concussion?—Yes.

3651. Have you known any instances of an explosion in works or stores of gunpowder by concussion?—I have never known any instances of accidents in any factories which could be traced distinctly to percussion or concussion, but I have heard of cases where accidents have been said to have occurred from that cause. My assistant, Captain Smith, frequently spoke of an accident which he told me one of the leading gunpowder manufacturers said he actually witnessed from a man dragging a gunpowder barrel over a floor upon which there was gunpowder, but I myself do not know of any cases of my own knowledge.

3652. Then if the gunpowder manufacturers hold as an article of faith and history that no such explosion has ever taken place you cannot contradict them?—No, only that I can say positively that it might be so caused.

3653. You have alluded to the question of cotton waste; is there much cotton waste used in gunpowder factories?—No, not much; there is some used in all factories, but no great quantities.

3654. I suppose they use just as much as is necessary for cleaning the machinery, and no more?—Yes.

3655. Have you ever seen more than a few pounds at a time?—No, I think not.

3656. Did you ever see spontaneous combustion from any quantity of cotton waste unless it was heaped up in considerable quantities?—Yes, certainly; I wrote a pamphlet a short time ago on the ignition of oiled cotton waste; I was in communication with Mr. Gellatly, who made experiments in oil in which he obtained ignition of a quantity of cotton waste which was not more than would fill an ordinary lucifer match box.

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3657. But I speak of spontaneous combustion in the ordinary process of commerce?—Yes, there was one within my own knowledge, of silk waste, which is supposed to be less liable to spontaneous combustion than cotton waste; that was in the Royal Laboratory at Woolwich last year. That quantity was a lump of perhaps six inches in diameter; it was inside a torpedo case, and took fire in the night at an ordinary temperature.

3658. But so far as your experience in gunpowder factories goes, you never heard of any explosion arising from that cause?—There have been many explosions which have been traced to no cause whatever, and I have a very strong opinion that some may have been from that cause.

3659. In your experience you have come across differences of opinion between yourself and gunpowder manufacturers as to what was allowable and what was not allowable?—Yes, certainly.

3660. That would always be the case where things were evidently questioned, and yet not positively found to be dangerous by universal consent and experience?—No doubt.

3661. It must more or less depend on the experience which the person brings to bear on the question?—Yes, no doubt.

3662. Now, with regard to explosions, how many times have you visited the scene of an explosion immediately after it has taken place?—I find it difficult to answer that question straight off. I can tell if I may be allowed to look up my returns.

3663. Have you, in pursuing your duties as inspector, made calculations of space and distances on which you base your opinion with reference to danger?—Only in the roughest possible way. You can say that a certain position would be obviously unsafe, and you can say what might be permitted, but there is no definite law ascertained.

3664. Therefore, the opinion with regard to danger from explosion is altogether uncertain?—Yes, under certain circumstances it is.

3665. Mathematically it is uncertain, and it must depend on the experience that the person has had in the matter, I suppose?—I cannot admit that without considerable qualification. There are certain things which are obviously unsafe, and which might be asserted to be so; but there are others, of course, where it is more questionable.

3666. So that, in passing an Act of Parliament where we make penal laws to apply to certain conditions of things, we require to be very careful lest we impede the trade by imposing too severe conditions?—Certainly.

3667. Have you, since Captain Smith left off assisting you, taken up other matters which he did not think it necessary to take up?—I think not. I may have observed points which, in the course of our first inspections, we did not observe, for of course, in inspecting a very large factory, it is impossible to say that you have observed everything. I am certain that I am proceeding on the same lines of inspection.

3668. But in the details it is possible, is it not, that you may have observed some matters which Captain Smith did not think it necessary to notice?—I am sure I have never called the attention of a gunpowder manufacturer to a matter which

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which, if Captain Smith had noticed, he would not have called attention to.

3669. You know the list of printed observations or suggestions which was printed or issued when Captain Smith was alive?—Yes.

3670. I suppose they may be considered as the subjects to which he may have wished the manufacturers to have their attention turned?—No doubt. Captain Smith did not draw that paper up; he had nothing to do with drawing it up, and there might be points besides those which he might think it desirable to recommend, but I believe there is nothing in the list of which he would not have approved.

3671. Now, with regard to the question of arbitration and that of immediate remedy, which is a very important duty, which you ask to be imposed on the inspector, you, I think, define the case to be this; if the danger in the eyes of the inspector is clear, if it is an unnecessary, if it is a personal danger, and if it is an urgent danger?—Yes.

3672. I should like to know whether you would consider a state of things which had lasted for 40 years a case of urgent danger?—Yes, it might quite possibly be an urgent danger.

3673. You would put your opinion against an experience of 40 years in such a case?—In certain obvious cases I should not hesitate to place my opinion against an experience of 40 years. I consider the case of the man who went into the powder magazine with a lighted candle, and which he said he had done for several years, was a case of urgent danger.

3674. That was not a case of arbitration; I referred more especially to the question of changes in building and machinery?—Then I should propose in every case to fortify my opinion by the opinion of an arbitrator.

3675. Then if a manufacturer were willing to go to an arbitrator in any reasonable case, would you propose to stop the machinery until that arbitration had decided the question?—I do not propose that for a moment.

3676. You would not propose to suspend any operations which had been carried on with safety for years until an arbitration could take place?—Certainly not, except where the practice was attended with urgent danger, and was contrary to the usage of the trade. In the Arbitration Clause (which does not refer to matters to be remedied forthwith) I give the licensee the right to object within a certain time.

3677. However urgent the inspector thought the danger was, still he could not stop the process of manufacture until an arbitration took place?—Not if it was a matter affecting the premises or machinery; I am very anxious that that should be made quite clear.

3678. Now, you spoke of having taken up several cases, and having summoned the manufacturers before the justices, but you spoke of some cases where things were done, not illegally, but where you called on the manufacturers to cease from doing them because you had the power of summoning them before the magistrates for some other matters?—We have foregone proceedings on condition of a manufacturer making certain alterations.

3679. That is to say, a person having broken the law, you have failed to prosecute him on condition of his assenting to adopt something which you could not legally enforce?—I obtained

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Mr. Whitwell—continued.

the authority of the Home Office with regard to that, because I represented that if proceedings were to be taken in every case, probably nearly every manufacturer in the Kingdom would have to be prosecuted.

3680. But is not that a state of things which ought not to exist, namely, that a man should be remitted from prosecution in consideration of his doing something which he was not legally bound to do?—I think it is most unsatisfactory, but it is one of the consequences of the present state of the law.

3681. Therefore, in any legislation on the subject, it would be most desirable that the inspector and the manufacturer should know what might legally be called for?—I suppose it would be necessary to give the Secretary of State some discretionary power with respect to instituting prosecutions.

3682. Unquestionably the Secretary of State should have discretionary power with respect to instituting prosecutions; but we have not quite got to that; I ask you whether it is not placing the inspector in a most invidious position when he is called upon to neglect his duty, in one sense, in order to force compliance with his wishes in matters which are not strictly legal?—It is very unsatisfactory.

3683. Then, in any Act of Parliament, it is of the utmost importance that what is legal and what is not legal is to be defined, is it not?—Certainly, as far as practicable.

3684. So that the inspector may not use illegal means to enforce compliance with the law?—Yes.

3685. Therefore, we must have change in the law on that ground alone, if not on any other ground?—I think it is necessary.

3686. How is it that you propose in block to abolish all the existing local Acts of Parliament, because, in your first day's examination, you said you were not acquainted with them all?—Just so.

3687. How is it possible for us to arrive at the view that they should all be repealed, when we really do not know what they are?—I do not, of course, propose to abolish the local Acts of Parliament themselves, but only to supersede by the new Act those provisions of local Acts which relate to explosives, and even that I do not propose should be done where the local authorities can show cause why it should not be done.

3688. I asked you whether you would repeal the Mersey Act, and I think you said you would; will you kindly read that letter from the town clerk to Mr. Rathbone, the Member for Liverpool (*handing it to the Witness*)?—I note that the town clerk says that the Liverpool Act is essential for the protection of the public, but the Act which I should propose is built on the lines of the Liverpool Act; I have gone to the Liverpool Act for a great many of my suggestions; I would merely propose to give them a more complete Act, or improve that part which relates to gunpowder.

3689. But seeing that Liverpool is governed by a special Act of Parliament, would it be desirable to repeal the Act, simply for the purpose of repealing the Act, if they are really protected under this Act as they would be under a general Act?—Certainly not; if they can show cause why it should not be repealed, I certainly would not repeal it.

G G 3

3690. Now

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3690. Now I should like to ask you with regard to the real signification of Suggestion No. 23. Would the Secretary of State have power under this suggestion, if it were carried out, to convert a gunpowder factory into a factory for the manufacture of some compound of nitro-glycerine?—No, that is not at all intended; it says, “any substantial alteration.” I put the word “substantial” in italics; the man is not to be allowed to make “any substantial alteration in the nature of the explosive to be manufactured, kept, or imported.” But I will tell you the kind of alteration which he might properly make. When No. 2 dynamite came in, they proposed to employ paraffin. Then the question arose, whether they might employ ozokerit instead of paraffin. Now, I think, the Secretary of State should clearly have the power to vary a license in that way, and he did so in that case.

3691. But if the licensing authority has granted power to erect a factory for the manufacture of a particular substance in a particular way, would it be wise for the Secretary of State to over-ride the decision of the local licensing authority without first submitting the subject in some way?—Yes, I think, quite so, in mere matters of detail of that kind.

3692. Why should there be any necessity for interference on the part of the Secretary of State with those mere matters of detail?—Because it is very important that the manufacturer should not be left himself to judge how far it is a material alteration or not; on the other hand, it would be very inconvenient to the manufacturer to have to go to the local authorities for permission to make every slight change.

3693. Would such a change as this require the intervention of the Secretary of State; a man buys refined saltpetre at first, and then thinks it would be more economical to manufacture his own saltpetre, should he then go to the Secretary of State?—It is not a question to be included in the license at all, except as regards the proximity of his saltpetre buildings to his powder buildings.

3694. But the license is for the purpose of manufacturing gunpowder, and that would be part of the process, would it not?—Certainly; there would be no objection to his manufacturing saltpetre, or his buying saltpetre.

3695. Then what do you mean by technical and internal detail as to dynamite and gunpowder?—With regard to gunpowder, dynamite, or gun-cotton, the great point I refer to there would be the putting up of an additional expensive magazine, or the extension of an existing building or some alteration which, in the opinion of the Secretary of State, did not affect the question of safety at all.

3696. But if a gunpowder manufacturer obtained power to erect his works, and had plenty of room within the danger surface, why is he not to erect any additional works without the sanction of the Secretary of State?—It is the opinion of the law officers of the Crown that he is not at present entitled to erect any additional works without going to a magistrate; perhaps the trade do not agree with that, however.

3697. Does the license specify how many machines a man is to employ?—Many licenses specify nothing at all; they simply say that he may make gunpowder in a certain place.

3698. With a license specifying nothing, surely the law officers of the Crown do not mean

Mr. Whitwell—continued.

to say that he is limited in that way?—Yes, they do; they say that the license extends to the buildings which he puts up under that license in the first instance, and no further.

3699. In that case, it would be impossible for a manufacturer to follow out your recommendations, and perhaps some of them may be holding back on that ground; I mean as to not taking down a building, and removing it to another place?—I am not aware of any gunpowder manufacturer going to a magistrate for an additional license.

3700. But you do not really mean that the manufacturer should go to the Secretary of State for every additional building which he puts up, do you?—I mean that after a man is licensed for a building in a particular position he should not add to that building without permission; I believe it would be desirable that the permission should be given by the Secretary of State, so as not to give the manufacturer the trouble of going to the licensing authority; but that is a matter of detail, and the matter of principle is that he should not do it without authority.

3701. You propose that all manufacturers hereafter should not make any additions to their buildings, or enlargement, without leave?—Certainly; but there should be an appeal to arbitration in every case.

3702. Do you know of any trade that is so hampered?—It is an exceptional trade as regards the danger to the public.

3703. Do you know of any trade that would be so harassed?—I do not think it is unnecessary, or I should not recommend it.

3704. Section 25 says, “If two or more buildings of a licensed factory are destroyed by explosion, the license not to erect more than one of such buildings without the written consent of the Secretary of State, or otherwise in accordance with such conditions as to mounds, &c., which the Secretary of State may impose.” If it were really established that there was no connection whatever between those two buildings, would you still require the leave of the Secretary of State to re-erect them?—I think an independent person should be the judge whether there had been any connection between those two buildings or not, and therefore I think, of course, it must go to the Secretary of State.

3705. Now Clause 28 says, “Harbour authorities to have power to make bye-laws, as in present Liverpool Gunpowder Act, to regulate the navigation and place of mooring of ships, safe stowing and safe keeping of explosives on board, regulating the kind of ship, barge, &c., licensing the same, fixing the place, time, and mode of shipping explosives, the precautions to be taken, and so on.” I suppose that is really intended to convey to the harbour authorities no more power than there is in the Liverpool Act?—Just the same; it is an abstract of the Liverpool Act.

3706. The phrasing is not exactly the same, is it?—That is my fault then.

3707. Then Section 29, “Railway and canal companies to have power to frame bye-laws for regulating the carriage of explosives over their rail or canal, the place and time and mode of loading, amount to be carried, and so on.” I suppose those are to be subject to the Secretary of State?—Yes, I say so in Section 30, “All bye-laws made as above to be confirmed by the Secretary of State (or Board of Trade), and the Secretary



Mr. *Whitwell*—continued.

Secretary of State (or Board of Trade) to have power to enforce the making of bye-laws, or where not made to make them, in any place where it may be deemed necessary." That is very important.

3708. You do not propose that the new Act, if it is passed, should compel the railway companies to carry explosives, to which they object?—I only ask that they should carry my samples.

3709. Do you think that it would be proper for Parliament, knowing the danger which attends those explosives, to compel a railway or canal company to carry any explosive to which they objected?—I think it would be quite reasonable if the company carried any explosives to require them to carry all that were licensed as considered safe, because at present the railway companies constitute themselves judges of whether an explosive is safe or not safe. I think we may conclude, from some of the evidence which we have heard, that their decision is based upon very imperfect grounds. I think, therefore, if a substance is considered safe enough to be manufactured or stored and used throughout the country, railway companies might fairly be required, although I have not proposed that, to carry.

3710. Not only the explosive substances at present in existence, but all such substances to be made in future, I suppose?—As they come into the category of safe explosives.

3711. That is to say, all substance to which the Home Secretary would allow a license to be given?—To which the local authorities have granted a license to manufacture or import. I would word it in that way, "all substances licensed for manufacture or importation."

3712. But you would not allow the local authorities to authorise the importation of dangerous substances, would you?—No, but all chemical substances to be imported under a special license from the local authorities would come under the view of the Home Secretary.

3713. That would be all substances that the Home Secretary allowed to be imported or manufactured?—Yes.

3714. You contemplate that more inspectors would be required than at present exist, do you not?—I do not believe that if the mine inspectors are appointed to do the work of inspecting mine magazines we should require more than one additional inspector.

3715. The searchers would be additional, would they not?—Yes, but that is a different thing.

3716. Would you think it proper to charge the expense of the searching and inspection on the trade?—No, because it is done in the public interest. I have not proposed that it should be so done. At Liverpool the inspection is charged against the trade in the case of the Mersey magazines, but I think it is wrong in principle.

3717. With regard to reporting all accidents, I think you advocate the reporting of all accidents, whether personal injury has been suffered or not?—All explosions; I do not want to know anything about other accidents, except explosions or fires.

3718. No accidents, even to the person, unless they arise from explosions or fires?—No, except they arise from explosions or fires.

3719. With regard to the grinding of charcoal in mills, is there any real danger if the charcoal

Mr. *Whitwell*—continued.

has been burnt for some little time?—There is always some danger, of course.

3720. Can you avoid that danger in a gunpowder factory?—I think it is an imprudent course to adopt; I certainly would not do it in a factory of my own.

3721. Have you ever heard of any accidents arising from it?—I think it is exceedingly probable that some of the accidents in the mixing-houses, of which there have been to my knowledge three, may have been caused in that way; it is amongst the causes to which I should be disposed to attribute them.

3722. The Committee is quite aware that there have been numerous omissions in not attending to what you have recommended; but I have had much pleasure in looking over many of your reports, for I found that a very considerable number of gunpowder manufacturers are told that you observe with great satisfaction the condition of their works?—That is so; I wish it to be made perfectly clear, that I think the gunpowder manufacturers have done a very great deal, but there are still points on which we are at issue, and I want some power to see whether I am right or whether they are right.

3723. There are a number of points not complied with, on which they do not see with your eyes, neither with my eyes, nor the eyes of many other members of the trade in some cases; many of them are elementary points almost; are you not aware that a number of manufacturers have complied with your requisitions, because you have asked them, rather than because they thought them necessary, though others have acknowledged they have added to their security?—I only know of one case where a man told me that he had complied with my suggestion, although he thought it was not necessary; in fact, he said he thought it was a very bad suggestion.

3724. If we get legislation on the subject, the probability I suppose is that what is absolutely necessary would be made statutory, or at all events effected by such bye-laws as the Home Secretary thinks fit?—I should think that you might regulate nearly everything in that way, but that would still leave some points that could not be included.

Mr. *Stevenson*.

3725. I think we gather from you that you were enabled to effect improvements which you considered necessary, but which the law did not provide for, by threatening proceedings under the existing Act?—Where we found illegality.

3726. Can you tell me what the particular offences were under the Act of Parliament, which you took advantage of in any case, for the purpose of putting pressure on, or, as you call it, a lever on, the manufacturer, to induce him to carry out your suggestions?—Yes; such points as having an excessive quantity in regulated buildings; for example, the quantity allowed in a press-house is a ton, or 10 cwt. more not under pressure; that is 20 cwt. We found cases where that quantity was exceeded, perhaps, to the extent of 400 or 500 lbs.

3727. Apart from the Act of Parliament, was there any real danger, or was it merely a technical violation?—In some instances, no doubt, any increase in the quantity constitutes an addition to the risk, but I am not prepared to say that in every case it was so.

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3728. You took advantage (with a very proper object) of the statute to threaten prosecutions for penalties, for the purpose of carrying out, perhaps, much more important provisions, which the statute had not provided for?—Yes.

3729. You enforce these provisions of the statute, not for their own sake, but for the sake of other points?—In some cases we enforce them for their own sake, but not in all.

3730. Then, having obtained convictions, you did not press for penalties, in order that the other requirements might be attended to; is not that so?—Yes, that was the course which we took in some cases.

3731. Do you think it desirable that the Act of Parliament should go into such detail as to specify the charge to be put in the incorporating mill?—My opinion is that, it is utterly impossible to include all the details in an Act of Parliament. That is one of the main features on which I have broken away from the trade. It is not desirable, and it is scarcely possible.

3732. You think that those quantities might be increased in many cases, without danger?—Yes, without danger.

3733. You probably think that you had better have a larger charge in one mill, and fewer mills?—That might be so in some cases, or else larger mills.

3734. In that case fewer mills might be required, I suppose?—I regard it as an unreasonable restriction on the development of the trade.

3735. You look for possible improvements in the manufacture, which might be affected by these restrictions?—Yes.

3736. Then how do you propose in any fresh legislation to guard against excessive charges or excessive quantities?—I propose, with reference to existing factories, that the charges shall remain as they are until each manufacturer showed that an increase might in each case be safely permitted. Take some cases where it would not be safe, where a man has got already three mills in one building, and where those buildings are in dangerous proximity to other buildings, I think it would be very objectionable to permit an increased charge, but in cases where a man's mill stands out in the middle of a moor, or is run into the side of a hill, and an explosion could only shoot forward like a gun, doing no injury to any other building, I do not see why his charges should not be increased. We should still, of course, have to look to the general producing power of his factory however.

3737. Then what enactment would you lay down for the guidance of the manufacturer; would you make it a general provision that he should so carry on his factory as to make the best possible arrangements for preventing accidents, specifying no details?—I do not think that it would do to leave it absolutely open; I think the quantities must be fixed in every case.

3738. That is to say, by Act of Parliament?—No, by the license; and, with regard to existing factories, I would leave them fixed as they are by the present Act, with power to dispense afterwards.

3739. Your proposed arbitration would become a very important feature in that case, would it not?—A very important feature indeed.

3740. Have you given any thought to the mode of carrying on that arbitration?—Yes; I think it is practicable.

Mr. Stevenson—continued.

3741. Would you have each particular manufacturer, in his own case, appoint his own arbitrator?—Yes.

3742. And in that case the Government would appoint another, I suppose?—Yes.

3743. With an umpire in case of necessity, I suppose?—Yes, exactly as it is in the Coal Mine Regulation Act. I think the phraseology of that Act might be adopted.

3744. Might not this happen, that a couple of arbitrators in one part of the country might disagree with you on a point quite similar to that on which another pair of arbitrators in another part of the country might agree with you?—Certainly.

3745. Then how do you hope to secure uniformity of operation?—We must leave it to the general average of cases. I believe that, as a general rule, the cases would be decided fairly and properly.

3746. Would it not be an improvement if the members of the trade could agree on one man as an arbitrator in every case all over the country, with a view to make the results more uniform?—I think that might rather fetter the trade, because there might be some questions on which the trade might desire to appoint an arbitrator of one class, and some on which they might desire to appoint an arbitrator of another class. A question of machinery, for instance, and a question of buildings might require different arbitrators; but there would be no objection to their appointing the same arbitrator over and over again, of course.

3747. Mr. Curtis mentioned a case in which the inspector required a scale beam to be covered with leather; will you explain that?—As it is a suspended thing, and if it falls on the ground and there happens to be any grit about, you may have a spark, and that is not fanciful. Take what happened at Messrs. Bickford & Smith's fuse factory. Eight girls lost their lives entirely owing to the falling of a steel arm from one of the machines; it struck a spark and lighted some powder lying in one of the crevices, and the fire ran along and the girls were killed. Generally throughout the trade, beams, before my time, were either of brass or were covered. I think Mr. Curtis's were all so except that one.

3748. Were some of those specimens of iron scale that you handed in of the nature of grit to produce an explosion?—Yes.

3749. In the case of the East Cornwall Company, you stated that the Court of Queen's Bench had reversed one of the decisions which you obtained?—Yes, but it was on a technical point entirely. The magistrates fined them, I think, 50*l.* for not having a lightning conductor, and the Court of Queen's Bench ruled that there was no summary jurisdiction in that particular case.

3750. Have you not differed in opinion with manufacturers with regard to the position of lightning conductors?—Yes, with some of them I have; but I have differed in such good company that I have had no hesitation in persisting. I have based my point of difference on Sir William Snow Harris, who says it is an exceedingly dangerous thing to connect them in the way they are connected, or rather not connected, in some of the factories. Having taken the precaution to refer that paper to Professor Tyndall before I acted upon it, I have had no hesitation in acting upon it since.

3751. I refer

Mr. *Stevenson*—continued.

3751. I refer to the case in which the inspector required the lightning conductors to be attached to a building where the manufacturer thought it should be detached; you say that you acted on high authority in that case?—Very high authority.

3752. And some of the manufacturers agree with you?—Nearly all agree with me.

3753. Do the majority of the trade agree with you?—Yes, nearly all; only two or three are fitted in that way.

3754. Do those two or three consider that their plan is better than yours?—I suppose they do.

3755. That would be one of the points on which an arbitrator would decide, I suppose?—Yes, but I think that would be generally yielded without arbitration.

3756. With regard to the Durham accident, did I understand from you that fuses were inserted in the cartridges that were hanging outside?—Yes, that seems quite clear from the report of the mine inspector.

3757. Of course that is quite contrary to all prudence, is it not?—Yes, the whole thing was horribly imprudent.

3758. With regard to the matter of personal license, you mentioned the other day, at page 40, that you would have the character considered of the person who was to succeed to the proprietorship of a gunpowder factory by sale or by purchase?—No, I think there should be an arrangement in the Act for making transfers.

3759. You speak now of the proprietor, of course?—Yes.

3760. The in-coming proprietor should be personally approved of before he was allowed to complete his purchase; is that your proposal?—Yes, it comes to that.

3761. Is not that a very strong interference with the course of trade?—I do not think it is an unnecessary interference.

3762. I can quite understand your proposal that the proprietor of a manufactory should be required to be responsible for the conduct of the persons employed; but is not that another thing?—Of course there might be a company, and you cannot inquire into the personal character of a company, but you might require them to show that the proposed manager was a proper person for his post.

3763. You would require him to pass an examination, in fact?—No, I would not do that; but I think that if a man was unable from any personal incapacity to manage his works, he then should show that he intended to appoint a fit person to do it for him.

3764. Would it not be time to interfere when you found on visiting the factory that he had an unfit foreman or manager?—It is an extremely invidious thing to interfere under those circumstances.

3765. Would it not be still stronger to interfere to prevent a man completing a purchase of a powder mill?—I imagine that the magistrates would reasonably wish to be satisfied that the person was a person who might be safely intrusted with such things, because it affects a great number of persons outside the factory.

Mr. *Whitelaw*.

3766. With regard to Section 45, you desire to have narrowly escaped explosions reported?—Yes.

3767. By what means do you contemplate being able to secure that they should be reported?—I am afraid that some of them would not be reported; but I believe that the majority of the trade would do it loyally if it was included in the Act.

3768. Would they not rather be inclined to trust to the chance of no explosion taking place?—I can see no objection in it. I cannot see why a man should not write up to say that he had narrowly escaped an explosion; some do it of their own free will, even now.

3769. Do you really think it would occur to a manager to write and tell you that he had narrowly escaped an explosion?—I think in many cases he would appeal to it as evidence of the excellence of his precautions; but we should miss some cases, no doubt.

3770. The statistics would not be very complete, would they?—No, not entirely reliable, perhaps.

3771. Do you not think that the conclusions drawn from such a source would be unreliable also?—I am quite sure that even those that have been reported to me have suggested some precautions that have been of great value.

Mr. *Hick*.

3772. Do you not think that by putting on too many restrictions and enforcing too many conditions by Act of Parliament you would be unnecessarily interfering with the manufacture, and preventing progress and improvement?—I would hope not to impose any restrictions which would have that effect. May I add that the tendency of my scheme, as it appears to me, is to remove restrictions with regard to quantities and other details which are included in the present Act.

3773. Then I will add this question, do you not think that by enforcing strict responsibility for the consequences of an explosion you would insure the greatest possible care?—No doubt it is very desirable to get that responsibility where you can, but without some regulations I am afraid you cannot do it.

Mr. *Dillwyn*.

3774. You spoke of a reference to arbitration which you would desire in case of difference between you and the manufacturers?—Yes.

3775. Of course your object would be to get some perfectly competent people to decide between you?—Yes.

3776. Suppose a difference arose between you and Mr. Curtis, could you easily obtain an expert who knew more about it than either of you?—Yes, I think so; I think that I could name two or three whom I should be quite willing to have acting as my arbitrators; there would probably be no better authority than General Boxer, or Colonel Askwith, or Colonel Younghusband; if it was an engineering question, I might prefer to go to a military or civil engineer.

3777. That is to say, you would go to competent persons who had spare time?—I suppose they would have to be paid for it.

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Mr. ALFRED DUDLEY KEIGHTLEY, re-called ; and further Examined.

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3778. I BELIEVE that you wish to make some remarks to the Committee with reference to the suggested repeal of the Liverpool Floating Depôts Act, 14 & 15 Viet. c. 67?—Yes; I wish to make some remarks from a strictly private-owner's point of view. Although those depôts are conducted under an Act of Parliament, they were constructed expressly to compensate the gunpowder makers for the loss of previous property; they cost a very large sum of money, and if they are now to be interfered with, and if the owners are to be required to store chemical explosives in them, they would object. It is the only magazine in the neighbourhood of Liverpool; the owners say if those other explosives require storage, let the other manufacturers supply storage for themselves at a safe distance from the floating depôt.

3779. I believe that you also desire to make some remarks as to new legislation to separate the manufacture and keeping of gunpowder from all other explosives?—On the previous day on which I gave evidence I mentioned a suggestion of my own, in which other manufacturers concurred, that separate clauses in any future legislation should provide for the conditions necessary for the carrying on of the gunpowder manufacture. That has received our united attention, and clauses are being prepared by the trade with that object, which we shall submit in due course.

3780. You wish also to remark on licenses considered as personal as well as local, and to suggest that the name of the factory owner or the agent of the magazine for the time being should be registered?—I would suggest that the most convenient mode of attaining the object, which I presume is to fix the responsibility, would be to register the owner or agent for the time being; it might easily happen that a dismissed person, if the license were personal, might insist on holding it adversely to his employer. The possession of a personal license by a manager might have very inconvenient results; they are already, as a class, difficult for employers to deal with. The management of most private factories is usually vested in the resident partner of the firm or company, with whom the responsibility ultimately rests, and any interference would tend to reduce the owner's responsibility. If the factory were to change hands, the general management would nearly always remain as before; and it is admitted by Major Majendie in his report that his representations alone have been sufficient to cause the removal of one incompetent manager. In the case of a local agent or dealer in charge of a magazine, he ought to be made responsible for his magazine, rather than the remote maker of the gunpowder.

3781. Now, with regard to Section 15, as to special licenses to manufacturers; I believe that the makers strongly object to leave the power of defining regulations for the manufacture to the inspector?—That is the main point on which we are at issue with Major Majendie; the trade has now been under Parliamentary restrictions for more than 100 years, and I may say that the whole of the machinery employed in it is calculated, for its present amount of work, though I admit it is capable of far more work if it is re-

Chairman—continued.

quired, but since the passing of the Act of 1860, mill explosions have been much less frequent than they were before; here I may say it is to be regretted that we have not the return which Major Majendie wishes for, of mill explosions from time to time; but as our works are laid out to comply with the existing law, a relaxation would be unfair to the larger as compared with the smaller makers, who would work with smaller relative capitals in what is a very competitive trade; this point is adverted to by Major Majendie, on page 55 of his report, and the result of any relaxation, in my opinion, will be that the manufacturer who is able, with a smaller number of mills, to make a much larger quantity of powder, would put greater pressure on the remaining buildings of his factory in order to finish the increased output of his mills, and thereby contribute to another and a much greater source of danger; we should not object to a discretion on the part of the Secretary of State or the inspector to relax distances if local circumstances allowed of it, but we think that the quantities should be defined in the Act, and strictly adhered to by all. If relaxation, by permission of the Secretary of State or the inspector were granted, there would be considerable grievance felt; particularly in cases of "suspected" relaxation (if I may call it so) in favour of particular makers.

3782. Now, have you anything to say to the Committee as to Section 19, namely, as to the granting of common licenses for a limited term?—According to my own experience from first to last a common magazine for storing unlimited quantities of powder, such as is now permitted, never costs less than 250*l.*, and I think that the proposed term of five years is very short, considering how it would have to run the gauntlet before the renewal of the license was granted.

3783. Do you propose that any term should be substituted for that?—Yes, it should be 15 years at least, in my opinion.

3784. Have you any remarks to make on Section 24, as to the forfeiture of license by explosion?—In my former evidence I adverted to the hardship of that section. Take the case of myself, resident in the north of England, holding a magazine in South Wales, near Cardiff. I choose an agent to put in charge of the magazine, who is himself, generally speaking, an ironmonger or something of that kind. The agent employs a storekeeper, whom he puts in charge of the magazine; that man may be incompetent or neglectful, but if an explosion were to happen in that magazine, according to this proposition I should lose my magazine, because I am forbidden to re-erect it except under a special license. Major Majendie has alluded to the construction of magazines, and he mentions specially that he considered a slate magazine an unsafe one by comparison. Now one of the greatest injuries to powder is exposure to damp, and considering the usefulness from that point of view of a wooden roof properly covered with slate, I do not see why slate should be objected to.

3785. Have you any remarks to offer to the Committee on Section 25, as to restrictions on re-erection of exploded buildings?—In many factories, and I am authorised by Mr. Curtis to refer to their No. 2 factory, any re-arrangement

*Chairman—continued.*

of the buildings in consequence of a communicated explosion would amount to a confiscation of the property.

3786. May I ask if you speak for the trade?—Mr. Curtis authorised me to say that, but I cannot speak for others.

3787. You desire also to make some remarks with regard to suggestion 27, do you not?—Yes, Section 27; Major Majendie suggests that no explosives should be carried as cargo in passenger ships, except by permission of the Board of Trade. Now I mention that the African steamers plying from Liverpool habitually carry gunpowder as part of their ordinary cargo. Major Majendie also mentioned that he considered that if powder were spilt on the rails, and a passenger train went over it, it would cause an explosion inevitably. Now I tried an experiment at our factory on a small tramway. I cannot mention what the weight of powder was, but in a secluded part of the factory I placed a quantity of powder on the rails, and ran loaded trucks weighing several tons over it, and the result was to squeeze the powder out without exploding it. The trucks would be running at about the rate of eight miles an hour.

3788. Did you put the break on?—I cannot say that I did, because there would be a liability to friction there.

3789. There is one other point, I believe, namely, with regard to Paper 13, on which you wish to make some remarks?—Yes, with regard to Paper 13, there is one special instance that I wish to draw attention to in order to make some remarks on the suggestions themselves. The special instance which concerns myself is that under the head of dangerous proximity of buildings to one another in the factory which I represent. It is here stated as to No. 8 factory, "I drew attention by letter, in November 1871, to the dangerous position of the charge house. That was admitted in the reply which I received, but in August 1872, it had not been altered, it was only about to be altered." I will not trouble the Committee with reading the whole of Major Majendie's report, but with reference to his drawing attention to the dangerous position of this charge-house, I may mention that the charge-house had existed for 110 years, and had never been injured by any explosion of mills near it at all. On the receipt of Major Majendie's letter I immediately endeavoured to find a more suitable position to put this charge-house in, within the area of the mills, but I could not find one, and as no explosion had ever injured it I considered it safer to leave it where it was. But in order to comply with the purport of a suggestion which was made in consequence of a door opening on a public road very little frequented and of the possible danger by workmen in passing striking matches on the door, I wrote to Captain Smith asking for an interview with him. I showed him a plan of the works, and received his approval of the plan of a protection to the door which I proposed. This was in December 1871, and in February or March the following year the whole of that plan was carried into effect. I received from Captain Smith, after the inspection of our factory in August 1872, a letter, dated Keswick, in which he says, "I ought to have written to you before this to say that I passed your mills at Bassenghyll on my way to Sedgwick, and looked in and found all correct." Major Majendie told me to-day that Captain Smith had reported that the factory was

*Chairman—continued.*

only about to be altered. It is possible that there may have been some repairs going on, but substantially the promised repairs had been completed at the time named. I wish to remark here on the very great candour with which Major Majendie has to-day admitted that there are differences of opinion on which manufacturers ought not to be condemned merely because they happen to be put on this black list.

3790. I suppose that that expression "black list" is your own?—We have all felt, with 89 charges brought against us, as if we were under a heavy indictment, but I feel, as I have already said, very much obliged to Major Majendie for his extreme candour; with regard to the question under B 2, as to the dangerous proximity of buildings to each other, that is admitted to be a matter of opinion between Major Majendie and ourselves; I observe that in factory No. 23 the proprietors are said to have added to the danger by putting up wood linings with iron nails; now, if iron nails are embedded in wood and then covered with soft material, such as putty, I cannot see that there is any danger in such iron nails.

3791. But you prefer copper nails, I suppose?—Yes, we prefer copper nails, in consequence of the prevalent theory on the subject; then with respect to the question of lightning conductors, Sir William Snow Harris's opinion was the means of introducing into the ships of the Royal Navy the present admirable arrangement; but they have there a large number of men who are capable of seeing that the surfaces of the conductors are kept bright, but if you have, say on a church steeple, a lightning conductor of an ordinary kind, in which there are many soldered joints which are inaccessible for cleaning, examination, or repair, but which are liable to oxidation and decay, it may happen that when the flash of lightning strikes the steeple you would find that the conductivity of the lightning rod is broken, and that thereby you have created a greater danger than you wished to avoid; another point which the powder makers feel is that with dust blowing from the doors of their buildings there may be more danger by having your lightning conductor absolutely attached to the building than in having it detached, or, at all events, having it placed against a mast or tree to the house, connected and insulated, than in having it absolutely attached without insulation; at least, I feel so myself.

3792. Then with regard to the miscellaneous regulations with reference to grinding charcoal in the mixing house, and so on?—I do not conceive that there is any danger in grinding charcoal, providing the charcoal is made into gunpowder mixture or removed from the mixing house as fast as it is ground. I cannot see any danger whatever in it. The danger consists in having a quantity of ground charcoal about, which is very liable in the freshly-burnt state to attract oxygen, and so set up spontaneous combustion. That is a subject of danger, but it is a question of storage more than of the actual process of grinding. I have endeavoured to pay some attention to the classification of these "disregarded" suggestions, and I think that if they were examined arithmetically it would be found that the number of neglected recommendations would be much diminished, but after the extremely candid evidence of Major Majendie to-day, I should be very sorry to go into any arithmetical question with him.

Mr.  
Keightley.  
12 June  
1874.

Mr. Whitwell.

3793. There is one question which I wish to ask you, namely, with reference to taking gunpowder in open barrels; are you in the habit of doing that?—We are in the habit of moving our powder in trucks carrying large tubs, which contain about 150 lbs. each, and over them is always thrown a tarpaulin, but with regard to the charges for the mills, the powder is carried from and to the charge houses on open barrows, but it is enclosed in bags, and thereby made safe from general danger. If it is wetted in transit it is more a question of the quality of the powder than anything else.

3794. With regard to inspection, I suppose you have been long enough in trade to value the opinion of the older hands in your works?—I should never venture to differ from them.

3795. You consider, do you, that the opinion of men who know that their lives are in danger, and who have been in the works for 40 years, cannot be lightly passed by?—Certainly not.

3796. You would not be surprised if manufacturers who had conducted their business satisfactorily for many years, with the help of the experience that they themselves had gained, and that of those around them, should hesitate in adopting the suggestions of some future inspector who knew nothing about gunpowder or gunpowder works?—We would be decidedly disposed to resist such suggestions by all the means in our power.

3797. You would, perhaps, think that the inspection ought to be administered simply in accordance with the prescribed rules and regulations?—Yes.

3798. You say that you approve of the present lightning conductor because you think it is safe?—Yes.

3799. If in a point in which you deliberately

Mr. Whitwell—continued.

adopted a given course, founding yourselves on your own experience, and knowing that you risk your own property and the lives of your people, you were overruled by an inspector, would not that have a very strong tendency to diminish the sense of your responsibility?—I should be disposed to say that I would not do it, except on a written order, and that the inspector should take the responsibility.

3800. Then with regard to the licenses being limited to 30 years, may I ask if the establishment of gunpowder works is not a very costly matter?—Yes, the plant is excessively dear.

3801. Can you give any approximation to the cost?—Yes.

3802. Cannot you give any approximation to the cost of a factory, say of 10 mills?—I would give as an approximation the cost of one of 20 mills; the outlay on plant and earthworks without any value for land is not less than from 50,000*l.* to 60,000*l.*

3803. You think that it would enhance the price of gunpowder very much if that 50,000*l.* was to be recouped to the manufacturer in the course of 30 years, I suppose?—Yes, certainly.

3804. Especially if he charges only ordinary interest on his capital?—He never charges more, and is glad to get it.

3805. In order to be recouped, if that factory had only a life of 30 years, he would have to raise the price of gunpowder or anything else that would be manufactured, and charge the increase in the vend of it to the public?—Yes, if the conditions of a highly competitive trade would let him.

3806. The public would thus not only have to pay for the additional provisions against danger, but also for the recouping of the expenditure so far?—Yes, certainly.

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## Appendix, No. 1.

PAPERS handed in by Major *Majendie*, R.A., 5 May 1874.

### STORE MAGAZINES FOR GUNPOWDER.

TABLE showing DISTANCES in YARDS of existing Inspected STORE MAGAZINES from nearest House, &c., when under half a Mile. (From Inspection Reports.)

Index Number of Magazines.	Approximate Capacity.	Distance from Nearest							REMARKS. If marked * Mineral Railway only.
		House.	Factory.	Charitable Institution.	Road.	Railway.*	River or Canal Bank.	Sea Wall.	
	<i>Tons.</i>								
1	50	-	-	-	-	-	150	-	
2	-	-	-	-	-	-	-	-	
3	75	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	
6	12	600	-	-	15	-	Close to	-	
7	15	180	-	-	-	70	-	-	
8	50	450	-	-	450	? 500	? 500	-	
9	15	200	-	-	15	100	-	-	
10	15	-	-	-	-	-	-	-	
11	25	300	-	-	-	80*	-	-	
12	20	80	-	-	15	80*	-	-	
13	30	128	-	-	? 450	168 (a)	-	-	(a) But in a cutting.
14	-	-	-	-	-	-	-	-	
15	30	200	-	-	165	-	-	-	
16	40	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	
18	-	-	-	-	-	-	-	-	
19	-	-	-	-	-	-	-	-	
20	-	-	-	-	-	-	-	-	
21	10	-	-	-	-	-	-	-	
22	20	-	-	-	-	-	-	-	
23	-	-	-	-	-	-	-	-	
24	15	144 (b)	-	-	190	-	-	-	(b) Village beyond, about 160 to 190 yards.
25	-	-	-	-	-	-	-	-	
26	75	300	-	-	700	700	-	-	
27	30	450	-	-	25	-	-	-	
28	35	250	-	250	200	-	-	-	
29	-	-	-	-	-	-	-	-	
30	12	37 (c)	-	70 (d)	37	450	-	-	(c) Others at 150 and 260 yards. (d) Another at 183 yards, and another at 170.
31	8	250	-	-	22	-	-	-	
32	-	-	-	-	-	-	-	-	
33	15	-	-	-	-	-	-	-	
34	80	-	-	-	-	-	-	-	
35	15	180 (e)	-	-	500	-	-	-	(e) Others 200 to 300 yards.
36	30	15 (f)	-	-	20	450	-	-	(f) In the middle of a village.
37	15	150	70	-	150	300	-	-	Well sheltered, on slope of a hill.
38	15	? 250	-	-	150	-	-	-	
39	250 (? 300)	60 (g)	-	? 500	450	200	Close to (h)	-	(g) Others at 100 and about 450 yards. (h) But on higher level.
40	-	-	-	-	-	-	-	-	

N.B.—In the case of those magazines of which the index numbers only are given, the distances have not been ascertained or recorded with sufficient accuracy to justify their insertion in this Return.

TABLE showing Distances in Yards of existing Inspected Store Magazines from nearest House, &c.—*continued.*

Index Number of Magazines.	Approximate Capacity.	Distance from Nearest							REMARKS. If marked * Mineral Railway only.
		House.	Factory.	Charitable Institution.	Road.	Railway.*	River or Canal Bank.	Sea Wall.	
41	30	-	-	-	-	-	-	-	
42	-	-	-	-	-	-	-	-	
43	-	-	-	-	-	-	-	-	
44	-	-	-	-	-	-	-	-	
45	-	-	-	-	-	-	-	-	
46	-	-	-	-	-	-	-	-	
47	-	-	-	-	-	-	-	-	
48	-	-	-	-	-	-	-	-	
49	-	-	-	-	-	-	-	-	
50	-	-	-	-	-	-	-	-	
51	-	-	-	-	-	-	-	-	
52	-	-	-	-	-	-	-	-	
53	-	-	-	-	-	-	-	-	
54	30	-	-	-	-	-	-	-	
55	-	-	-	-	-	-	-	-	
56	50	-	-	-	-	-	-	-	
57	-	-	-	-	-	-	-	-	
58	-	-	-	-	-	-	-	-	
59	8	450	-	-	20 (a)	-	-	-	(a) Bye road.
60	8	50 (b)	-	400	50	400	-	-	(b) And others thenceforward.
61	10	? 450	-	-	300	400	-	-	
62	-	-	-	-	-	-	-	-	
63	15	-	-	-	-	-	-	-	
64	45	200	140 (c)	-	? 25	-	-	-	(c) Another at 200.
65	-	-	-	-	-	-	-	-	
66	5	-	-	-	-	-	-	-	
67	20	-	-	-	-	-	-	-	
68	20	-	-	-	-	-	-	-	
69	20	-	-	-	-	-	-	-	
70	20	275	-	-	100	36	-	-	
71	40	250	-	-	-	? 50	-	-	
72	-	-	-	-	-	-	-	-	
73	10	-	-	-	-	-	-	-	
74	-	-	-	-	-	-	-	-	
75	-	-	-	-	-	-	-	-	
76	-	-	-	-	-	-	-	-	
77	2	300	-	-	100	-	-	-	
78	3	192	-	-	400	700	-	-	
79	2	250	250	-	80	-	-	-	
80	12	104	-	550	550	180	-	-	
81	3	87 (d)	130	103	83	-	-	-	(d) Another at 110 yards. 333 yards to parish church.
82	12	250	450	-	-	-	-	-	
83	2	25 (e)	-	-	5	-	120 (f)	-	(e) A row of houses. (f) Dunkeld Bridge.
84	1	30 (g)	-	-	40	-	-	-	(g) And opposite side of street, 50 yards.
85	8	173 (h)	-	-	250	700	-	-	(h) A row of cottages.
86	5	82 (i)	-	200	90	-	-	-	(i) Other cottages, 200 to 250 yards.
87	100	210	400	-	Close	-	-	-	
88	15	150 (j)	? 350	150	Close	300	-	-	(j) More at 200 yards.
89	150 (? 250)	80 (k)	250 (l)	-	-	-	10	-	(k) Others 200 to 250 yards. (l) Southern outfall about quarter-of-a-mile.
90	300	100	300 (m)	-	-	-	Close	-	(m) Other works about half-a-mile.
91	20	310	-	-	Close	-	-	25	
92	2	300	-	-	30	-	10 (n)	-	(n) Above the level of the canal.
93	20	170 (o)	300	-	-	-	-	-	(o) Village about 300 yards.
94	-	-	-	-	450	-	-	-	
95	10	-	-	-	400	-	-	-	
96	-	-	-	-	100	-	-	-	
97	5	28	-	-	41	-	-	-	
98	250 tons.	-	-	-	-	-	-	-	Floating magazine in the Thames.
99	20	700	-	-	30 (p)	-	Close	-	(p) Bye road. Main road 450 yards.
100	8	60	-	-	250	200	-	-	

N.B.—In the case of those magazines of which the index numbers only are given, the distances have not been ascertained or recorded with sufficient accuracy to justify their insertion in this Return.

TABLE showing Distances in Yards of existing Inspected Store Magazines from nearest House, &c.—*continued.*

Index Number of Magazines.	Approximate Capacity.	Distance from Nearest							REMARKS. If marked * Mineral Railway only.
		House.	Factory.	Charitable Institution.	Road.	Railway.*	River or Canal Bank.	Sea Wall.	
101	<i>Tons.</i> 5	600	-	-	95	-	-	-	
102	25(a)	?350	-	-	-	-	450	-	(a) Limited by license to 20 tons. Well screened.
103	10	170	-	-	Close	-	-	-	
104	15	100	-	-	-	300	-	-	
105	24	174	-	-	154	-	-	-	
106	5	-	-	-	-	-	90	-	
107	25	150	-	-	-	-	70	-	
108	2	? 250(b)	-	-	-	-	250*	-	(b) Village.
109	4	Close	-	-	Close	-	-	-	
110	35	21(c)	-	-	100	450	-	-	(c) Others about 100 yards scattered about.
111	7½	? 250	500	-	-	-	Close	-	? License limited to three tons.
112	10	-	300	-	-	-	-	-	
113	100	46(d)	200	-	-	-	Close	-	(d) 120 yards from a row of cottages; only 33 paces from No. 114 magazine.
114	125	50(e)	150	-	-	-	Close(f)	-	(e) Many cottages 50 to 70 yards. (f) But a double river wall.
115	100	50	-	-	-	-	Close	-	
116	35	-	-	-	100	300	-	-	
117	40	? 500	-	-	250	-	-	-	
118	5	? 150	-	-	100	450*	-	-	
119	40	200(g)	-	600	250	200	30(h)	-	(g) Several cottages. (h) Canal bank strengthened by 30 feet of refuse.
120	25	-	150	-	300	-	Canal below.	-	
121	50	50	450	-	15	-	5	-	
122	15	? 350	-	-	-	-	-	-	
123	10	250	-	-	400	-	-	-	
124	20	450	-	-	-	? 120*	-	-	
125	20	? 350	-	-	100	? 350	-	-	
126	15	450	-	-	-	-	(i)	-	(i) Outside an embankment, apparently above high water, except very high tide. Six magazines near one another, on bank of River Usk.
127	150	400	-	-	-	-	(i)	-	
128	200	400	-	-	-	-	(i)	-	
129	30	400	-	-	-	-	(i)	-	
130	60	90	-	-	-	-	(i)	-	
131	45	150	-	-	-	-	(i)	-	
132	?	-	-	-	-	-	-	-	Closed.
133	14	300	-	-	-	-	-	5(j)	(j) Not liable to inundation.
134	15	-	-	-	-	-	-	(k)	(k) On sea bank, above high water.
135	40	400	-	-	150	-	-	-	
136	40	100	-	150(l)	40	70	-	-	(l) Primitive Methodist Chapel, built since magazine.
137	35	200	-	-	450	-	-	-	
138	20 ? 30	250	-	-	200	-	-	-	
139	?	300	-	-	300	-	-	-	Closed.
140	15	300	-	-	450	-	-	-	
141	25	-	-	-	-	-	-	-	
142	50	100	-	100	90(m)	-	-	-	(m) A mountain road passes close to magazine.
143	40	400	-	-	400	-	-	-	
144	7	53(n)	150	-	-	120*	-	-	(n) Two cottages; more at 100 yards, and from 300 to 400 yards. Screened.
145	12	300	-	-	50	450	-	-	Screened.
146	4	-	-	-	20	-	-	-	Screened.
147	30	100	-	-	40	? 60	-	-	Screened.
148	15	40	-	-	-	20	-	-	Cottage and railway built since magazine.
149	25	150	150	-	150	150	-	-	} A few yards apart.
150	40	150	150	-	150	150	-	-	
151	30	65	-	-	-	50	-	-	} Very near together.
152	20	150	-	-	-	150	-	-	
153	20	150	-	-	-	150	-	-	
154	10	-	-	-	300	200	-	-	
155	30	100(o)	-	-	50(p)	600	-	-	(o) Others at 200 yards, and more at 300 to 400 yards. (p) Bye road. High road at 200 yards.
156	6	500	-	600	400	700	-	-	
157	4	75	-	-	450	-	-	-	Sheltered.

N.B.—In the case of those magazines of which the index numbers only are given, the distances have not been ascertained or recorded with sufficient accuracy to justify their insertion in this Return.

TABLE showing Distances in Yards of existing Inspected Store Magazines from nearest House, &c.—*continued.*

Index Number of Magazines.	Approximate Capacity.	Distance from Nearest							REMARKS. If marked * Mineral Railway only.
		House.	Factory.	Charitable Institution.	Road.	Railway.*	River or Canal Bank.	Sea Wall.	
158	Tons. 30	100	-	-	50	-	110	-	
159	50	150	-	-	40	-	70	-	
160	30	450	-	-	450	-	50	-	
161	35	450	-	450	450	50(a)	-	-	(a) Railway on a 50 feet embankment. Magazine below.
162	15	300	-	-	10	-	-	-	
163	10	200	-	-	200	450	-	-	
164	2	400	-	-	-	-	200	-	
165	10	? 250	-	-	250	200*	-	-	
166	4	300	-	-	-	450	200	-	
167	20	450	-	-	450	-	10	-	
168	40	150	80	-	400	450	-	-	Magazine in a hollow.
169	8	450	-	-	120	-	-	-	
170	20	180	-	-	200	-	10	-	
171	-	120(b)	100	-	Close	-	30	-	(b) A few cottages.
172	30	400	-	-	100	-	-	-	
173	40	-	-	-	100	-	-	-	} Only seven yards apart.
174	40	-	-	-	100	-	-	-	
175	5	400(c)	-	-	150	450	-	-	(c) Houses newly erected.
176	50	160	-	-	100	-	-	-	
177	40	? 300	-	-	250	250*	-	-	Sheltered.

N.B.—In the case of those Magazines of which the index numbers only are given, the distances have not been ascertained or recorded with sufficient accuracy to justify their insertion in this Return.

Home Office, Whitehall, }  
April 1874. }

V. D. Majendie, Major, R.A.,  
Her Majesty's Inspector of Gunpowder Works.

#### CIRCULAR to Town Clerks.

Home Office, Whitehall, London, S.W.,  
29 November 1871.

Sir,

HAVING been directed by the Home Secretary to inquire into the practice of the trade in gunpowder, fireworks, and other explosives, with a view to arriving at a basis of amended legislation, which would be more satisfactory to the trade and safer to the public, I have the honour to request that you will favour me with such observations and suggestions on this point as your experience may dictate.

The points on which I am specially anxious to have the benefit of your opinion are the following:—

1st. The quantity of gunpowder, fireworks, or other explosives to be permitted to be kept by any dealer within a city.

2nd. The conditions under which such powder, fireworks, cartridges, or explosives should be kept and sold.

3rd. As to the desirability of requiring all dealers in gunpowder, cartridges, and other explosives to be duly licensed, and how such licenses should be obtainable.

4th. As to the desirability of frequent recurrent inspection by competent officers of all premises in which gunpowder, fireworks, cartridges, and explosives are kept.

5th. As to the desirability of requiring every dealer to provide a suitable certified receptacle or magazine for his powder, &c., and to register at the police and fire brigade stations the precise locality where such magazine or receptacle is situated; and whether it should be incumbent on dealers to place the magazine or receptacle outside the dwelling-house.

6th. As to the restrictions and precautions to be imposed with regard to the transport of gunpowder, fireworks, and other explosives through the streets of cities.

7th. As to the desirability of forbidding the sale of gunpowder, &c., by gas, candle, or other artificial light.

8th. As to the practicability and advisability of providing a "City magazine" at a convenient distance from the City, for the deposit of the gunpowder dealers' stores, as is done in the principal Scotch towns.\*

9th. Generally any suggestions having reference to any special local circumstances connected with the trade in gunpowder, fireworks, &c., which you may think it worth while to make, will be acceptable.

I have, &c.

The Town Clerk of

\* In the case of seaport towns, or towns situated on large rivers, some suggestions may perhaps occur with reference to the shipment and unshipment of powder, &c.

ABSTRACT of REPLIES received from LORD MAYOR of LONDON, TOWN CLERKS, and  
CONSERVATORS of the THAMES.

Birmingham - - -	Dealers to be licensed and subject to local inspection. Quantity (within 100 yards of dwellings) not to exceed 100 lbs. Inspection (without warrant) of suspected places. (Calls attention to "Webley v. Woolley" as illustrating necessity for amendment of present law.)
Brighton - - -	Quantity to be limited to 14 lbs. Only canisters to be used, and these not to contain more than 1 lb. each. Dealers to be licensed and subject to local inspection. Detached places of storage to be provided. Transport to be only in certified conveyances. Public magazines to be provided.
Bristol - - -	Agrees with report of chief constable of Bristol. Licenses to be for one year only. Increased powers of supervision to be given to police.
Conservators of the Thames.	Adhere to suggestions contained in letter of 16th November 1864. (See Parliamentary Papers, "Gunpowder, 1865.")
Deal - - -	Dealers to be licensed and subject to inspection.
Dover - - -	Dealers to be licensed (implied rather than expressed). Licenses to be annual.
Durham - - -	Gunpowder to be sold only in sealed canisters. Dealers to be licensed and subject to local inspection. Special receptacles or detached places for storage to be provided. Transport to be at night only. No sale by artificial light. Public magazine to be provided.
Hastings - - -	Dealers to be licensed and subject to inspection. Proper receptacles to be provided.
Hull - - -	Quantities to be regulated by local circumstances. Dealers to be licensed. Proper receptacles to be used. No sales by artificial light. (Thinks present law as to retail unsatisfactory.)
Liverpool - - -	Dealers to be licensed and subject to local inspection. (At present in Liverpool all persons having over 50 lbs. have to register.) Quantities to be limited. Transport to be under local regulations. (Ascribes immunity from accidents since explosion "Lottie Sleigh," with 11 tons, on 15th January 1864, to the vigilance and supervision exercised by virtue of the local Act. These regulations are very detailed, and include provision as to regulation of transport, places of loading and unloading, receptacles for storage, licensing of gunpowder hoys.)
Lord Mayor of London	Only very small quantities to be kept in populous cities. Explosives to be kept only in proper receptacles (if possible, top storey of house). Dealers to be licensed and subject to local inspection. No sale by artificial light, except enclosed lamps.
Manchester - - -	Agrees with the report of the chief constable of Manchester.
Newcastle-upon-Tyne -	Limit to be 100 lbs. Separate receptacle at top of house to be provided. Dealers to be licensed and under local (police) inspection. Public magazines to be provided in large towns.
Plymouth - - -	Dealers to be licensed and subject to local inspection. Quantities and places of storage to be fixed by local regulations. Public magazine desirable, but sees difficulty in way of establishing it.

App. No. 1.

ABSTRACT of Replies received from Lord Mayor of London, Town Clerks, &c.—*continued.*

Portsmouth - - -	Present quantities to be reduced. Dealers to be licensed and under local inspection ("without inspection the mere granting of licenses would be no safeguard to the public"). In large towns no dealer in petroleum to be licensed to store explosives. Transport to be at stated hours only, and under local regulations. No sales by artificial light. Public magazine to be provided for large towns.
Stafford - - -	Agrees with report of chief constable of Stafford.
Wigan - - -	Quantities to be limited. Dealers to be licensed and subject to local inspection. Transport to be in properly constructed vehicles only, and under police permit. (Instances fatal results of reckless use of powder in mines.)
York - - -	Dealers to be licensed and subject to inspection. Explosives to be stored only in suitable certified receptacles. Quantities to be limited, and local regulations to be adopted, and no sale by artificial light. Transport to be in early morning and in proper vehicles. Public magazine to be provided for towns where large quantities of explosives are kept.
Bath - - -	} Nil.
Carnarvon - - -	
Gravesend - - -	
Leeds - - -	
Swansea - - -	
Wolverhampton - - -	

## CIRCULAR to Head Constables of Boroughs.

Sir,

Home Office, Whitehall, 10 November 1871.

HAVING been instructed by the Secretary of State for the Home Department to inquire into the subject of the manufacture, storage, and transport of gunpowder and other explosives, with a view to arriving at a basis of amended legislation which would be more satisfactory to the trade, while affording greater security to the public, I have the honour to request that you will favour me with any suggestions and observations upon the subject which your experience may suggest.

I shall be especially glad to have the benefit of your opinion upon such points as the following:—

1st. The nature of restrictions to be imposed upon the storage and sale of explosive articles, as to quantity, manner of storing, &c.

2nd. The regulations to be adopted for the safer conveyance of explosive substances, especially in populous districts.

3rd. The regulations to be adopted for the safer loading and unloading of vessels and other craft containing gunpowder, &c.

4th. What provisions should be made to obtain a more complete and effectual supervision of places in which gunpowder and other explosives are stored.

5th. As to any alteration in the mode of procedure against offenders under the Gunpowder Acts, and in the penalties for offences under those Acts, which your observation may have led you to consider advisable.

6th. Generally, any suggestions with regard to amendments, which, in your opinion, should be introduced in a new Act.

I shall esteem it a favour if you can let me have your remarks on the above points with as little delay as possible.

I have, &amp;c.

(signed)

V. D. Majendie,

Captain Royal Artillery.

The Head Constable of the  
Borough of



ABSTRACT of REPLIES received from CHIEF CONSTABLES and SUPERINTENDENTS of POLICE.

Bedford (Borough)—Chief Constable - - -	Public magazine to be provided. Retailers to be licensed (license not less than 1 l.). 50 lbs. to be limit of quantity. Inspection by Chief Officer of Police. Not less than 1 lb. to be sold to any person. Register to be kept of all persons who buy.
Berks—Chief Constable - - -	Chief Officer of Police to be empowered to grant search warrants.
Blackburn—Chief Constable - - -	Public magazine for every town of over 20,000 inhabitants. Dealers to be strictly limited in quantity. Dealers to be licensed and under local inspection.
Bolton-le-Moor—Chief Constable - - -	Police to have power of search without warrant. Present quantities to be reduced.
Brecon—Chief Constable - - -	Quantities above 10 lbs. to be in fire-proof safes or detached stores. Dealers to be registered and under local inspection.
Bristol—Chief Constable - - -	Retailers to be licensed (after inspection). Local inspectors to be appointed.
Bucks—Chief Constable - - -	"Greater restrictions" to be placed on dealers.
Cardiganshire—Chief Constable - - -	Limit of quantity to be considerably reduced.
Carlisle—Chief Constable - - -	Retailers to be licensed.
Chester—Chief Constable - - -	Dealers to be registered, and subject to local inspection. (Search warrants, unsatisfactory; mention case of a boy sticking a lighted candle into a barrel of gunpowder thinking it was seeds.)
Coventry—Chief Constable - - -	No explosives to be kept except in special detached store. Covered conveyances only to be used, and to be legibly marked. Transport to be in daytime only. Local police inspection, and search without warrant.
Cumberland and Westmoreland—Chief Constable	Covered conveyances to be used. Shipment and unshipment to be under local supervision. Local inspection. Minimum penalty to be fixed.
Denbighshire—Chief Constable - - -	Retailers to be limited to 50 lbs.
Devizes—Chief Constable - - -	Quantities allowed to be kept to be reduced. Powder to be sold only in closed cases or canisters. Covered vehicles only to be used for transport.
Devonport—Chief Constable - - -	Dealers to be placed under similar restrictions to dealers in petroleum. (Petroleum Act includes license and local inspection.)
Dorchester—Chief Constable - - -	Dealers to be licensed. Special places of storage to be provided. No sales after dark. Powder to be sold only in closed cases or canisters. Proper conveyances to be provided, and transport to be under local restrictions. Local inspection. Minimum penalty.
Dover—Chief Constable - - -	Quantity kept by retailers to be reduced to 100 lbs. Larger quantities to be in special detailed stores. Local inspection.
Dudley—Chief Constable - - -	Public magazine to be provided. Special vehicles to be used for transport. Quantities allowed to be kept by dealers and others to be reduced.
Dunstable—Chief Constable - - -	Dealers to be licensed and under local inspection. Explosives to be kept in small quantities in proper receptacles.
Durbam (County)—Chief Constable - - -	Would not propose any additional restriction except as to transport.

ABSTRACT of Replies received from Chief Constables and Superintendents of Police—*continued.*

Flintshire—Chief Constable	-	-	-	-	Proper places of storage to be provided. Transport through towns to be forbidden when practicable. Local inspection. Dealers to be licensed.
Glamorgan—Chief Constable	-	-	-	-	Retailers to register. Special receptacles or places of storage to be provided. Covered carts only to be used for transport. Minimum fine to be laid down by statute.
Glossop—Chief Constable	-	-	-	-	Explosives to be kept in specially provided stores. Local inspection.
Gloucester (Borough)—Chief Constable	-	-	-	-	Public magazine to be provided.
Hanley—Chief Constable	-	-	-	-	Dealers to be licensed and under local inspection. Covered vans only to be used, and no transport after dark. Minimum penalty to be fixed.
Hartlepool—Chief Constable	-	-	-	-	Police inspection. Public magazine. Retailers to register. Firework licenses in boroughs to be granted by justices.
Herefordshire—Chief Constable	-	-	-	-	Explosives to be stored only in proper magazines.
Hertford (Borough)—Chief Constable	-	-	-	-	Special stores to be used, and not entered after dark. Transport to be in special covered vans and under police supervision. Special wharves or places, if landed, to be appointed. Dealers to be licensed, and under local inspection. Present penalties to be increased.
Huddersfield—Chief Constable	-	-	-	-	Retailer's limit (in towns) to be 10 lbs. Public magazine to be provided. Restrictions on carriage. Power of entry and seizure by police on order by mayor or magistrate.
Hull—Chief Constable	-	-	-	-	Dealers to be licensed and under local inspection.
Ipswich—Chief Constable	-	-	-	-	Local inspection. Transport to be under local supervision.
Kent—Chief Constable	-	-	-	-	Special detached stores to be provided for explosives. Special dress and shoes to be worn. All explosives to be carried in covered vans. District Inspectors to be appointed.
King's Lynn—Chief Constable	-	-	-	-	Dealers to be licensed and under local inspection. Fireproof receptacles to be provided for storage.
Lancashire—Chief Constable	-	-	-	-	Local inspection. Dealers to be licensed Sales to be between sunrise and sunset only. Quantity to be limited to 25 lbs. (without license). Powder to be sold only in closed canisters or cases. Powder to be conveyed only in approved vehicles. Powder to be duly declared and cases to be labelled.
Leeds—Chief Constable	-	-	-	-	Strongly in favour of Borough Magazine. Retailers to be under inspection and licensed. Inspectors to have power of immediate search on suspicion.
Leominster—Chief Constable	-	-	-	-	Local inspection. Detached places of storage to be provided.
Lichfield—Chief Constable	-	-	-	-	Dealer to be licensed; retail limit to be 50 lbs.
Liskeard—Chief Constable	-	-	-	-	Regulations as to storage to be more stringent. Police to have power to search without warrant. Regulations as to transport to be more stringent. (Instances case of seizure of powder in transport when leakage had occurred, and a train was being laid as cart proceeded.)
London (City of)—Chief Commissioner of Police					License for retail dealer, with a power of entry and inspection. Vehicles used to be registered. Magazine for seized explosives to be provided.
Maidstone—Chief Constable	-	-	-	-	Quantities above 10 lbs. to be stored in detached store.

ABSTRACT of Replies received from Chief Constables and Superintendents of Police—*continued.*

Manchester—Chief Constable - - - -	Special place of storage to be provided. Local inspection. Covered vans only to be used for transport.
Metropolitan Police: 1st Division—District Superintendent - -	Quantity allowed to be kept to be reduced. Explosives to be kept only “in a properly fitted room.” Dealers to be licensed (this is implied rather than expressed). Explosives to be carried only in covered licensed van, and legibly marked “Powder Van,” and to be under special regulations. All powder craft to be licensed and special place of shipment appointed. Local inspection and special powers of entry.
H Division—Superintendent - - - -	Dealers to be licensed and name written on outside of premises. Quantity to be limited. To be carried only between sunrise and sunset. Dealers to be subject to local supervision. Suspected places to be entered (on written authority by District Superintendent) without warrant.
G Division—Superintendent - - - -	Quantities to be greatly reduced. No sales to take place after dark. Distances for manufacture of fireworks to be increased. Transport to be in covered vans only. Places for loading and unloading to be appointed. Dealers to be licensed, and the fact legibly written on premises.
K Division—Superintendent - - - -	Quantities above 25 lbs. to be in properly constructed places only. No sales after dark. Transport to be in covered vans only, and under regulations. Dealers to be licensed. Shipment and unshipment only at appointed places.
V Division—Superintendent - - - -	Proper places of storage only to be used. Quantity in neighbourhood of houses to be reduced. Dealers to be licensed. Powder in “large quantities” to be carried only in covered vans. Water carriage of powder to be under regulation. District Inspectors to be appointed.
N Division—Superintendent - - - -	Dealers to be licensed. Explosives not to be sold to persons under 16. Premises of dealers to be inscribed with license. (About 200 persons sell gunpowder in this division, who keep each under 10 lbs.)
Thames Division—District Superintendent -	(States that in 1870–71 “immense quantities of gunpowder and other explosives were conveyed through the Metropolis in open carts to Blackwall, then transferred from land to water carriage. “On the 27th December 1870, 15 vehicles loaded with barrels of gunpowder, about 20 tons, were sent from Camden Town to Blackwall Stairs, a densely populated neighbourhood, to be shipped off. “The whole of the loaded vans were detained in the shed for some time, waiting the arrival of the barges to take in the cargo. The whole of the operations being in compliance with the law the police had no legal power to interfere”.) Explosives to be carried only in covered vans, and at a certain distance apart. (“On the 26th November 1870, 100 barrels of powder, five tons, were seized by the police of the division; brought from Camden Town Railway Station, in two open vans,” and the powder was forfeited.)

ABSTRACT of Replies received from Chief Constables and Superintendents of Police—*continued.*Metropolitan Police—*continued.*Thames Division—District Superintendent—*continued.*

- (“The practice of transferring gunpowder from land to water carriage, and *vice versa*, at public landing places, viz.: Wapping Dark Stairs, High-street, Wapping, and Blackwall Stairs, has been carried on for many years, and it is a common practice for men to be standing about the spot, smoking their pipes, while such transfers are being carried on.” But there is nothing contrary to the Act in this.)  
Special places of shipment, &c., to be appointed.
- 2nd Division—District Superintendent - - - Concurs in views of his Divisional Superintendents.
- D Division—Division Superintendent - - - Special places of storage to be provided,  
Quantity to be limited  $\left\{ \begin{array}{l} 100 \text{ lbs. for dealers.} \\ 25 \text{ lbs. for non-dealers.} \end{array} \right.$   
Properly packed and under regulations.  
Dealers to be under local inspection.  
Suspected places to be liable to search without warrant.  
No explosive to be sold to persons under 16.  
Properly constructed vans only to be used for transport, and to be carried only under a pass.
- E Division—Division Superintendent - - - All explosives to be so manufactured and stored that an explosion would not injure others.
- S Division—Division Superintendent - - - Quantities about 7 lbs. to be stored apart from buildings.  
Vans used in transport to be legibly marked.  
Local inspection.
- X Division—Division Superintendent - - - Public inspector to be approved to enforce Acts.
- Y Division—Division Superintendent - - - Quantities to be greatly reduced (10 lbs. to non-dealers).  
Explosives to be kept in detached stores.  
No transport after dark.  
Dealers to be licensed (implied rather than expressed).
- 3rd District—District Superintendent - - - Agrees generally with his Division Superintendents.
- A Division—Division Superintendent - - - Dealers to be licensed (implied rather than expressed).  
Special places of storage to be provided.  
Local inspection.  
Transport to be in properly constructed vehicles only; and not after dark except from midnight to 6 a.m.  
Register of buyers to be kept.
- B Division—Division Superintendent - - - Transport to be only between 1 and 5 a.m.  
Local inspection.
- C Division—Division Superintendent - - - Quantity carried to be reduced.  
Transport to be during night only.  
Local inspection (especially with regard to gunmakers filling cartridges).  
Quantity to be reduced.
- T Division—Division Superintendent - - - Dealers to be licensed, and all sales to be recorded.  
Quantities to be reduced.  
Transport to be in covered vehicles only, and by permit (for large quantities).  
Local inspection.
- V Division—Division Superintendent - - - Local inspection and search without warrant.  
Regulations as to transport to be more stringent in the case of small dealers.
- No. 4 District—District Superintendent - - - Quantities allowed to be carried to be reduced.  
Proper vehicles to be provided.  
District inspectors to be appointed.  
Dealers to be licensed.
- L Division—Division Superintendent - - - Storage to be in properly constructed detached stores.  
Covered vans only to be used for transport.  
Dealers to be registered.  
(Trade in explosives to be largely carried on in unsuitable places.)
- M Division—Division Superintendent - - - Dealers to be licensed.  
Explosives to be kept only in isolated stores.  
Loading of powder to be regulated.  
Local inspection and search without warrant.  
Register of purchasers to be kept.

ABSTRACT of Replies received from Chief Constables and Superintendents of Police—*continued.*

Metropolitan Police— <i>continued.</i>	
No. 4 District— <i>continued.</i>	
P Division—Division Superintendent - - - - -	Transport to be in proper covered vans only. Loading to be under supervision. Local inspection and search without warrant.
R Division - - - - -	Explosives to be kept only in properly constructed stores. Loading to be under regulation and supervision. (District inspection and search without warrant.)
W Division—Division Superintendent - - - - -	Explosives to be kept only in approved stores. Covered vans only, and proper receptacles to be used in transport. Local inspection.
Detective Department - - - - -	Dealers to be licensed. Covered vans only to be used for quantities over 100 lbs., and vans to be at a distance apart. Specified places to be appointed for loading, and proper regulations to be laid down by Home Secretary. Local inspection.
Middlesborough—Head Constable - - - - -	Retailers to be licensed. To be limited to 10 lbs., except in isolated stores. Quantities above 25 lbs. to be conveyed in approved vehicles. Proper regulations as to unshipping gunpowder to be enforced. (Instances steam cranes at work on same wharf.) Seizure to be optional according to circumstances. Regulations to be enforced as to miners preparing "shots" and straws for blasting. (Gives instances of carelessness and results.)
Montgomery—Chief Constable - - - - -	No sales after dark. Transport to be in covered vehicles only, and under local supervision. Local inspection.
Newport—Chief Constable - - - - -	Retailers to be licensed.
Northamptonshire—Chief Constable. - - - - -	Dealers to be licensed. Proper magazine to be provided. Conveyance to be regulated, and to be by day only. District inspectors to be appointed. Minimum fine to be fixed.
Northumberland—Chief Constable - - - - -	Retailers to be licensed and subject to police inspection. Power of search without warrant, on suspicion. Time for proceedings to be extended beyond 28 days. Licensed persons to notify quantity for which they are licensed on their sign boards.
Pembrokeshire—Chief Constable - - - - -	Explosives to be stored only in proper magazine. Transport to be in special vehicles and under local supervision. Shipment of explosives to be regulated. Dealers to be under local supervision.
Penzance—Chief Constable - - - - -	Dealers to be licensed. Dealers to give notice of receipt of explosives to police. Local inspection to be established. Vessels carrying explosives to be under regulations.
Portsmouth—Chief Constable - - - - -	Dealers to be licensed. Transport to be in special vehicles, and at early train of morning. Dealers to be licensed and under local inspection.
Radnorshire—Chief Constable - - - - -	Quantities allowed to be kept and carried to be reduced. Dealers to be licensed. Proper receptacles and vehicles to be used.
Richmond (W. R. York)—Chief Constable - - - - -	Thorough inquiry should be made by competent persons in Durham and Northumberland, "where many abuses exist." Powder is conveyed with no more caution than ordinary goods. Has himself weighed up in packages of 1 lb. to 7 lbs. by gaslight.

ABSTRACT of Replies received from Chief Constables and Superintendents of Police—*continued.*

Richmond (W.R. York)—Chief Constable— <i>contd.</i>	Miners frequently prepare their charges by a naked candle. Carts, imperfectly covered, with gunpowder in them pass through populous districts, and often stand at doors of public-houses without supervision. Very little caution is used in shops. Miners frequently keep their powder under their beds. A man was tried at Houghton-le-Spring in 1869 for murder, having fired 25 lbs. by red-hot poker and killed a baby. (See also Yorkshire.)
Saffron Walden—Chief Constable - - - -	Explosives to be kept in special detached store. Local inspection.
Shropshire—Chief Constable - - - -	Limit to be 5 lbs. of explosives within half a mile of any building. Local inspection.
Southampton—Chief Constable - - - -	Special places of storage to be provided. Local inspection. Dealers to be licensed.
Staffordshire—Chief Constable - - - -	Dealers to be licensed and under local inspection.
Stratford-upon-Avon—Chief Constable - - - -	Explosives to be stored in separate detached stores. Transport to be under police permit. Dealers to be registered and under local inspection.
Sudbury—Chief Constable - - - -	Explosives to be sold only under Inland Revenue license. Excise officers to have right of inspection. Gunpowder not to be stored in cellars or under shops.
Suffolk—Chief Constable - - - -	Dealers to be licensed and under inspection. Escort to be provided for all removals. Unshipments to be under regulation. Second offence to involve forfeiture of license.
Tynemouth—Chief Constable - - - -	Covered conveyance to be used. Police supervision.
Wakefield—Chief Constable - - - -	Explosives to be stored in special receptacle, place or store. Covered vans only to be used for transport. System of local inspection to be established.
Walsall—Chief Constable - - - -	Public magazines to be provided. Local regulations to be made as to storage and transport. Dealers to be licensed. Twenty-eight pounds only to be kept in shops or houses. Local inspection.
Westmoreland ( <i>see</i> Cumberland).	
Wigan—Chief Constable - - - -	Dealers to be licensed, and to keep only in fit and approved stores. No loose powder to be sold. (With proper supervision quantity might be increased beyond 200 lbs.) (Gives example of fatal explosion from carelessness.) (Gives example of inadequacy of search warrants.) Local inspection.
Worcester (Borough)—Chief Constable - - - -	Retail quantity to be less than 200 lbs.
Yarmouth, Great—Chief Constable - - - -	Twenty lbs. only to be kept, and that in separate store. Inspector to visit shops weekly. Covered conveyances to be used.
York (W. R.)—Chief Constable - - - -	Proper places of storage to be provided. Covered vehicles to be used (under proper regulations). Wharves to be specially reserved for shipment and unshipment of explosives. Dealers to be licensed and under local inspection. Non-dealers to be limited to 14 lbs. (See also Richmond.)
York (N. R.)—Chief Constable - - - -	Conveyance of explosives to be under supervision. Dealers to register and to be under inspection (local).
York (Borough)—Chief Constable - - - -	Public magazine to be provided. No carriage by passenger trains, or after dark. Local inspection.

## CIRCULAR to Proprietors of Gunpowder Works.

Appendix, No. 1.

## MANUFACTURE OF GUNPOWDER.

Home Office, Whitehall, S.W.,

14 November 1871.

Gentlemen,

HAVING been instructed by the Secretary of State for the Home Department to inquire into the practice of the gunpowder trade, with a view to arriving at a basis of amended legislation, which would be more satisfactory to persons engaged in the trade, and safer for the public, we have the honour to request that you will oblige us with a correct plan or tracing (to scale) of the premises used by you for, or in connection with, the manufacture of gunpowder. The plan or tracing should show distinctly the position of each building on the premises of whatever description,\* and whether in actual use or occupation, or not; also the nature of each building, with reference to its present, past, or proposed employment. It is not necessary for the plan or tracing to be in elaborate detail, so long as it gives distinctly the foregoing information.

We have also the honour to represent that you will favour us, at your earliest convenience, with answers to the accompanying questions.† No replies or information with which you may be good enough to furnish us will be made use of with a view to any proceedings, but will be treated absolutely as without prejudice.

We beg to direct your attention especially to the information conveyed to you in the last question, to express fully and freely your views with regard to the existing Gunpowder Law, and to make such suggestions as may occur to you for its improvement.

I am, &amp;c.

(signed) V. D. Majendie, Captain R. A.

The Proprietor of the \_\_\_\_\_

Gunpowder Works,  
\_\_\_\_\_

## QUESTIONS.

1. What description of saltpetre do you generally make use of in the manufacture of gunpowder?
2. Do you refine the material yourselves, or purchase it ready refined from others?
3. If you purchase it after refining, what tests are you in the habit of applying to ascertain its freedom from grit and other foreign substances?
4. What special precautions do you exercise to prevent any accidental admixture of grit and other foreign bodies with the saltpetre before sending it to the mixing houses?
5. Do you refine the sulphur you make use of, or do you purchase it ready refined from others?
6. If you purchase refined sulphur, what tests are you in the habit of applying to ascertain if it is entirely free from grit and other foreign bodies?
7. What special precaution do you make use of to prevent any admixture of grit and other foreign bodies with the refined sulphur before sending it to the mixing-houses?
8. Do you prepare your own charcoal, or do you purchase it from others?

*The Answers to be written on this side.*

\* Including dwelling-houses, offices, &amp;c.

† It is requested that the plans may not be kept back for the completion of the answers to the questions.

Appendix, No. 1.

- The Answers to be written on this side.*
9. Do you purchase it whole or ground, and, in either case, what means do you adopt to satisfy yourselves that it is free from all admixture of grit and other foreign substances?
  10. Describe your general arrangements for the storage of unground charcoal.
  11. Describe your general arrangements for the storage of ground charcoal.
  12. How many mixing-houses have you, and how many of these are usually at work?
  13. Are each of these houses detached buildings, or do they form parts of other buildings?
  14. Of what materials are the mixing-houses constructed? (Specify floor, walls, roof, and metal work.)
  15. Is any other operation than that of mixing carried on in any of these houses?
  16. How many pairs of runners for the incorporation of powder have you, and how many of these are generally in use?
  17. Of what material are the runners and beds composed?
  18. State the diameters, thicknesses at edge, and weights of the runners you employ.
  19. At what speed per minute are they usually worked?
  20. What motive power (steam or water) is employed to drive them?
  21. What is the structure of the mill-houses? (Specify walls, floor, roofs, and metal work.)
  22. Is the charge at present laid down by the Gunpowder Act for each pair of mill-stones (viz., 50lbs. of sporting and Government powder, and 60lbs. of blasting or coarser powder), in your opinion, the quantity best calculated to prevent accident?
  23. If not, state what you think the amount of charge should be, and your reasons for thinking so, bearing in mind the greater destructive effect which will arise from the explosion of a larger charge.
  24. How many charge-houses have you?
  25. Describe the structure and dimensions of the charge-houses (specifying walls, floors, roof, and metal work).
  26. Do you make use of all or any of the charge-houses for the storage of anything but green and finished charges, and if so, of what?
  27. Have you any self-closing arrangement for the doors of the charge-houses?
  28. What do you consider to be "a safe and suitable distance"\* between a stone or brick charge-house and an incorporating mill?
  29. State the capacities of each of the charge-houses on your premises.
  30. How many "expense" or small magazines (as distinct from your charge-houses and your store magazine) are there on your premises?
  31. State the construction of these magazines (specifying walls, floor, roof, and metal work).

\* See Gunpowder Act, clause 2.



- The Answers to be written on this side.* Appendix, No. 1.
32. For what purposes are these magazines used, and is any description of work carried on within them?
  33. State the capacities or dimensions of each of these magazines.
  34. Do you make use of any machine or machines for breaking down the mill-cake before pressing?
  35. Are these hand machines, or are they driven by steam or water power?
  36. In what houses of the factory are these machines placed?
  37. How many press-houses have you, and how many of them are usually at work?
  38. How many presses are there in each of these houses?
  39. Is any other operation except pressing carried on in any of these houses?
  40. State the capacity of each individual press.
  41. Of what nature are the presses (screw or hydraulic), and by what power are they worked?
  42. Do your workmen remain in the press-houses during the time the presses are working?
  43. Do you break up the press-cake in any way before sending it to the "corning" or "granulating" machines?
  44. In what house or houses is this preliminary breaking-up performed?
  45. How many corning or granulating houses have you?
  46. Do any of these houses contain more than one corning or granulating machine?
  47. Has each of your granulating machines a dusting or separating machine attached to it?
  48. How are the granulating machines driven?
  49. Can you in any way account for the frequency of accidents in corning or granulating houses?
  50. How many dusting and glazing houses have you?
  51. Are both operations (viz., dusting and glazing) conducted in each of these, or have you any house or houses reserved for "dusting" exclusively?
  52. Have you laid down, or do you observe, any rules as to the quantities of powder to be permitted at one time in each of these houses, and do you consider that a limit of twice the quantity which can be dusted or glazed at one time could be observed without inconvenience?
  53. How many stoves for drying powder have you, and what is the capacity of each?
  54. Of what nature are these stoves, *i. e.*, how are they heated?
  55. What arrangement do you adopt to prevent overheating?
  56. What is the temperature usually maintained in each during the drying operation; and have you special arrangements for raising or lowering it as required?
  57. What is the capacity of your store magazine?

- Appendix, No. 1. 58. What is the distance between it and the nearest building in which any gunpowder is either stored or handled? *The Answers to be written on this side.*
59. What is the distance between it and any inhabited house, or any building in which fires are maintained?
60. Is any description of work carried on within the magazine, such as shifting or barrelling powder, coopering, &c.; and, if so, what is the average number of workpeople engaged thereon?
61. Describe the structure of the magazine (specifying walls, floor, roof, and metal work).
62. Is the magazine provided with a good and sufficient lightning conductor, and is the conductor attached to the building?
63. In what descriptions of cases or barrels do you pack your powder before issuing it to the retail trade?
64. Do all or any of your workmen change their ordinary clothes for working suits before commencing work; if any do, state what description of work these men are engaged on?
65. Are your workmen inspected before going to work to ascertain that they are sober, and that they have nothing in their pockets, or about their persons, which might cause accident?
66. Are all or any of the men employed by you on gunpowder work supplied with magazine shoes or goloshes?
67. Do you take special precautions to prevent any articles or implements of iron or steel from being brought into or used in the factory?
68. Do you carry on any gunpowder work by night in any department of your premises; if so, of what nature?
69. Are any of the buildings used by you in which gunpowder is either handled or stored artificially lighted or heated? If so, state the nature of the lighting or heating apparatus.
70. Have you any printed or written rules for the management of your factory; if so, will you forward a copy, with your replies, to these questions?
71. By whom, and at what date, were the premises you occupy licensed for the manufacture of gunpowder?
72. Will you be good enough to state your opinion as to the sufficiency, or otherwise, of the existing law relating to gunpowder, and to make such suggestions as may occur to you with a view to its amendment?

## FORMS USED IN INSPECTION OF MAGAZINES.

Class of Magazine.	Distinguishing Number.	Number on Magazine List.	Date of Inspection.

1. County and Place.
2. Proprietor.
3. Local agent or magazine holder.
4. If licensed or legally existing.
  - (a) When.
  - (b) By whom.
  - (c) For what nature of explosive.
  - (d) For what quantity.
  - (e) What stipulations, if any, annexed to license.
5. Situation as regards
  - (a) Borough.
  - (b) Parish church.
  - (c) Inhabited houses.
  - (d) Factories, charitable institutions, &c.
  - (e) Roads.
  - (f) Railways, river banks, or sea walls.
  - (g) Ricks.
  - (h) If a mining magazine, distance from mine, quarry, or colliery.
  - (i) General nature of surrounding ground.
6. Constructive details.
  - (a) If enclosed by wall.
  - (b) If provided with lightning conductor.
  - (c) Form and size.
  - (d) Walls { External and Internal
  - (e) Roofs { External and Internal.
  - (f) Doors.
  - (g) Keys, locks, hinges, &c.
  - (h) Windows and ventilators.
  - (i) Floor and covering.
  - (j) Nails, metal work, &c.
  - (k) Shelves, bins, &c.
  - (l) Foot-board.
7. Capacity (approximate).
8. Stock at time of visit (approximate).
9. Internal economy.
  - (a) By whom powder is received and delivered.
  - (b) Magazine slippers, clothing, &c.
  - (c) Precautions to exclude matches, &c.
  - (d) If the barrels are opened in the magazine, or any other work carried on there.
  - (e) Implements.
  - (f) Rules.
  - (g) If anything else is stored in magazine.
  - (h) State of floors, shelves, &c.
  - (i) General condition.
10. Points on which the law is not complied with.
11. Points which require to be attended to to increase safety of magazine.
12. Remarks.

## Appendix, No. 1. SUGGESTIONS as to the REGULATIONS to be enforced in FIREWORK FACTORIES.

1. THE license should relate only to the premises and buildings shown on a plan thereto annexed.

2. The quantity of gunpowder and fireworks should be limited by license as follows:—

(a) The quantity of gunpowder (whether in grain or meal) in the magazine and factory together shall not exceed at one time lbs.\*

(b) The quantity of composition (other than that in finished fireworks) in the magazine and factory together shall not exceed at one time lbs.\*

3. The magazine and buildings in which loose gunpowder, composition, or “stars” are present, or are liable so to be, should be treated as “danger buildings” or “specially protected buildings,” and distinguished by the letter “D” (for danger), or the letters “S. P.” (for “specially protected”) legibly marked upon the doors; and no handling of loose composition or gunpowder, or any operations likely to involve the same should be permitted in any buildings not so marked and distinguished.

4. The following regulations should be enforced in all the “danger buildings”:—

(a) No exposed iron or steel work to be permitted in the structure of the buildings, benches, shelves, floors, &c., and all existing iron or steel work to be either removed or covered up with leather, canvas, kamptulicon, putty, or other suitable material.

(b) No iron or steel tools, weights, scales, or other implements to be used in the danger buildings except the same be safely and suitably covered over with leather, canvas, or otherwise, or except where the use of uncovered iron tools can be shown to the satisfaction of the Secretary of State, or a person authorised by him, to be indispensable.

(c) No artificial fire or light to be admitted into any danger buildings, which should be warmed (if at all) only by means of steam or hot water, and artificially lighted (if at all) only by means of outside lamps of a safe and suitable pattern, except on the written approval of the Secretary of State, or a person authorised by him.

(d) The floors and working benches of the danger buildings to be covered with kamptulicon, linoleum, or other soft non-porous material.

(e) The walls of all danger buildings which are built of brick or stone to be lined with wood.

(f) The floors, benches, shelves, &c., of the danger buildings to be kept scrupulously clean and free from grit, and from all accumulations of unnecessary material, and vertical sliding foot boards not less than 6 inches high to be fitted at the door of each danger building.

(g) Each danger building to be swept out not less than once every day that it is in use, and thoroughly washed out not less than once every week.

(h) No greater quantity of explosive or inflammable composition than 30 lbs. (whether loose or made up into fireworks) to be allowed in any danger building (except the magazine) at one time.

(i) Not less than one bucket filled with water to be present in each danger building during working hours.

(j) No person to be admitted to any danger building without either changing his or her shoes for magazine slippers or placing the feet into the overshoes provided for the purpose; the magazine slippers or overshoes to be made of leather, india-rubber, list, or other suitable material, without any iron or steel about them.

(k) All persons working in the danger sheds to be required to wear unflammable overclothing, † and no pockets to be allowed in any of the clothes of the persons so employed, except with the written approval of the Secretary of State, or of a person authorised by him.

(l) No

\* The limit to be imposed should depend in each case upon the isolation and distribution of the buildings, and upon the screens or mounds or natural features by which communicated explosions or injurious effects outside the factory can be prevented.

† A smock or blouse would meet the case if made of wollen or other unflammable material; but it is obviously desirable in the case of females that the underclothing also should be as far as possible of an unflammable description; also the head-dress, if any is worn, should be unflammable.

(l) No repairs to be permitted to any danger building until the same has been thoroughly washed down and all explosive material removed therefrom. Appendix, No. 1.

(m) The operation of mixing compositions, whether for rockets, "coloured fires," "stars," or any description of fireworks, to be carried on in an isolated shed, which is to be used exclusively for this purpose and for the purpose of making "stars," and legibly marked on the door with the words "composition shed."

(n) Before the "filling or charging" of any rocket, squib, or other firework, or the mixing of any composition, or the making of "stars" are commenced, the bench where such work is to be carried on is to be carefully swept down, and all composition not immediately required for use removed; and during these operations no workman should have in the workshop more composition than is contained in a single box, not to exceed 5 lbs., except in the case of mixing composition, when the quantity present should not exceed what is necessary for immediate use, in no case to be in excess in the whole building of 30 lbs., or, if the composition be of a description which is more easily ignited by friction or percussion than ordinary gunpowder, not in excess of 10 lbs., that which is not being actually manipulated being kept in a closed or covered vessel.

(o) No composition which has fallen on to the floor to be afterwards used for manufacturing purposes, it should be immediately destroyed by placing it in water.

(p) No person is to be permitted to take either his or her meals in any danger building.

5. With regard to the factory generally, the following regulations should be enforced:—

(a) No person to be allowed to smoke or to bring on to the premises any matches, vesuvians, pipe lights, or other dangerous articles, except the person duly authorised to light the lamps (if any) or the fire (if any) in the case-making shed, and for this purpose none other but "safety matches," which strike only on the box, should be employed, except with the written approval of the Home Secretary, or a person authorised by him.

(b) Notice of any accident by fire or explosion (whether causing injury to any person or not) should be sent within 12 hours of its occurrence to—

Her Majesty's Inspector of Gunpowder Works,  
Home Office,  
Whitehall,  
London, S.W.

(c) Any practice objected to in writing by the Secretary of State, or by a person authorised by him, as dangerous, to be immediately, or within such time as may be expressed in such written order, discontinued, subject to an appeal to the licensing authorities.

(d) No person to light the lamps (if any) or the fire (if any) in the case-making shed except a person duly authorised by the licensee, and appointed in writing to that duty.

(e) No strangers or unauthorised persons to be admitted except under proper restrictions, and with the knowledge and approval of the licensee, or of a person duly authorised by such licensee; and no work to be carried on out of the ordinary working hours except with the knowledge and approval of the licensee or his agent as aforesaid.

(f) No gunpowder, composition, or fireworks to be carried into or out of the factory or magazine, or from one building to another, except in a closed vessel or carriage, or properly covered over and secured against accidental ignition.

(g) No other manufacture but that of fireworks to be carried on upon the premises.

(h) Nothing in the license to be held to override any provision in the statutes relating to the manufacture of gunpowder, fireworks, ammunition, percussion caps, and other explosive preparations or compositions.

(i) No oiled cotton rags or waste or articles liable to spontaneous ignition to be deposited in any buildings of the factory, and if the use or presence of such articles is indispensable, a separate and safe place should be provided for them.

(j) Sufficient and ready means of escape to be provided for all the persons employed in the several buildings in the event of accidents, and the doors of all buildings in which work is being carried on to be kept unlocked during working hours, and only fastened (if at all) with a piece of thin twine, or with a light catch which can be easily opened from the inside.

(k) No person to be admitted to work who is intoxicated, or in the opinion of the licensee, or of a person authorised by him, is unfit for work, and no spirituous liquors

## Appendix, No. 1.

to be admitted on to the premises; nor should the workpeople be permitted to take their meals in any working building containing any explosive material.

(l) Gaming, skylarking, and irregular or riotous behaviour of all sorts to be strictly prohibited.

(m) Regulations for the guidance of the workpeople to be drawn up and submitted to the Home Secretary, or a person authorised by him, for approval, and, when approved, to be strictly enforced. A copy, signed by the licensee, to be affixed to each building affected thereby, and a copy, similarly signed, given to each work person concerned.

No alteration to be made in these rules, except with the written approval of the Secretary of State, or of a person authorised by him.

By the Gunpowder Act of 1860 (23 & 24 Vict. c. 139, sects. 15 and 16) a manufacturer is empowered to make such rules for the regulation of the conduct of his servants and workmen as he may consider calculated to prevent accidents; and any servant or workman violating the rules made for his guidance, may be apprehended without a warrant by a police constable or by the manufacturer, or by any person authorised by him, and taken before a magistrate, for the enforcement of a penalty not exceeding 5 l.

*N.B.*—By the same Act (23 & 24 Vict. c. 139, sects. 6 and 16) it is illegal—

(1) To manufacture or sell fireworks without a license, or to sell the same to any person apparently under 16 years of age.

(2) To manufacture fireworks within 50 yards of a dwelling-house, or of any building unconnected with the manufacture.

(3) To fill or charge fireworks with explosive material within 20 yards of other workshops connected with the manufacture.

(4) To have more than 30 lbs. of ordinary firework composition, or what is equivalent as regards explosive power to 30 lbs. of gunpowder in the workshop where the fireworks are filled.

(5) To manufacture fireworks which contain detonating composition, or composition which is more easily ignited by percussion or friction than ordinary gunpowder, in buildings situated less than 30 yards from any other workshop connected with the same manufacture.

(6) To have more than 10 lbs. of any detonating composition, or composition which is more easily ignited by percussion or friction than ordinary gunpowder, in any building connected with the manufacture.

(7) To carry on the manufacture of fireworks without having a magazine of brick or stone at least 50 yards from any workshop connected with the manufacture.

(8) To do any act in, to, or about any place where fireworks are made or kept tending to cause explosion, or to bring into any such place anything tending to cause explosion.

*V. D. Majendie*, Major R.A.,  
Her Majesty's Inspector of Gunpowder Works.

Home Office, Whitehall, S.W.,  
1 January 1874.

RESULT of INSPECTIONS of STORE MAGAZINES for GUNPOWDER, between  
1st April 1873 and 31st March 1874.

## Magazines inspected:—

First inspections	-	-	-	-	-	-	-	-	51
Second	„	-	-	-	-	-	-	-	34
Third	„	-	-	-	-	-	-	-	5
Fourth	„	-	-	-	-	-	-	-	1
TOTAL									91*

In the 51 magazines inspected for the first time,—

2 violations of the law were observed in 1 magazine.  
1 violation „ „ 6 magazines.

And as regards ordinary precautions for safety,—

At least 1 precaution was omitted in 3 magazines,  
„ 2 precautions were „ 1 magazine,  
„ 3 „ „ „ 6 magazines,  
„ 4 „ „ „ 6 „ „  
„ 5 „ „ „ 9 „ „  
„ 6 „ „ „ 9 „ „  
„ 7 „ „ „ 7 „ „

while nine were considered so bad as to require almost entire remodelling.

Only one of these magazines could be considered in a thoroughly satisfactory state (No. 176). The store-man in charge had been formerly employed as foreman in the Royal Laboratory, Devonport.

In the 34 magazines inspected for the second time,—

2 violations of the law were observed in 4 magazines,  
1 violation „ „ 5 „ „  
and at least 1 precaution was omitted in 4 „ „  
„ 2 precautions were „ 1 magazine,  
„ 3 „ „ „ 2 magazines,  
„ 4 „ „ „ 5 „ „  
„ 5 „ „ „ 8 „ „  
„ 6 „ „ „ 5 „ „  
„ 7 „ „ „ 3 „ „

and five were pronounced in an entirely unsatisfactory condition. In many cases, however, improvements, more or less, had been made since the previous visit. One of these magazines was also in a thoroughly satisfactory state; at the former visit at least six precautions had been omitted (No. 77, at Elgin).

In the five magazines inspected for the third time,—Two violations of the law were found in one magazine. In two magazines two precautions were omitted; in one five; and in one six precautions; the remaining one (Glasgow) being in a thoroughly satisfactory condition (No. 26).

In the case of the magazine (near Edinburgh, No. 24) visited for the fourth time, the recommendations made on the occasion of the third inspection having been carried out, it was reported on as quite satisfactory.

\* In addition to the above, 13 other magazines (or 104 in all) were visited; but owing to absence of storekeeper with keys, &c., the interior could not be inspected.

## Appendix, No. 1.

RESULT of INSPECTIONS of MAGAZINES for GUNPOWDER at MINES, QUARRIES,  
COLLIERIES, &c., between 1st April 1873 and 31st March 1874.

## Magazines inspected:—

First inspections -	-	-	-	-	-	-	-	-	110
Second „	-	-	-	-	-	-	-	-	23
Third „	-	-	-	-	-	-	-	-	3
TOTAL -									136*

## In the 110 magazines visited for the first time,—

3 violations of the law were observed in	2	magazines,
2 „ „ „	6	„
1 „ „ „	27	„

## And as regards ordinary precautions for safety,—

At least 2 precautions were omitted in	1	magazine,
„ 3 „ „	1	„
„ 4 „ „	8	magazines,
„ 5 „ „	15	„
„ 6 „ „	38	„
„ 7 „ „	32	„

while 15 were considered to be in such a bad condition as to require entire re-modelling.

It will be noticed that in no single magazine of the 110 visited for the first time were the arrangements entirely satisfactory.

## In the 23 magazines inspected for the second time,—

3 violations of the law were observed in	3	magazines,
and 1 „ „ was „	8	„
while at least 2 precautions were omitted in	1	magazine,
„ 3 „ „	2	magazines,
„ 4 „ „	2	„
„ 5 „ „	8	„
„ 6 „ „	6	„
„ 7 „ „	3	„

and the remaining one was in a thoroughly unsatisfactory state.

In the three magazines visited for the third time,—One violation of the law was found in two instances; while in two magazines three ordinary precautions for safety were omitted, and the third magazine (No. 59) still called for complete re-modelling, to enforce which proceedings were instituted against the owners.

\* In addition to the above, 12 other magazines (or 148 in all) were visited; but owing to absence of storekeeper with key, &c., the interior could not be inspected.



RESULTS of INSPECTION of MAGAZINES for NITRO-GLYCERINE PREPARATIONS,  
between 1st April 1873 and 31st March 1874.

Magazines inspected :—

First inspections	-	-	-	-	-	-	-	-	52
Second	”	-	-	-	-	-	-	-	6
Third	”	-	-	-	-	-	-	-	3
									61*
									61*

In the 52 magazines inspected for the first time,—

6 violations of the law or conditions of the license were observed in 6 magazines.

4	”	”	”	”	4	”
3	”	”	”	”	10	”
2	”	”	”	”	9	”
1	”	”	”	”	10	”

And as regards ordinary precautions for safety,—

At least 1 precaution was omitted in 7 magazines,
” 2 ” ” 12 ”
” 3 ” ” 9 ”
” 4 ” ” 7 ”
” 5 ” ” 4 ”
” 7 ” ” 1 magazine,

while nine magazines were considered in such a thoroughly unsatisfactory state as to require entire remodelling.

It will thus be seen that there were only 13 magazines in which no violation of the law was observed, and there were only three in which it could be considered that all the ordinary precautions for the safety of the people employed in it were taken. There was only one magazine out of 52 in which neither a violation of the law or an omission of some one or more precautions was observed (Smith’s Mine, at Frizzington, No. 13).

In the six magazines inspected for the second time,—

2 violations of the law were observed in 1 magazine,
1 violation ” ” 2 magazines,
and at least 1 precaution was omitted in 2 ”
” 2 precautions were ” 2 ”
” 3 ” ” 1 magazine,

and in only one of the six was there neither a violation of law or an omission of any precaution.

In the three magazines inspected for the third time,— One violation of the law was observed in one case, and two in another; in two of them one precaution was still omitted, and in the remaining one two precautions.

The marked improvement in the magazines inspected for the second and third times is worthy of notice.

Home Office, April 1874. V. D. Majendie, Major R.A.,  
Her Majesty’s Inspector of Gunpowder Works.

\* In addition to these, 11 magazines (or 72 in all) were visited, but owing to absence of storekeeper with key, and other reasons, the interior could not be inspected.

RETURN of FACTORIES of GUNPOWDER, GUNCOTTON, AMMUNITION, FIREWORKS, &c.; STORE MAGAZINES for GUNPOWDER; and MAGAZINES for NITRO-GLYCERINE PREPARATIONS, in the UNITED KINGDOM.

## ENGLAND AND WALES.

COUNTIES.	Factories.						Store Magazines for			Magazines for Nitro-Glycerine			
	Gunpowder, and other Explosives.			Ammunition, Fireworks, Blasting Fuze, &c.			Gunpowder.			Preparations.			
	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	Licenses Issued up to 31st March 1874.	Licenses Revoked and Surrendered up to 31st March 1874.	Licenses in Force on 31st March 1874.	Total Visited up to 31st March 1874.
Anglesey	-	-	-	-	-	-	3	-	2	-	-	-	-
Bedford	-	-	-	-	-	-	-	-	-	-	-	-	-
Berkshire	-	-	-	-	-	-	-	-	-	-	-	-	-
Buckinghamshire	-	-	-	-	-	-	-	-	-	-	-	-	-
Cambridge	-	-	-	-	-	-	-	-	-	-	-	-	-
Cardigan	-	-	-	-	-	-	3	2	5	7	-	7	-
Carmarthen	-	-	-	-	-	-	2	-	2	1	-	1	-
Carnarvon	-	-	-	-	-	-	5	-	5	24	1	23	8
Cheshire	-	-	-	-	-	-	2	1	1	2	-	2	-
Cornwall	3	-	3	8	1	9	7	-	7	76	12	74	9
Cumberland	-	-	-	-	-	-	1	-	1	35	2	33	*18
Denbigh	-	-	-	1	-	1	2	-	2	1	-	1	-
Derby	1	-	1	-	-	-	3	-	3	1	-	1	1
Devon	1	-	1	-	-	-	9	3	11	10	-	10	5
Dorset	-	-	-	-	-	-	-	-	-	-	-	-	-
Durham	-	-	-	1	1	1	10	-	10	9	-	9	1
Essex	-	-	-	6	1	7	3	1	4	-	-	-	-
Flint	-	-	-	-	-	-	5	2	4	5	-	5	-
Glamorgan	1	-	1	2	-	2	7	2	9	18	2	16	1
Gloucester	1	-	1	4	2	6	2	-	2	20	7	13	5
Hampshire	1	-	1	-	-	-	-	-	-	-	-	-	-
Hereford	-	-	-	-	-	-	-	-	-	-	-	-	-
Hertford	-	-	-	-	-	-	-	-	-	-	-	-	-
Huntingdon	-	-	-	-	-	-	-	-	-	-	-	-	-
Kent	4	-	4	5	6	11	2	-	2	1	-	1	1
Lancashire	2	-	2	5	-	5	16	1	14	23	2	21	-
Leicester	-	-	-	-	-	-	-	-	-	1	-	1	-
Lincoln	-	-	-	-	-	-	-	-	-	1	-	1	-
Merioneth	-	-	-	-	-	-	6	2	8	5	-	5	-
Middlesex	2	-	2	2	3	5	-	-	-	-	-	-	-
Monmouth	-	-	-	-	-	-	6	2	8	3	-	3	-
Montgomery	-	-	-	-	-	-	1	-	1	3	-	3	-
Norfolk	-	-	-	2	-	2	-	-	-	-	-	-	-
Northampton	-	-	-	-	-	-	-	-	-	-	-	-	-
Northumberland	-	-	-	-	-	-	10	-	10	3	-	3	1
Nottingham	-	-	-	-	-	-	2	-	2	1	-	1	-
Oxford	-	-	-	-	-	-	-	-	-	-	-	-	-
Pembroke	-	-	-	-	-	-	2	1	3	-	-	-	-
Radnor	-	-	-	-	-	-	-	-	-	-	-	-	-
Rutland	-	-	-	-	-	-	-	-	-	-	-	-	-
Shropshire	-	-	-	-	-	-	2	-	1	-	-	-	-
Somerset	-	-	-	1	-	1	2	1	1	9	-	9	3
Stafford	-	-	-	2	-	2	16	-	16	5	-	5	4
Suffolk	1	-	1	-	-	-	-	-	-	-	-	-	-
Surrey	1	1	2	5	1	6	-	-	-	-	-	-	-
Sussex	1	-	1	2	-	2	-	-	-	-	-	-	-
Warwick	-	1	1	8	3	11	-	-	-	-	-	-	-
Westmoreland	3	-	3	-	-	-	-	-	-	4	-	4	-
Wilts	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester	-	-	-	1	-	1	-	-	-	-	-	-	-
York	1	1	2	7	-	7	6	-	5	29	4	25	5
TOTALS ENGLAND and WALES	23	3	26	62	17	79	135	18	139	297	20	277	62

\* One of these has two Numbers (50 and 15).

N.B.—The foregoing Return does not profess to include all places where explosives are manufactured and stored, but only those which have been inspected or noted for inspection. Gunpowder magazines for the use of mines are not included, and of these there are many hundreds, of which — have been visited.

SCOTLAND.

COUNTIES.	Factories.						Store Magazines for			Magazines for Nitro-Glycerine			
	Gunpowder and other Explosives.			Ammunition, Fireworks, Blasting Fuze, &c.			Gunpowder.			Preparations.			
	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	Licenses Issued up to 31st March 1874.	Licenses Revoked and Surrendered up to 31st March 1874.	Licenses in Force on 31st March 1874.	Total Visited up to 31st March 1874.
Aberdeen	-	-	-	-	-	-	1	-	1	4	-	4	-
Argyll	3	1	4	-	-	-	-	-	-	3	-	3	-
Ayr	1	-	1	-	-	-	1	-	1	15	-	15	-
Banff	-	-	-	-	-	-	1	-	1	2	-	2	-
Berwick	-	-	-	-	-	-	-	-	-	-	-	-	-
Bute	-	-	-	-	-	-	-	-	-	1	1	-	-
Caithness	-	-	-	-	-	-	-	-	-	1	-	1	-
Clackmannan	-	-	-	-	-	-	1	-	1	-	-	-	-
Cromarty	-	-	-	-	-	-	-	-	-	-	-	-	-
Dumbarton	-	-	-	-	-	-	-	-	-	2	-	2	-
Dumfries	-	-	-	-	-	-	1	-	1	-	-	-	-
Edinburgh	1	-	1	1	-	1	1	1	2	2	-	2	-
Elgin	-	-	-	-	-	-	2	-	2	-	-	-	-
Fife	-	-	-	-	-	-	2	-	2	2	-	2	-
Forfar	-	-	-	-	-	-	4	-	4	3	-	3	-
Haddington	-	-	-	-	-	-	1	-	1	2	-	2	-
Inverness	-	-	-	-	-	-	1	-	1	-	-	-	-
Kincardine	-	-	-	-	-	-	-	-	-	-	-	-	-
Kinross	-	-	-	-	-	-	-	-	-	-	-	-	-
Kirkcudbright	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanark	-	-	-	1	1	2	4	-	4	28	1	27	-
Linlithgow	-	-	-	-	-	-	1	-	1	2	1	1	-
Nairn	-	-	-	-	-	-	-	-	-	-	-	-	-
Orkney and Shetland	-	-	-	-	-	-	-	-	-	1	-	1	-
Peebles	-	-	-	-	-	-	-	-	-	-	-	-	-
Perth	-	-	-	-	-	-	3	-	3	2	-	2	-
Renfrew	-	-	-	-	-	-	1	-	1	6	-	6	-
Ross	-	-	-	-	-	-	-	-	-	-	-	-	-
Roxburgh	-	-	-	-	-	-	-	-	-	-	-	-	-
Selkirk	-	-	-	-	-	-	-	-	-	-	-	-	-
Stirling	-	-	-	-	-	-	1	-	1	1	-	1	-
Sutherland	-	-	-	-	-	-	-	-	-	1	-	1	-
Wigton	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	5	1	6	2	1	3	26	1	27	78	3	75	-

I R E L A N D.

COUNTIES.	Factories.						Store Magazines for			Magazines for Nitro-Glycerine			
	Gunpowder and other Explosives.			Ammunition, Fireworks, Blasting Fuze, &c.			Gunpowder.			Preparations.			
	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	In Work on 31st March 1874.	Closed previous to 31st March 1874.	Total Visited up to 31st March 1874.	Licenses Issued up to 31st March 1874.	Licenses Revoked and Surrendered up to 31st March 1874.	Licenses in force on 31st March 1874.	Total Visited up to 31st March 1874.
Antrim	-	-	-	-	-	-	-	-	-	5	1	4	-
Armagh	-	-	-	-	-	-	-	-	-	-	-	-	-
Carlow	-	-	-	-	-	-	-	-	-	-	-	-	-
Cavan	-	-	-	-	-	-	-	-	-	-	-	-	-
Clare	-	-	-	-	-	-	-	-	-	-	-	-	-
Cork	1	-	1	-	-	-	1	-	1	2	-	2	-
Donegal	-	-	-	-	-	-	-	-	-	-	-	-	-
Down	-	-	-	-	-	-	2	-	2	-	-	-	-
Dublin	-	-	-	-	-	-	-	-	-	1	-	1	-
Fermanagh	-	-	-	-	-	-	-	-	-	-	-	-	-
Galway	-	-	-	-	-	-	1	-	1	1	-	1	-
Kerry	-	-	-	-	-	-	1	-	1	-	-	-	-
Kildare	-	-	-	-	-	-	-	-	-	1	-	1	-
Kilkenny	-	-	-	-	-	-	1	-	1	2	-	2	-
Kings County	-	-	-	-	-	-	-	-	-	-	-	-	-
Leitrim	-	-	-	-	-	-	-	-	-	-	-	-	-
Limerick	-	-	-	-	-	-	-	-	-	-	-	-	-
Londonderry	-	-	-	-	-	-	1	-	1	1	-	1	-
Longford	-	-	-	-	-	-	-	-	-	-	-	-	-
Louth	-	-	-	-	-	-	1	-	1	1	-	1	-
Mayo	-	-	-	-	-	-	-	-	-	-	-	-	-
Meath	-	-	-	-	-	-	-	-	-	-	-	-	-
Monaghan	-	-	-	-	-	-	-	-	-	-	-	-	-
Queen's County	-	-	-	-	-	-	-	-	-	1	-	1	-
Roscommon	-	-	-	-	-	-	-	-	-	-	-	-	-
Sligo	-	-	-	-	-	-	-	-	-	-	-	-	-
Tipperary	-	-	-	-	-	-	-	-	-	-	-	-	-
Tyrone	-	-	-	-	-	-	-	-	-	-	-	-	-
Waterford	-	-	-	-	-	-	2	-	2	-	-	-	-
Westmeath	-	-	-	-	-	-	-	-	-	-	-	-	-
Wexford	-	-	-	-	-	-	-	-	-	-	-	-	-
Wicklow	-	-	-	-	-	-	-	-	-	1	-	1	-
Ireland	1	-	1	-	-	-	10	-	10	16	1	15	-
Scotland	5	1	6	2	1	3	26	1	27	78	3	75	-
England and Wales	23	3	26	62	17	79	135	18	139	297	20	277	62
GRAND TOTAL	29	4	33	64	18	82	171	19	176	391*	24	367	62
The above Factories consist of—													
Gunpowder Factories	24	2	26	-	-	-							
Guncotton, Dynamite, &c.	5	2	7	-	-	-							
Blasting Fuse	-	-	-	8	-	8							
Blasting Cartridge	-	-	-	4	1	5							
Ammunition	-	-	-	8	4	12							
Firework and Fog Signals.	-	-	-	44	13	57†							
TOTAL	29	4	33	64	18	82							
* Total number of General Licenses issued up to 31 March 1874													308
Total number of Special Licenses issued up to 31 March 1874													88
Deduct—													396
Three, Isle of Man, cancelled, G. 101, 115 and 223													5
Two, for use only (no magazine), s. 23, 62													
													391
† Two Factories bear the No. 32.													

Appendix, No. 2.

PAPERS handed in by Colonel *Younghusband*, 8 May 1874.

ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY.

Appendix, No. 2.

NOTICE TO VISITORS.

VISITORS are particularly requested to pay attention to the following regulations:—

I.—On entering the Factory to hand over to the police at the gate any *lucifer matches*, *cigar lights*, &c., *tobacco pipes*, or any *iron* or *steel* articles, such as *knives*, *keys*, &c., which they may have in their pockets.

II.—In going round the Factory to be particularly careful not to carry into any of the buildings either *walking-sticks* or *umbrellas*.

III.—In walking round the Factory not to turn up their *trousers* at the ankle, as experience has proved this is a very likely means of carrying small pebbles or gritty particles into the houses.

IV.—To take especial care when about to enter one of the houses not to step over the foot-boards until they have put on the *magazine shoes* provided, guarding also against allowing the latter to touch that part of the floor which is outside the board; and further, to be especially careful in putting on or taking off the *magazine shoes* not to allow any particle of *mud*, *grit*, or *sand* to fall on the floors of the building or platform.

C. W. *Younghusband*, Colonel R.A.,  
Superintendent.

RULES AND REGULATIONS for the MEN employed in the ROYAL GUNPOWDER FACTORY, *Waltham Abbey*.

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EVERY man employed in the Royal Gunpowder Factory shall be provided with a copy of the following rules, which he is to keep in good order, and be ready to show to the master worker when ordered to do so.

Every man must make himself thoroughly acquainted with the general rules; and also with the rules laid down for the particular branch of the Factory in which he is employed.

The foremen of all houses shall read to their men weekly, the part of the rules which relates to the work on which they are employed.

## Appendix, No. 2.

## I.—GENERAL RULES.

1. Smoking is strictly prohibited in any part of the works, grounds, roads, &c., belonging to this department.
2. Lucifer matches, cigar lights, or other combustibles are on no account to be brought into any part of the works, or grounds.
3. The men are cautioned against carrying keys, knives, or other articles of iron about their persons, when employed in, or about the houses, mills, or powder boats.
4. Before going into any house, mill, or powder boat, the men are to change their clothes and boots, and put on their working dress (made without pockets or metal buttons) and slippers. On leaving off work they are to resume their own clothes and boots. The practice of turning up the working trousers at the ankle is strictly forbidden, as experience proves that small stones and gritty particles are very apt to be carried into the houses thereby.
5. The greatest care must be taken in keeping the platforms, floors, &c., of the different houses and boats perfectly free from dirt, or grit. The platforms should be constantly wetted.
6. No implements, except those provided, are to be used in any house, mill, or powder boat. These implements are to be used carefully and gently, and never to be thrown down violently.
7. The wash-houses are to be kept clean, and as free from grit as possible.
8. When cotton waste is issued for cleaning machinery it must be very carefully looked over, as it almost always contains fragments of iron wire, nails, &c.
9. No repairs are to be executed in any house, mill, or powder boat, until all the powder has been swept down and removed, and the house, mill, or boat washed, or mopped out. The master worker, or in his absence the assistant master is held responsible that no house, or mill, is handed over to the chief foreman of machinery, or to the engineer department for repairs of any description whatever, until this has been done.
10. Powder barrels and charge boxes are always to be rolled on their chimes, and never to be dragged along the platforms, or along the floors of houses, or boats. Barrels, or charge boxes filled with powder are never to be placed one in the other; each barrel or box is to be rolled separately.
11. Instances having occurred of men rupturing themselves when lifting boxes or barrels of powder, the men of the factory are cautioned against lifting any heavy weight while the feet are apart. The feet should always be kept together in performing any duty of this sort.
12. When a thunderstorm is approaching the works, the men employed in the houses, mills, or powder boats are to close carefully the window shutters, slides and doors, stop the motion of the machinery, and then quit the vicinity of such houses, mills, or powder boats, until the storm has passed over.
13. There is no thoroughfare past No. 1 mill, or on the mill head. No men are allowed to pass that way except those whose duties oblige them to do so. The men employed at the barrel houses must go round by the Long Walk.
14. The foremen and men of the factory are to obey without hesitation the orders of the master worker, or his assistants, and in the same way the men are to obey the foreman placed immediately over them. Should a man feel himself aggrieved with regard to any order given to him, he can afterwards make a complaint to the master worker.
15. The men employed in the factory are to remember that they are bound to answer civilly all questions put to them by the inspector of police, serjeant, or constable, on duty at the gate, as to the contents of bags, &c., or articles taken by them in or out of the factory. The police have orders to search and examine when necessary, all persons taking anything with them in or out of the factory.
16. The men employed in the factory are also cautioned not to answer inquiries made to them by strangers about the factory as to the amount of gunpowder stored, how it is guarded, how it can be approached, &c.
17. No workman employed in the factory is to enrol himself in any Militia, Yeomanry, or Volunteer corps without the permission of the superintendent.
18. On the occasion of an explosion or fire happening, those persons who possess keys of the works must on no account admit any persons whatever into the factory, except those actually employed therein.
19. The men are specially cautioned to carry on the work entrusted to them in as careful and gentle a manner as possible.  
No undue haste must ever be shown; and no greater force used than is absolutely necessary to serve the purpose required. The men must never forget that a moderate degree of friction may be safely endured with powder alone, which might cause accident if by chance any foreign substance may have got mixed with it.
20. Special care must always be taken to redouble every precaution during the prevalence of hot dry weather. The floors, platforms, &c., must be attended to with the greatest care during such weather, as experience has proved that sandy or gritty particles are then more likely to be carried into the houses by the wind, or about the men's dress, or hair, than at other times.

21. As no means must be neglected to exclude particles of sand or grit, the men engaged in handling powder or its materials must be careful to keep their hair and beards cut short, to lessen the risk of particles being introduced in this manner.

22. Any man infringing these rules, which have been drawn up with a view to the prevention of accidents, will not only be immediately dismissed, but will also render himself liable to be handed over to the custody of the police, for wilfully endangering the lives of others, and the property of the Government.

23. When cases of smallpox or scarlet fever break out in the houses of persons employed in the factory, such persons will instantly, under pain of dismissal, report the circumstance.

The medical officer will then inquire into the case, and certify whether in his opinion the attendance at work of the person concerned would be dangerous to others employed in the same department, in which case such person will not be permitted to come to work.

While so absent the person will receive pay at half the ordinary rate.

## II.—SPECIAL RULES FOR STORE BRANCH.

1. All foremen and men employed by the store branch at the grand magazine, or elsewhere, are to be under the immediate orders of the officer of the store branch then present.

2. When their services are no longer required, the officer of the store branch will direct them to report themselves to the master worker, should they have finished their work before bell ringing.

3. He will also in that case notify to the master worker the hour at which he dismissed the men.

4. Should a powder boat arrive at the grand magazine while an officer of the store branch is present, the foremen and men of the boat must obey any directions given by him during their stay at the magazine.

5. These orders are to be read to working parties on arrival.

## III.—SPECIAL RULES FOR THE CHIEF FOREMAN OF MACHINERY.

1. The chief foreman of machinery is held responsible that no repairs are executed in the tank of any mills, or group of mills, while the runners are in motion on powder; and that no repairs are executed in any building till that building has been regularly handed over by the master worker as being perfectly free from powder or powder dust.

2. The chief foreman of machinery, or, in his absence, the master artificer, is held responsible that the engine-drivers and stokers, and other men employed under him, are thoroughly acquainted with all the rules.

He is also to see that the rules are strictly carried out, and to report any infringement of them to the assistant superintendent.

3. Should a fire take place the chief foreman of machinery and the master artificer will attend in case their services may be required. They must be prepared with any tools or wrenches that may be necessary, independent of those carried on the engines.

## IV.—SPECIAL RULES FOR ENGINE-DRIVERS AND STOKERS.

1. The engine-driver going on duty is to go round with the engine-driver he is about to relieve, in order to ascertain the state of the bearings, steam gauge, vacuum gauge, and everything connected with the engine before taking charge; he is also to ascertain whether the signals to and from the boiler house, and mills, are in good working order.

2. The stoker is to be very careful that the water is always at the proper height in the boiler.

3. Before lighting the fires at any time, he is to ascertain this by opening the gauge-cocks, when the water ought to flow freely from them.

4. When the steamer is no longer required he is to shut the steam valve closely.

5. If by any accident the water should get too low in the boiler, he must on no account allow any water to run in; this would be highly dangerous. He should draw the fires as quickly as possible, and allow the boiler to cool down.

6. The stoker going on duty is to go round with the stoker he is about to relieve, in order to ascertain the height of the water in the boiler, and satisfy himself as to the state of the feed-valve, steam-valve, and safety-valves, and everything connected with the boiler before taking charge; he is also to ascertain whether the signals to and from the engine rooms are in good working order.

## V.—SPECIAL RULES FOR THE SALTPETRE REFINERY.

1. The master refiner is held responsible that no powder is removed from the mill-head, or from the Horse-Mill Island until it has been satisfactorily ascertained that the powder in the pans is thoroughly saturated with water, and perfectly safe from any chance of ignition.

2. The greatest precautions are to be taken to guard against the admission of any particle of sand, gravel, or grit into the refined saltpetre. Magazine shoes (which must be kept

Appendix, No. 2. (clean on all occasions) must be worn by the men engaged in shovelling it into the tubs or bins; and care must also be taken that the shovels are kept clean for this special work.

#### VI.—SPECIAL RULES FOR CYLINDER HOUSE AND CHARCOAL STORE.

1. At every burning, the slips and their covers must, previous to being filled with wood, be carefully examined by the foreman, or assistant foreman.
2. When the charcoal has been shot out into the small coolers, the slips and covers must be again examined, and should any portion of the ironwork be deficient, it is evident that the missing portion must be in the cylinder, the large cooler, or in the charcoal which has just been shot out into the small coolers.
3. The cooler containing this charcoal must be marked, and put on one side in order that the charcoal may be picked over separately.
4. Every cooler and cover must be examined daily by the foreman, and assistant-foreman, and should the rivets appear loose, or coolers or covers be defective in any way, such coolers and covers are to be sent away at once for repair.
5. The foreman of the cylinder-house will be held responsible that any piece of iron which may have become detached from any slip, cooler, or cover, is discovered and removed from the charcoal.
6. Charcoal after being picked, must on all occasions be carefully guarded against the admission of any particles of sand, gravel, or grit.

#### VII.—SPECIAL RULES FOR SULPHUR REFINERY.

The greatest care must be taken in removing the refined sulphur from the tubs into which it is run, to place it directly in the enclosed space intended for its reception; and at that time, and also when it is broken up and transferred to the tubs for transmission to the sulphur mill, to guard against the admission of any particle of sand, gravel, or grit.

#### VIII.—SPECIAL RULES FOR CHARCOAL MILLS.

1. No charcoal is to remain in the charcoal mill during the night.
2. The charcoal, when ground, is to be removed at once to the store for ground charcoal on the mill-head.

#### IX.—SPECIAL RULES FOR MIXING HOUSES.

1. No greater quantity than twelve bags of mixed composition is ever to be in the mixing-house at one time. When this quantity is mixed it is to be removed to the magazines.
2. No mixed charge, or charcoal, is to remain in the mixing-house at night.
3. No. 1 Mill must be stopped while mixed charges are being removed to the Lower Island.

#### X.—SPECIAL RULES FOR MILLS.

1. The runners are never to be moved off powder, without the leathers being used. The foreman of mills is always to be present during this operation.
2. The platforms and mill floors are to be kept as clean as possible, and constantly wetted.
3. No implements are to be used except those provided.
4. No powder or composition is to be moved on the mill barrows, or conveyed in any manner without being properly covered over.
5. The lamp cases are to be kept filled with water to the depth of one inch.
6. The red signal is to be shown when the machinery is in motion, and to be lowered when the mills are stopped.
7. While the runners are in motion, no boat, truck, or wheelbarrow containing powder is to be allowed to approach a mill; nor are repairs to be executed in, or about a mill, or its platform; nor are the lamps to be cleaned, or filled with water.
8. The millmen are cautioned to wear their gloves, and button their caps under the chin, whenever they approach or enter a mill for any purpose whatever, while the runners are in motion.
9. After spreading the charge on the mill-bed the millmen will cause the runners to turn round a quarter revolution, and will then after stopping them take care to break up, and distribute amongst the charge, the portion of mill cake left under the runners from the last charge. If this be found to adhere to the mill bed, it must be tapped with a wooden mallet, *not spudded up*.
10. The millmen are specially cautioned to examine carefully before starting their mills and occasionally during their working, every part of the machinery, particularly the nuts and bolts, drip-pans and fittings of the ploughs, with the view of ascertaining that everything is sound, and that there is no risk of anything falling off into the charge during the time the mills are working.

11. The



11. The millmen at the water-mills are to be particularly careful to see that the water-gates are properly secured previous to leaving their mills at night.

12. Not more than three millmen from those on duty at the mills at the mill-head, nor more than two millmen from those on duty at the steam mills, are allowed to go to the watch house at the same time for the purpose of getting their meals, &c.

13. All the mills will leave off working at 10.30 p.m. on Saturday nights, provided the charges then on are ready to be taken off.

The proper time must, however, always be taken in putting on and taking off a charge.

#### *Special Additional Rules for No. 10 Mill, Lower Island.*

1. When the wind is northerly, as shown by the vane near the bridge, No. 10 mill must on no account be worked, if there is any work going on in the breaking-down house, or if there is any powder in it.

2. The foreman of the breaking-down house will always inform the millman when the house is cleared out, at the end of the day's work.

3. The doors of the magazines, Nos. 11, 14, and 15, are never to be opened; nor is any boat-load of powder to pass in front of them till all the Lower Island Mills have been stopped.

#### XI.—SPECIAL RULES FOR FOREMAN OF MILLS.

1. The foreman of mills is to have a general superintendence of all the mills under the master worker.

2. He is to examine all charges before they are taken away from the charge magazines, in the morning and at noon.

3. He is to keep an account of the work every mill performs during 24 hours, and give in the same at the master worker's office, every morning.

4. He will visit the mills once every night at uncertain hours, to see that everything is correct, and report verbally to the master worker the following morning.

5. He is also to attend at six o'clock a.m. and six o'clock p.m. at the change of duties, to see that the millmen are sober and fit for duty.

6. Unless something extraordinary should occur to render his presence necessary, he will be allowed to leave the works between the breakfast and dinner hours; also for one hour in the afternoon.

7. The foreman of mills is held responsible that the runners are never moved off powder without the leathers being used; he is to be present when the runners in any mill or group of mills are moved off powder, previous to the mill or group of mills being swept down, or when it may be necessary to place the runners on charcoal.

#### XII.—SPECIAL RULES FOR BREAKING-DOWN HOUSES, Nos. 1, 2, AND 3.

1. The men are to remain in the wash-houses while the machinery is in motion.

2. The foreman may, however, if he thinks necessary, occasionally enter the house to satisfy himself that the machinery is working properly.

3. No powder-boat is to be allowed to approach while the machinery is in motion.

4. The quantity of powder at any one time in the house is not to exceed 1,200 lbs.

5. On all occasions when No. 10 mill, Lower Island, is stopped on account of a northerly wind, the foreman of the breaking-down house, Lower Island, must give information to the millman as soon as all the powder has been removed from the house to the magazine.

#### XIII.—SPECIAL RULES FOR PRESS HOUSES, Nos. 1, 2, AND 3.

1. The men are to remain in the wash-houses while the machinery is in motion.

2. No powder-boat is to be allowed to approach while the machinery is in motion.

3. The quantity of powder at any one time in the house is not to exceed 900 lbs.

#### XIV.—SPECIAL RULES FOR GRANULATING HOUSES, Nos. 1, 2, AND 3.

1. The men are to remain in the wash-houses while the machinery is in motion.

2. The foreman may, however, if he thinks necessary, occasionally enter the house to satisfy himself that the machinery is working properly.

3. No powder-boat is to be allowed to approach while the machinery is in motion.

4. The quantity of powder at any one time in the house is not to exceed 1,200 lbs., except under peculiar circumstances, such as a boat leaving the house for the mill-head, or some long distance, when it would be necessary to leave a larger quantity to carry on the work, but even on these occasions the quantity in the house is never to exceed 1,500 lbs.

## Appendix, No. 2.

## XV.—SPECIAL RULES FOR DUSTING HOUSES.

1. As there must be of necessity a considerable quantity of powder dust about the dusting houses, the greatest care must be exercised in keeping the platforms clean.
2. The foreman is to be careful never to keep a greater quantity of powder in the house than is actually necessary for its proper working.

## XVI.—SPECIAL RULES FOR STOVES.

1. The stoveman is to take care that the stove is always kept at the regulated temperature, viz.: 115° at No. 1 stove, and 125° at No. 2 stove.
2. He is to be very careful that the water is always at the proper height in the boiler.
3. Before lighting the fires, he is to ascertain this by opening the gauge-cocks, when the water ought to flow freely from them.
4. When the steam is no longer required, he is to shut the steam-valve closely.
5. If by any accident the water should get too low in the boiler he must on no account allow any water to run in; this would be highly dangerous. He should draw the fire as quickly as possible and allow the boiler to cool down.
6. The stoveman going on duty is to go round with the stoveman he is about to relieve, and examine with him the temperature of the stoves, the height of the water in the boiler; also the feed-valve, steam-valve, and safety-valve, in order to satisfy himself as to the state of everything before taking charge.
7. Not more than 5,600 lbs. of powder to be dried at the same time in one stove.

## XVII.—SPECIAL RULES FOR HEADING-UP HOUSES.

1. Previous to receiving powder into these houses the platforms must be damped with water. The floor of the houses must be damped *slightly*.
2. The floors and platforms are to be kept perfectly clean, and free from grit.
3. Any powder that may by chance fall on the floor or platform must be immediately swept up.
4. All chips and broken hoops are to be removed from the house every evening.
5. The houses are to be thoroughly swept out before being closed for the night.

## XVIII.—SPECIAL RULES FOR BOATS.

1. The powder boats are to be cleaned out every day when the work is over, and again cleaned out and examined in the morning before going to work, to ensure there being no grit or other foreign substance in them.
2. No boat with powder is to approach a mill, granulating house, press house, or breaking-down house, while the red signal is shown to signify that the machinery is in motion.
3. The boatmen are to take care to use the leathers provided for them when landing or embarking powder, at the magazines, or elsewhere. The platforms must be wetted on these occasions.
4. When an open boat is used, the barrels or boxes must be carefully covered.
5. The slides and doors of the boats are always to be shut, whether there be powder in them or not.

*Special Rules for Boats on the Lower Head.*

1. Boats with powder going to and coming from the Lower Island, are on no account to pass any barge whatever in the Government waters, until the boatmen have ascertained that there is no fire or light on board the barge.
2. On seeing a barge in any part of the Government waters through which the powder boat will have to pass, one of the boatmen must go in advance, and ascertain whether any fire or light is on board.
3. Should any barge be passing through the water lying between the storehouse yard and Town Mead, the powder boat must not enter that part of the water until the barge has passed through.
4. No boat to pass under the refinery bridge with powder, until it has been reported all clear by the constable on duty.

## XIX.—SPECIAL RULES AND REGULATIONS to be strictly observed by the Masters and Men of the Barges.

1. On arrival at any station, the master is immediately to report himself to the senior military store or control officer, and if any stores are on board, to deliver the bills of lading.
2. The

2. The master is to keep the receipts and deliveries. The tally of all stores passing into or out of the vessel is to be taken by the master, who will be held responsible for the delivery of all the stores according to the receipt tally.

3. The master is to attend daily at the military store office at the station where the vessel may be lying to receive such orders as the senior military store officer may find it necessary to give, and from whom alone he will receive his instructions.

4. The master is directed frequently to examine the hold, and to be particularly careful that all iron bolts, nails, &c., are covered with sheet lead, or tanned hide, and that any defects in the barge or stores are immediately reported to the senior military store officer at the station.

5. Previously to receiving any gunpowder, ammunition, &c., the master is to take especial care to examine the hold, and see that it is clean swept, free from grit or dust, and in a fit state to receive the stores, which he is to report to the senior military store officer.

6. Combustible stores are on no account to be placed in the hold of a powder barge with ammunition.

7. On receiving gunpowder, ammunition, &c., the master is to see that the barge's hold is covered with clean wadmiltits, that the leather cushions are always used so as to cover the deck and combings of the hatchways, the barrels and boxes carefully stowed, the hatches covered with double tarpaulins, properly secured and locked, and that the keys remain in his own possession.

8. Cushions stuffed with oakum and covered with leather are to be used for landing all powder barrels or cases, whether in the hold of the barge, or on the wharf, when loading or discharging powder.

9. In stowing powder in the hold of the barge the barrels are to be carried, and on no account to be rolled over each other, and clean wadmiltits are to be laid down for the purpose of protection.

10. No leaky or badly coopered barrel is to be received on board, and should such be offered the master is to refuse to receive it, and to report the circumstance immediately to the senior military store officer in charge at the station.

11. After the barge has been discharged, the wadmiltits, &c., are to be removed, and the hold carefully cleaned out.

12. On delivery of the above stores the same caution is to be used as in loading, and if any barrels or boxes should have been unavoidably broken, or any powder become loose, it is to be carefully swept up, and the circumstance reported by the master to the senior military store officer before delivery to the magazine.

13. When gunpowder or ammunition is shipped, no fire is under any circumstances to be permitted on board, and only those lights necessary for the safety of the barge will be allowed.

14. Fires will be provided in the cook-houses at the several stations when requisite for cooking provisions.

15. When at anchor in a roadstead, or in the track of shipping, a mast-head light is to be shown, and when under weigh, the side-lights according to Admiralty regulation. No light to be shown in the River Lea.

16. When there is no gunpowder or ammunition on board, a fire may be lighted, and the master is to see it carefully extinguished at 8 p.m., and one hour previously to going alongside any ship or magazine. The fire must not be lighted before 6 a.m. The funnel to be carefully examined and swept daily.

17. Smoking on board is strictly prohibited under any circumstances whatever.

18. Having received gunpowder, ammunition, or combustible stores on board, a red flag is to be hoisted at the mast-head (or at the mast case in the Lea), and kept flying until the cargo is discharged. The master and man are to remain on board until all the stores are discharged, except it may be necessary to procure water or provisions, of which notice is to be given to the senior military store officer, but the vessel is not to be left without either the master or man, nor is any person to absent himself without express permission from the senior military store officer at the station.

19. No lucifer matches are at any time to be used on board, and any person found to be in possession of the same will be immediately dismissed. The usual tinder-box, &c., is to be kept by the master, and used for the purpose of striking a light when actually necessary.

20. When a barge laden with powder or combustible stores is unable to be unloaded on the day of arrival, she is to haul into the stream a distance of 900 yards from the Magazine Wharf.

21. When absent from his own station, and meeting with any accident, whereby the safety of the barge is endangered, or delay likely to arise, the master is to report immediately to the superintendent, and apply for assistance to the nearest military store officer, dockyard, or ship, belonging to Her Majesty.

22. The master will be held strictly responsible that the service upon which his barge is employed is performed with the utmost dispatch, and in the event of his being obliged to seek shelter, that no unnecessary delay is allowed to take place before again proceeding on his voyage. The military store officer, to whom the stores are consigned, is to be immediately informed of the circumstance.

## Appendix, No. 2.

23. No boats, unless required for service, are to be allowed alongside after 8 p.m. No light to be given to any person asking for it.
24. Every man employed in this service is to devote himself exclusively to it, and the master will be held responsible for the conduct of his men; and in the event of any disobedience of his orders, he is to report the same to the superintendent, through the senior military store officer at the station, at which he may have arrived.
25. The powder barge is to be painted red outside; and when a barge is temporarily employed in conveying powder, a piece of white painted canvas with the word "powder," in black 18-inch letters thereon, is to be strapped to the rigging on each outer side.
26. Each barge will be furnished with two red flags, also with as many pairs of magazine slippers as there are men in crew; and a like number of pairs of trowsers and frocks for working when embarking or disembarking powder, or combustible stores; these articles are not to be worn at any other period.
27. When the master or men work in the hold, they are to wear the under-clothing provided for magazine labourers, in lieu of their ordinary clothing.
28. The barge is not to pass under a railway bridge when a train or engine is approaching. The master is to send on his man to ascertain the state of the lines, and he is not to allow the barge to pass under the bridge until the lines are reported clear. When passing through locks, or under bridges, any person smoking in the vicinity is to be warned that there is gunpowder on board.
29. The sinking valves are to be used in cases of emergency, whether from fire or any other cause, there might be a risk of danger to the vessel, or its cargo, whether consisting of gunpowder or other stores.
30. On no account whatever are strangers, or any persons, except those employed by Government, whose duties require them to be present, to be allowed on board a barge at any time. The barge masters are held responsible that this order is strictly obeyed.

## XX.—RULES FOR THE MANAGEMENT OF THE FIRE ENGINES.

1. The detachment told off to each engine will be drilled at least twice a month; and as it is of the greatest importance that every member of the detachment should be thoroughly acquainted with his duties, no change must be made in the detachments without the sanction of the superintendent.
2. The foreman of each detachment is held responsible that his engine is in good working order, and ready for immediate use; that it is kept perfectly clean; that everything is in its place; and that the men of the detachment are properly instructed in their duties.
3. The strength of the detachments for a large sized engine is two foremen and 16 men; for a second sized engine, two foremen and 14 men.
4. On an alarm of "fire" being given, the master worker will order out whatever engines he may think necessary, and communicate immediately with the superintendent and assistant superintendent.
5. The engines will be conveyed to the fire by the first men that can be got together; and the detachments belonging to each engine will collect themselves at their respective engines as soon as possible.
6. Should the fire happen during working hours, the bells are on no account to be rung, as the establishment has abundant means for extinguishing a fire; and the ringing of the bells only causes unnecessary alarm. At other times, however, it will be necessary to raise an alarm by ringing the bells, in order to get the workmen together.
7. The police will be informed of the fire, and will be careful to prevent any persons who are not connected with the factory from entering.
8. The chief foreman of machinery and the master artificer will always attend in case their services may be required, and will be prepared with any tools or wrenches which may be required, independent of those carried with the engines.
9. Before working the engines, the foreman of each will see that the men of his detachment are placed according to their numbers, as told off in the drill. They will then work the engines without noise and confusion.
10. Should the fire take place in a situation where the suction pipes cannot be used, water must be supplied to the engines by means of each man of the detachment carrying a bucket with him. The best way to keep up a continuous supply is to form two lines of the bystanders about six feet apart, and cause the one line to pass the full buckets to the engine; the other to pass the empty ones back to the water.
11. The windows and doors of buildings which have caught fire must be kept shut as closely as possible to diminish the draft of air to the fire.
12. Great caution must be exercised in using the saws, axes, &c., to form a gap between burning buildings and others which the fire has not reached. As much unnecessary damage is often done in this way, no demolition is to be commenced except under the distinct orders of the senior officer of the factory present at the time.
13. After the fire is extinguished, the foreman of the detachments will see that the lengths of hose which have been used are well washed and hung up to dry; and that, after two days have elapsed, they are well oiled with neat's foot oil, and coiled up ready for use.
14. The foremen and men of the detachments are to make themselves thoroughly masters of the Drill for the Fire Engines, a MS. copy of which is kept in the master worker's office.
15. Should

15. Should a fire happen in the town or neighbourhood, the senior officer of the factory on the spot at the time may, if applied to by the parish authorities, use his discretion as to allowing the engines to proceed to the fire. If the engines are sent, the foremen and Nos. 1 to 8 of each detachment must accompany them to see that they are properly handled.

**XXI.—WORKING HOURS OF THE FACTORY.**

1. To equalise the work at the different seasons of the year, the working hours of the Gunpowder Department of the Factory will for the future be—  
 From 1st March to 30th September, 7 a.m. to 5.30 p.m.  
 From 1st October to 28th February, 7 a.m. to 5 p.m.  
 The dinner hour will be from 12 to 1 all the year round.  
 The mill-men on day-duty work all the year round from 6 a.m. to 6 p.m.; beginning work as early as possible on Monday morning.  
 They continue working on Saturdays till 10.30 p.m.  
 The mill-men on night-duty commence work at 6 p.m., and are relieved at 6 a.m.  
 The mill-men must not leave the factory during these hours of duty.  
 The cylinder-house men and the refiners of sulphur, whose hours of labour are modified by the work on hand, are not required to adhere strictly to the above hours.

**2. Store and Saltpetre Departments.**

The hours in the store and saltpetre departments will be the same as those in the gunpowder department; but the indulgence now granted to the men employed in the saltpetre refinery of leaving at 12.50 p.m. on Saturdays, provided they can finish their work to the master refiner's satisfaction, is continued as a temporary arrangement.

**3. Machinery Department.**

The artificers and mechanics work all the year round from 6 a.m. to 5.30 p.m., leaving on Saturdays at 12.30 p.m.  
 The gasmen relieve each other at 6 a.m. and 6 p.m.  
 The stokers and engine drivers work the same hours as the mill-men.  
 If employed in the workshops, they work the same hours as the artificers.

## Appendix, No. 3.

PAPERS handed in by Major *Majendie*, R. A., 8 May 1874.

## Appendix, No. 3.

## NOTICE.

## ILLEGAL MANUFACTURE OR SALE OF FIREWORKS.

By the Act 23 & 24 Vict. c. 139, it is illegal—

1. To manufacture or sell fireworks without a license.
2. To manufacture fireworks within 50 yards of a dwelling-house, or of any building unconnected with the manufacture.
3. To fill fireworks within 20 yards of other workshops connected with the manufacture.
4. To carry on the manufacture of fireworks without having a magazine of brick or stone at the required Statutory distance from the other workshops of 50 yards.

Notice is hereby given that all persons acting in contravention of the above quoted Act of Parliament are liable to heavy penalties, and will be rigorously proceeded against as the law directs.

*E. Y. W. Henderson,*

The Commissioner of Police of the Metropolis.

Metropolitan Police Office,  
4, Whitehall-place,  
19 February 1872.

## THAMES DIVISION.

RETURN of the Average Quantity of GUNPOWDER Shipped during the Undermentioned Years.

## BLACKWALL STAIRS ONLY.

(There are other Shipments at Wapping, Collier Dock, Blackwall, and Bow Creek.)

Year.	Average Number of Tons.
1868 - - - - -	14
1869 - - - - -	3
1870 - - - - -	241
1871 - - - - -	75
1872 - - - - -	132
1873 - - - - -	122

*W. Alston*, Superintendent.

BLACKWALL STATION.

RETURN of the Quantities of GUNPOWDER Landed and Shipped off in the Locality of *Blackwall* during the past Five Years.

DATE.	Quantity, Weight, or No. of Barrels.	Shipped or Landed.		Where Shipped or Landed.	Name of Officer present at Shipment.	REMARKS.
		Barges.	Vans.			
22 February 1868	14 tons	Phœbe		Blackwall Stairs	P. C., 46, G. Roberta	For transhipment.
7 Dec. - 1869	3 "	Quickstep	3 vans	ditto	Inspector Goode	L. & N. W. R. S., Poplar.
25 March 1870	8½ "	Ditto	5 " P. C.	ditto	Inspector Trickie	For transhipment.
7 May - "	4 "	Telegram	3 " P. C.	ditto	P. C., 35, Loft	ditto.
28 " - "	5 "	Ditto	ditto	ditto	P. C., 80, Anderson	ditto.
26 July - "	4 "	Joseph Honey	2 vans, P. C.	ditto	P. C., 93, Hathaway	ditto.
27 " - "	3½ "	- ditto	ditto	ditto	Inspector Trickie	ditto.
5 November "	4½ "	- ditto	ditto	ditto	Inspector Goode	ditto.
16 " - "	7½ "	Telegram	5 vans	ditto	Inspector Trickie	ditto.
18 " - "	22½ "	Annie Eliza	14 "	ditto	ditto	ditto.
19 " - "	3 "	Joseph Honey	2 "	ditto	P. C., 93, Hathaway	ditto.
19 " - "	7 "	- Ditto	4 "	ditto	ditto	ditto.
20 " - "	5 "	Clara Ann	2 "	ditto	Inspector Varley and Trickie.	Seized and conveyed to Woolwich Arsenal.
28 " - "	5 "	- ditto	4 "	ditto	Inspector Trickie	For transhipment.
29 " - "	4 " 12 cwt.	Quickstep	3 " 1 P. C.	ditto	ditto	Great Northern Railway.
30 " - "	3½ "	Clara Ann	3 "	ditto	P. C., 87, Callaghan	For transhipment.
1 December "	6 "	- ditto	4 "	ditto	P. C., 93, Hathaway	ditto.
1 " - "	13 " 15 cwt.	Joseph Honey	8 " 3 P. C.	ditto	P. C., 108, Judgo	ditto.
1 " - "	6 "	- ditto	4 "	ditto	Inspector Goode	ditto.
2 " - "	7½ "	Telegram	5 "	ditto	ditto	ditto.
2 " - "	17 " 5 cwt.	Clara Ann	11 " 3 P. C.	ditto	P. C., 93, Hathaway	ditto.
2 " - "	9 " 15 "	- ditto	7 " 2 "	ditto	Inspector Goode	ditto.
3 " - "	17 "	Telegram	9 "	ditto	Inspector Trickie	ditto.
3 " - "	7 "	Ditto	4 " 1 cart	ditto	ditto	ditto.
3 " - "	1 "	Clara Ann	1 "	ditto	ditto	ditto.
3 " - "	12 "	- ditto	9 " 2 P. C.	ditto	P. C., 68, J. White	ditto.
6 " - "	2 "	- ditto	2 "	ditto	Inspector Goode	ditto.
6 " - "	1 "	- ditto	1 "	ditto	ditto	ditto.
6 " - "	9 "	- ditto	6 "	ditto	ditto	ditto.
6 " - "	4½ "	- ditto	3 "	ditto	Inspector Trickie	ditto.
6 " - "	16 " 9 cwt.	Telegram	11 "	ditto	P. C., 93, Hathaway	ditto.
8 " - "	1 "	Powder Boat	1 "	ditto	Inspector Goode	ditto.
9 " - "	2 "	Joseph Honey	2 "	ditto	ditto	ditto.
12 " - "	2 "	John	2 " P. C.	ditto	Inspector Trickie	ditto.
13 " - "	1½ "	2 Powder Boats	1 "	ditto	P. C., 93, Hathaway	ditto.
15 " - "	7½ "	Clara Ann	5 "	ditto	Inspector Trickie	ditto.
16 " - "	3 "	- ditto	2 "	ditto	P. C., 93, Hathaway	ditto.
16 " - "	5 "	Joseph Honey	3 " 1 cart	ditto	ditto	ditto.
17 " - "	1 "	Powder Boat	1 " P. C.	ditto	ditto	ditto.
31 " - "	8 "	Betsey	5 "	ditto	Inspector Trickie	ditto.
11 January 1871	4¾ "	Telegram	3 " P. C.	ditto	ditto	ditto.
15 February "	6 "	Quickstep	4 "	ditto	Inspector Goode	ditto.
17 " - "	4½ "	3 Powder Boats	3 "	ditto	ditto	ditto.
24 " - "	15 "	Volante	11 "	ditto	ditto	ditto.
8 March "	10¾ "	Quickstep	8 "	ditto	ditto	ditto.
16 " - "	5 "	- ditto	5 "	ditto	P. C., 80, W. Anderson	ditto.
25 April - "	4½ "	- ditto	4 "	ditto	Inspector Varley	Camden Town Railway.
25 " - "	5 barrels	Powder Boat	1 cart	ditto	ditto	For transhipment.
26 " - "	7¾ tona	Quickstep	6 vans	ditto	Inspector Trickie	ditto.
22 June - "	5 "	3 Powder Boats	3 " P. C.	ditto	ditto	ditto.
10 October "	5 "	Quickstep	3 "	ditto	Inspector Varley	ditto.
11 November "	5 "	- ditto	3 "	ditto	ditto	Great Northern Railway.
15 March 1872	6 "	- ditto	4 "	ditto	Inspector Goode	Great Eastern Railway.
5 April "	5 "	Volante	3 " P. C.	ditto	Inspector Trickie	For transhipment.
16 " - "	2 "	Quickstep	3 "	ditto	P. C., 56, Lewis	Great Northern Railway.

DATE	Quantity, Weight, or No. of Barrels.	Shipped or Landed.		Where Shipped or Landed.	Name of Officer present at Shipment.	REMARKS.
		Barges.	Vans.			
11 May - 1872	5 tons	Black Boy	3 vans	Blackwall Stairs	P. C., 42, Hatwell	Great Northern Railway.
28 " - "	5 "	Volante	3 " 1 P. C.	ditto	Inspector Trickie	For transhipment.
14 June - "	2 "	1 Powder Boat	1 " "	ditto	ditto	ditto.
24 " - "	6½ "	Volante	5 " -	ditto	Inspector Goode	ditto.
24 " - "	8 "	ditto	6 " -	ditto	P. C., 42, Hatwell	ditto.
4 July - "	1¾ "	1 Powder Boat	2 " P. C.	ditto	Inspector Trickie	ditto.
19 " - "	8 "	Quickstep	6 " 2 P. C.	ditto	Inspector Varley	Grand Junction Canal.
19 " - "	6½ "	ditto	4 " -	ditto	ditto	For transhipment.
7 August "	6 "	Volante	4 " 1 cart	ditto	Inspector Trickie	ditto.
8 " - "	10 "	ditto	7 " -	ditto	Inspector Goode	ditto.
12 " - "	8 "	ditto	6 " -	ditto	Inspector Trickie	ditto.
6 Sept. "	6½ "	ditto	4 " 1 cart	ditto	ditto	Grand Junction Canal.
19 " - "	4½ "	Quickstep	3 " -	ditto	ditto	Great Northern Railway.
20 " - "	5 "	ditto	Railway Carriage	Midland Railway Wharf.	Inspector Varley	For transhipment.
10 October "	1½ "	ditto	1 van P. C.	Blackwall Stairs	P. C., 42, Hatwell	Grand Junction Canal.
17 " - "	3½ "	ditto	2 " 1 P. C.	ditto	Inspector Trickie	ditto.
30 " - "	3½ "	Volante	2 " "	ditto	ditto	For transhipment.
30 " - "	5½ "	ditto	3 " 2 "	ditto	P. C., 80, Anderson	ditto.
31 " - "	2 "	ditto	2 " -	ditto	ditto	ditto.
7 Nov. "	1½ "	Betsy	1 " P. C.	ditto	Inspector Trickie	ditto.
20 " - "	3½ "	Volante	2 " 1 P. C.	ditto	ditto	Grand Junction Canal.
10 Dec. - "	3 "	ditto	2 " -	ditto	Inspector Goode	Camden Town Railway.
13 " - "	18 "	Quickstep	12 " P. C.	ditto	Inspector Varley	Great Northern Railway.
17 Jan. 1873	3½ "	Volante	2 " 1 P. C.	ditto	P. C., 56, Lewis	Grand Junction Canal.
20 " - "	3½ "	ditto	2 " "	ditto	P. C., 80, Anderson	Camden Town Railway.
29 " - "	2 "	ditto	2 " -	ditto	Inspector Goode	Great Northern Railway.
4 Feb. - "	4 "	Quickstep	3 " 1 P. C.	ditto	P. C., 42, Hatwell	ditto.
18 " - "	4½ "	ditto	3 " -	ditto	Inspector Trickie	ditto.
24 " - "	10 "	Volante	Railway Carriage	Midland Railway Wharf.	Inspector Varley	For transhipment.
21 March "	4 "	Quickstep	3 vans	Blackwall Stairs	P. C., 42, Hatwell	Grand Junction Canal.
1 May - "	2 "	Volante	2 " -	ditto	ditto	Great Northern Railway.
17 " - "	4 "	Quickstep	2 " P. C.	ditto	P. C., 90, Corsan	Grand Junction Canal.
19 " - "	1½ "	Volante	2 " -	ditto	Inspector Goode	For transhipment.
5 June - "	6 "	Quickstep	4 " -	ditto	ditto	Great Northern Railway.
6 " - "	1½ "	William	1 " -	ditto	P. C., 14, Gardner	For transhipment.
28 " - "	15 "	Quickstep	9 " 2 P. C.	ditto	P. C., 57, Long	Great Northern Railway.
8 July - "	5½ "	Volante	4 " -	ditto	Inspector Trickie	Grand Junction Canal.
17 " - "	4 "	Quickstep	2 " -	ditto	Inspector Goode	For transhipment.
9 August "	4 "	ditto	3 " -	ditto	Inspector Terry	Grand Junction Canal.
20 " - "	2 "	ditto	1 " P. C.	ditto	Inspector Goode	ditto.
26 " - "	5½ "	ditto	3 " 1 P. C.	ditto	Inspector Trickie	ditto.
12 Sept. - "	4 "	Volante	2 " -	ditto	Inspector Goode	Great Northern Railway.
15 " - "	7 "	ditto	4 " 2 P. C.	ditto	P. C., 108, Judge	ditto.
23 " - "	1 "	Sappho	1 " -	ditto	P. C., 10, Daley	ditto.
25 October "	2 "	Volante	1 " P. C.	ditto	Inspector Trickie	Grand Junction Canal.
3 Nov. - "	5 "	ditto	2 " 1 P. C.	ditto	Inspector Terry	ditto.
12 " - "	4 "	Sappho	2 " 2 P. C.	ditto	Inspector Trickie	ditto.
17 " - "	6 "	Volante	4 " -	ditto	P. C., 40, Egaltan	ditto.
5 Dec. - "	10 "	ditto	7 " 5 P. C.	ditto	P. C., 60, Vine	ditto.
9 " - "	4 "	ditto	2 " P. C.	ditto	Inspector Trickie	ditto.

W. Alston, Superintendent.

J. Varley, Inspector.



Appendix, No. 4.

PAPER handed in by Colonel *Younghusband*, 12 May 1874.

(Issued with Army Circulars, October 1872.)

Appendix, No. 4.

REGULATIONS for GUNPOWDER MAGAZINES in charge of the Control Department, including RULES for the Reception, Conveyance, Storage, Classification, and Examination of Gunpowder and Ammunition.

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GUNPOWDER MAGAZINE REGULATIONS.—CONTROL DEPARTMENT.

I.—CHARGE OF MAGAZINES.

1. AT home stations the premises in which gunpowder is stored will be watched by a warder and guard by day, and by a military guard with civil watchmen during the night. At foreign stations the civilian warders and watchmen are not usually required, the watching being performed by military sentries.
2. The guard will be visited by an officer by day, and also, when practicable, by night. A copy of the guard report will be furnished every morning to the control officer in charge by the officer commanding the troops.
3. The control officer in charge at home stations will occasionally inspect the police, warders, or watchmen, to see that they are on the alert and doing their duty.
4. The police, warders, watchmen, and sentries will not permit any persons but such as are employed in the service of the department to enter the magazines or enclosures. All the outer gates will be kept shut, and no artificer, labourer, or other person will be allowed to pass during the working hours without leave from the control officer in charge.
5. The police, warders, watchmen, and sentries will not allow any smoking or fire near the magazine, laboratory, or shifting room, nor will they suffer any person to come within the outer gates who has the least appearance of intoxication. They will immediately secure anyone guilty of any of these offences, and report the circumstance to the control officer in charge.
6. Any person in the employ of the department who may be detected smoking in any part of the gunpowder works, magazines, or laboratories, or bringing tobacco pipes or lucifer matches into the premises, will be immediately dismissed.
7. The night sentinels will strike on their respective bells every quarter of an hour; and every sentinel who does not hear the bell next to him struck will report the fact to his non-commissioned officer, on being relieved.
8. No shrubs or cultivation whatever will be allowed in or near magazine yards, nor are any animals to have access to them.

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9. The control officer in charge will not absent himself for a night from the magazines without authority.

10. The control officer will superintend all operations which are being carried on by the foremen, labourers, and others under his orders, and see that the whole of the duties are properly conducted.

11. On no occasion will strangers have access to a magazine without the attendance of a control officer or foreman, whose duty it will be to take care that all persons entering have attended to the necessary precautions, and that they have no articles of a combustible nature in their possession.

12. The foreman will be present when the labourers arrive in the morning. He will unlock the door of the magazine, open the shutters, and when the weather permits, open the windows and air-holes for the purpose of ventilation.

13. The foreman will keep a regular daily entry of all receipts and issues, and make the necessary alterations in the tally-boards attached to the bays in the magazine.

14. The foreman will remain at the magazine during the working hours, and on no account leave it, unless ordered to do so by superior authority.

15. The foreman and labourers will always wear during the working hours, in place of their ordinary clothing, the dress prescribed and furnished by the War Department, viz., jacket of lasting cloth, trousers of Oxford cloth, and plain blue Glengarry, to be supplied by the director of clothing on application. They will change their shoes in the shoe-house, and never appear at the magazine in any other than those prescribed by these regulations. (See §. 18.)

16. Particular care will be taken that the shutters to the windows or air-holes to the powder magazines and store-houses be opened every fine day; and, when they are open, a person will always be in charge on the spot. All the windows and doors of the magazines will be well secured every evening before the night guard is set.

17. The foreman will close and bar the shutters and air-holes; and on leaving work he will see that everything is secure, lock the doors, and make his report to the control officer in charge, with whom he is to deposit the keys.

18. The several persons whose duty obliges them to go into the magazines, will invariably exchange their shoes for magazine slippers before they enter, or else enter without shoes. Care will be taken to provide a sufficient supply of either goloshes or slippers of suitable sizes, fitted with straps and brass buckles to fasten over the instep, so as to prevent sliding or shuffling along the floors or platforms.

19. When there is an outer wall to the magazine, the door in it, on any person entering, will be shut before that of the magazine is opened; and the inner door of the magazine shut before the outer one is opened on his going out.

20. The floors of the magazines, shifting rooms, and passages, will be well swept, and kept free from all gravel, sand, or grit; and previously to the removal of powder, the rolling-ways and stages will also be carefully watered.

21. The following regulation contained in paragraph 4 of the Enclosure to War Office Circular No. 498, dated 7th November 1859, has been extended to Home Stations:—

“In order to secure the best mutual intelligence between departments, which in some respects, are dependent on one another, and a knowledge of each others wants and resources, it is desirable that the officer commanding the Royal Artillery, the commanding Royal Engineer, and the Controller should, once a year, or oftener, if necessary, make a conjoint inspection of the works, magazines, stores, workshops, &c., of all their departments, not as a board, or with any view to a joint report, but that neither should have any excuse for not being personally acquainted with anything that the interest of the service requires him to know in the department of the other, and for the opportunity that would thus be afforded to each of calling attention on the spot to requirements which it may be the departmental duty of the others to know.”

22. Minutes recording these inspections, and any departmental action taken in consequence thereof, will be entered in books to be kept for that purpose by the officer commanding Royal Artillery, the commanding Royal Engineer, and the Controller respectively. The senior inspecting officer will report to the general officer commanding, previous to his making his annual inspection report, that such inspections have been made, stating the dates thereof, and also the names of the officers attending.

## II.—PRECAUTIONS AGAINST FIRE.

23. The police, warders, watchmen, and sentries will be particularly attentive to the least appearance of a storm, and on hearing the first clap of thunder, or seeing a flash of lightning, though the storm may be at a great distance, they will immediately give an alarm by ringing the bells at their posts; and the control officer or magazine keeper, as the case may be, on hearing such alarm, will immediately cause all the magazine doors and windows to be shut, and use every precaution necessary for the safety of the magazine.

24. When

24. When such alarm has been given, it will be the duty of every person in the employ of the department, whether on or off duty, immediately to repair to the office to render such services as may be required of him by the control officer in charge.

25. The same precautions will be adopted in the event of any fire breaking out in the neighbourhood of the magazines.

26. All the lights on the premises occupied by the foremen, artificers, and labourers attached to the station will be extinguished at half-past 10 P.M.; except in cases of sickness, which are to be reported to the control officer in charge.

27. No percussion caps will be kept in any magazine, shifting house, or other building where any manipulation of gunpowder takes place; but all surplus caps, either loose or in zinc cylinders, will be placed in a secure store by themselves.

28. The fire-engines, engine-hose, ladders, fire-hooks, &c., will be kept in perfect repair, and so lodged, that they at all times be ready and fit for use.

29. The person in charge of the magazine should know perfectly the arrangement and whereabouts of each article, so as to be able to find it at once in the darkest night.

30. The control officer in charge will be held responsible that the cisterns are kept constantly full of water, for the security of the magazine, and that the several pumps and lightning conductors are kept in proper repair, and the wells full. Should any of these things become defective, a requisition will immediately be made on the Royal Engineer Department for the repairs to be performed.

### III.—VENTILATION OF MAGAZINES.

31. Filled cannon cartridges having been destroyed by mildew in a magazine which had been reported free from damp, the Secretary of State for War directs that particular attention may invariably be paid to the ventilation of all magazines.

32. A memorandum explanatory of the principles on which the ventilation of magazines is to be regulated, is printed in the Appendix (*see* page 298). Local instructions based on these principles, will be prepared for the guidance of the subordinates in immediate charge of the buildings. Copies of any such instructions will, in each case, be forwarded to the War Office.

33. Each magazine used for the permanent storage of loose gunpowder to the extent of 100 barrels and over, will be provided with a common thermometer to indicate the temperature of the internal walls.

34. At each station, the control officer in charge will be supplied with a pair of wet-and-dry-bulb thermometers, for the purpose of observing the dew points. These thermometers should be placed, when used for observations, in some spot in the open air, protected from the sun and wind, and not exposed to any exceptional influences. The scale attached to the dry bulb will indicate the temperature of the external air. The scale attached to the wet bulb will indicate a temperature more or less below that of the air, in proportion to the quantity of moisture which the air contains; except in the case of its being completely saturated, when both scales will give similar readings. It is necessary for the wet bulb to be always supplied with water, and its capillary threads and muslin covering kept in order.

35. By means of the annexed Table, the dew-point may be ascertained for various degrees of temperature, and when the air is in different conditions with regard to dampness.

36. Whenever, notwithstanding a careful attention to ventilation, magazines are found to be damp, their condition may be improved by the use of quick-lime, which has the property of absorbing from the air about one-third of its own weight of water.

37. The proper time for using lime is when the condition of the magazine would not be improved by ventilation, and when, consequently, the ventilators are closed. Lime would be of very little service while a rapid current of air was passing through the building.

38. Lime will be used during the seasons of the year least favourable for ventilation in all magazines that show signs of dampness.

39. The lime should be fresh from the kiln, broken into lumps not larger than about the size of a pigeon's egg, and exposed to the air of the interior of the magazine in shallow vessels. It should be kept in air-tight casks until spread out for use.

40. The best limes for absorbing moisture are fat limes (which are least valuable for building purposes), such as those produced from white chalk and the non-hydraulic limestones.

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41. TABLE showing the dew-point of the air at different degrees of temperature, when the reading of the wet bulb of the Thermometer is from 1 to 10 degrees below that of the dry bulb.

Tem perature (Fahrenheit).	Dew-point when the Wet Bulb stands from 1° to 10° lower than the Dry Bulb.									
	1° Lower.	2° Lower.	3° Lower.	4° Lower.	5° Lower.	6° Lower.	7° Lower.	8° Lower.	9° Lower.	10° Lower.
34	31½	28½								
36	33½	31	28½							
38	35½	33¼	30¾	28½						
40	37¾	35½	33¼	30¾	28½					
42	39¾	37½	35½	33¼	31	26¾				
44	41¾	39½	37½	35½	33	30¾	28½			
46	44	41¾	39¾	37½	35½	33	31½	29¼		
48	46	43¾	41¾	39¾	37½	35½	33¼	31½	29	
50	48	45¾	43¾	41½	39½	37½	35¼	33¼	31	29
52	50	48	46	44	42	40	38	36	34	32
54	52	50	48	46	44	42	40	38	36	34
56	54	52	50	48	46	44	42	40	38	36
58	56	54½	52½	50½	48½	46½	44¾	42¾	41	39
60	58	56½	54½	52½	50½	48½	46¾	44¾	43	41
62	60	58½	56½	54½	52½	50½	48¾	46¾	45	43
64	62	60½	58½	56½	54½	52½	50¾	48¾	47	45
66	64½	62½	60½	58½	57	55½	53½	51½	49¾	48
68	66½	64½	62½	60½	59	57½	55½	53½	51¾	50
70	68½	66½	64½	62½	61	59½	57½	55½	53¾	52
72	70½	68½	66½	64½	63	61½	59½	57½	55¾	54
74	72½	70½	69½	67½	65½	63½	62	60½	58¾	57
76	74½	72½	71	69	67½	65½	64	62½	60¾	59
78	76½	74½	73	71½	69½	67½	66	64½	62¾	61
80	78½	76½	75	73½	71½	69½	68	66½	64¾	63
82	80½	78½	77	75½	73½	71½	70	68½	66¾	65
84	82½	80½	79	77½	75½	73½	72	70½	68¾	67
86	84½	82½	81	79½	77½	75½	74	72½	70¾	69
88	86½	84½	83½	81½	80	78½	76¾	75½	73¾	72
90	88½	86¾	85½	83½	82	80½	78¾	77½	75¾	74

#### IV.—CARE AND STOWAGE OF GUNPOWDER.

42. On the arrival of powder the control officer will look to the distinguishing marks on the heads of the barrels, and will arrange them in the magazines so as to keep the barrels of the several lots together as far as practicable.

43. Every barrel, box, or case will be carefully examined, in order to discover whether it be perfectly closed, so that no powder can escape, and whether any of the hoops be fastened with iron nails, or there be any iron or anything objectionable on any part of the barrel, &c. Should any barrel, box, or case be discovered so circumstanced, it will not be received into the magazines, but the powder will be immediately shifted into another barrel or case, and a report made to the Controller. These precautions must never be dispensed with, as fatal accidents have happened from their being neglected. A record of the examination will be made on every arrival of powder.

44. No barrel, box, or case will on any account be opened in the magazine, but, when required, will be taken to a shifting room, which ought always to be provided for that purpose.

45. No barrels containing powder or ammunition will be suffered to lie open in the magazine, and no powder will be shifted from one bay to another, or otherwise, without a sufficient number of tanned hides or wadmiltits being placed under the barrels, in order to keep the powder as much as possible from the floors; any loose powder will be carefully swept up, and not suffered to remain. Care must also be taken that all powder barrels are properly and securely stacked in the several bays; and, in case any of the heads of the barrels start, they will immediately be removed, and the powder shifted into serviceable barrels.

46. In the event of the issue of a less quantity than a whole barrel, the package containing it will be marked like the barrel from which it is taken. In the journal of issue, the marks, dates, &c., will be noted as a matter of record.

47. In stacking barrels or cases of powder and ammunition, a space will be left between them and the wall of the magazine, to allow of a free circulation of air and prevent injury from damp.

48. Occasional opportunities will be taken at all stations (especially where the magazines are liable to damp) of shifting powder from one bay to another, and opening and re-coopering a few barrels, in order to ascertain if the powder is free from lumps, and to keep the barrels in a serviceable and good state. If in performing this work the powder should be found in any way lumpy or set, it will be shifted from one barrel to another, the lumps being broken down with the hand as the powder is passed from the barrel to which it belongs, to the new one.

49. The

49. The practice of periodically rolling about barrels must not be resorted to, as it breaks the grains of powder into dust. Appendix, No. 4.

50. Ammunition for breech-loading small-arms, which contains its own means of ignition must not be stowed within the same masonry compartments of magazines as gunpowder, whether the latter is loose or in the shape of filled gun cartridges.

51. Control officers will accordingly take the necessary steps for placing ammunition of this class in separate masonry compartments.

52. Powder, the produce of broken-up breech-loading small-arm ammunition, will not be stored in magazines or used for any purpose, on account of the danger which might arise from a mixture of the detonating composition with it.

53. Such powder will be carefully kept separate, wetted, and reserved for extraction of the saltpetre.

54. Breech-loading small-arm ammunition should not, however, be broken up without the special order of the Surveyor General, obtained through the Controller, Royal Arsenal.

55. Powder from Palliser shells will be treated in a similar manner to that obtained from B. I. ammunition.

56. Powder from shells, unless it can be sold on the spot, will be stored in a magazine separate from other powder, or wetted and reserved for extraction. Powder, although called "shell" in the returns, is not to be condemned, unless it actually came out of shells. A great portion of the powder in R.A. charge for filling shells, was never in shells at all, while the remainder was issued in flannel bags as bursters.

57. The powder which has been longest in store, will always be issued first, except by special order to the contrary. All new powder barrels, when properly seasoned, will be correctly tared, and the weight of the tare marked on the barrel.

58. When any of Her Majesty's ships are returning home from foreign stations, control officers will apply to the senior naval officer for permission to land such serviceable powder and ammunition as may be required at the station, and to send home any unserviceable powder and ammunition in exchange.

59. Upon no account whatever are friction tubes, percussion fuzes, or fuzes of any kind that contain their own means of ignition, within themselves, to be placed inside any magazine.

#### V.—COOPERAGE.

60. All tools, instruments, or other articles used in the magazines are to be made of wood or copper, and nothing containing iron, or liable to cause ignition, will be admitted.

61. The use of iron rivets to copper hoops of the description used for powder barrels, whether loose or otherwise, is forbidden, even if those hoops should be intended to be applied in the first instance to barrels not containing powder, as they are liable to be afterwards transferred to such as may contain it.

62. To prevent any inconvenience to the service that might arise from the want of proper rivets necessary to replace those which may break, control officers at all stations will keep a small store of copper rivets sufficient for that purpose, and make timely demands for such as they may require.

63. The pieces of wood forming the heads of powder barrels will be put together with wooden pins, and in no case will iron be used.

64. In heading and unheading powder barrels, the persons employed will never use the bare adze against the copper hoops, but will invariably apply a wooden setter.

65. Whenever it may be necessary to shift gunpowder from one barrel to another, the barrel intended to receive such powder will first have all the marks, except the tare on it, carefully obliterated, and will then be re-marked with precisely the same marks as the barrel from whence the powder is transferred, with the exception of the tare marks.

66. Nails will on no account be used to fasten on the hoops in re-heading powder barrels.

67. Powder barrels, either for stowage or issue, will contain 100 lbs. each, except in the case of "P" powder, of which each barrel contains 125 lbs. The quantity of powder in cannon and small-arm cartridges will be calculated accordingly.

#### VI.—EXAMINATION AND CLASSIFICATION OF GUNPOWDER.

68. The examination of gunpowder in store will be conducted by inspectors of warlike stores and other proof officers, in the following manner:—

69. About one-fifth part of the whole quantity in store will be tested annually; of this fifth, one in every 20 barrels, selected indiscriminately, will be examined. In the second year

Appendix, No. 4. the same course will be pursued with reference to another fifth of the store, and so on until the whole shall have been examined, when the process will be repeated.

70. The barrels actually examined will in each case be marked, and other barrels will be selected when the same lot again comes under examination.

71. The examination of powder will be confined to an inspection by sight and hand, for the purpose of testing its qualities in the following points:—

1st. As respects the condition of the grain, which should be firm, crisp, and bright in colour.

2nd. As regards freedom from dust and foreign matters.

This latter point will be ascertained by pouring the powder from a bowl held two or three feet above the barrel.

72. The firing proof, by means of the Eprouvette Mortar, will cease.

73. If the examination be in all respects satisfactory, and there be no sign of deterioration, the powder may be placed in Class I.

74. Any portion of service powder found on inspection to be unmistakably dusty or broken in the grain, may at once be reduced to an inferior class.

75. Exceptions to this rule will, however, be made in the case of R. F. G. and R. L. G. powders, which, if only dusty, will be redusted and restored to the 1st Class.

76. In cases that admit of doubt, the report of the examination will be transmitted through the local Controller to the Superintendent, Royal Gunpowder Factory, before the powder is reduced from the service class; but if urgently required for service it may be issued.

77. Service powders include all descriptions used for firing projectiles, whether from cannon or small arms. Serviceable powders include service, blank, and shell powders.

78. After examination, gunpowder will be classified and marked according to the following table; and if repaired, the barrels will be specially distinguished (*see* § 87), in order to ensure their being issued before gunpowder in a less deteriorated condition. Re-examination will be noted in like manner with date.

Class.	Designation.	Description.
I.	Service. - - -	1. All new powder. 2. All returned powder (including cannon cartridges) which on examination may be found uninjured.
II.	Blank - - -	1. Powder from broken-up cannon cartridges, unless specially placed in Class I. 2. Powder from broken up S. A. Ammunition.* 3. Service powder found dusty or broken in the grain at periodical inspections, or on return; except in the cases of R. L. G. and R. F. G. powders, which if only dusty will be re-dusted for service.
III.	Shell - - -	1. Powder found too dusty for Class II. 2. Powder emptied from shells.
IV.	Doubtful - - -	All powder whatever (except new powder) returned into store, and awaiting examination.
V.	Condemned for sale -	Powder found on examination to be too much deteriorated to be placed in any of the above classes..
VI.	Condemned for extraction.	Powder found to be too much damaged and unfit for anything but extraction of saltpetre.

79. Powders found on examination to be repairable, will at once be marked with the class to which they are capable of being converted; but will be crossed in white chalk, in order to indicate that they are only equivalent to a doubtful powder in an issuing point of view.

80. At home stations all powder returned into store will, in the first instance, be placed in Class IV.; it will be removed to one of the other five classes on the result of the inspection being determined. At stations where conveniences for local examination may exist, a requisition will be made by the Controller to have this inspection made without delay. If circumstances should render such a course impracticable, the gunpowder will be retained as "doubtful," and a report of the circumstances made to the Controller, Royal Arsenal, Woolwich, who will convey the orders of the Surveyor General in the matter.

81. At

\* Powder obtained by breaking up breech-loading small-arm ammunition should be at once thoroughly wetted, as it may contain small particles of detonating composition. In this state it is useless except for extraction of saltpetre, and will therefore be placed in Class VI.

81. At foreign stations the examination of powder will be conducted by the proof officer, on the requisition of the control officer. The examination will be made as soon as possible after delivery into store, in order to enable the Commissary to assume charge of the gunpowder in accordance with its existing state and condition.

82. At stations where no Artillery are located, the Commissary will personally examine all powder contained in the original packages as soon as received into store. If no signs of deterioration present itself, he may assume charge of the powder under its original classification, and may re-issue it accordingly; but should there be any reason for doubt, the powder will be taken in charge and marked as under Class IV., and the circumstances reported to the Controller, Royal Arsenal, Woolwich, who will communicate the orders of the Surveyor General.

83. Powder from broken up cartridges, and powder emptied from shells, will in all cases be sifted before being returned into store, so that all extraneous articles may be detected. Barrels of powder "emptied from shells" are to be distinguished as such.

84. The sizes of sieves used in sifting powder before returning it into store, will be as follows:—

For R. L. G. powder, a sieve of 3 meshes to the inch.

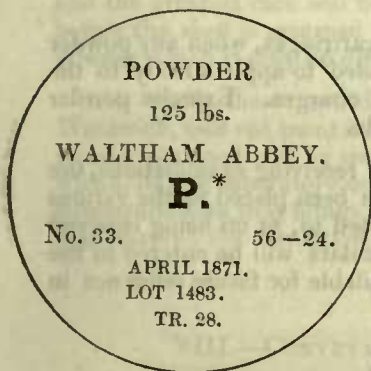
L. G.	"	"	6	"	"
R. F. G.	"	"	8	"	"
F. G.	"	"	12	"	"
Pistol	"	"	16	"	"

85. On receiving powder, Commissaries will look to the distinguishing marks, showing the description of powder, maker's name, and dates of stoving; and will arrange the barrels in the magazine accordingly, carefully keeping the powder of each date of stoving together as far as practicable.

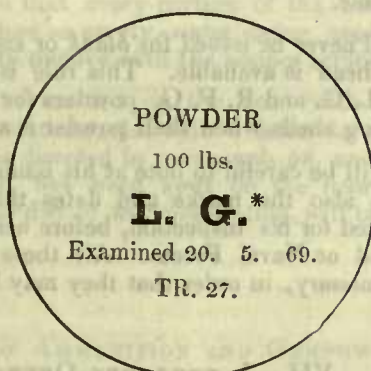
86. In issuing service powder, care will be taken to issue as far as possible, the powder of the same maker, and of the same date of stoving.

87. The annexed examples will show the manner in which the heads of barrels will be marked in future.

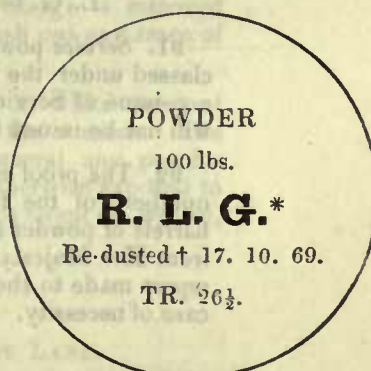
No. 1.



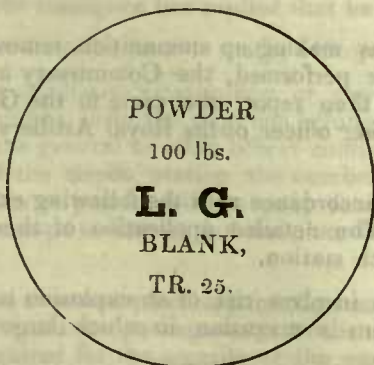
No. 2.



No. 3.



No. 4.



No. 5.



88. No. 1 applies to new powder.

No. 2 applies to returned powder, which, after examination, has been classed for service.

No. 3 applies to returned powder, which, after examination, has been re-dusted or otherwise repaired for service.

No. 4 applies to blank or exercise powder.

No. 5 applies to shell powder.

The

\* These letters will be in red paint.

† Or "Repaired," as the case may be.

## Appendix, No. 4.

The 5th line in No. 1 contains—

1. The brand of powder (No. 33).
2. The number of barrels in the brand (56).
3. The number of the barrel itself in the brand (24).

89. Gunpowder is divided into lots for convenience of storing; each of the 100 barrels composing a lot is marked with the same number, and the numbers of the lots run consecutively for each manufacturer, as powder is supplied.

90. The following list shows the purposes for which powders of the several descriptions are to be used; and demands and issues will be regulated in accordance therewith.

*P.* For the *battering* charges of all rifled guns of 7-inch calibre and upwards, and for all service charges of 40 lb. and upwards. When no *P.* powder is available, *R. L. G.* will be used.

*Service R. L. G.* For service charges, up to 40 lb., of all M. L. R. guns above the 64-pr.; and likewise for *battering* charges of all guns when *P.* powder is not available.

*Service L. G.* For all S. B. ordnance and B. L. R. guns, for M. L. R. guns up to the 64-pr. inclusive (except the 7-pr. with which *F. G.* is used), and may be used in cases of necessity with M. L. R. guns up to the 9-inch of 12 tons inclusive.

*Service R. F. G.* For rifled small arms of every description, except Martini-Henry musket and pistols.

*Service F. G.* For 7-pr. M. L. R. guns, for all smooth bore small arms, and for the bursting charges of Shrapnel shells.

*Service Pistol.* For Colt's, and Dean and Adam's cartridges, and for bursting charges of all Shrapnel shells.

*Blank or Exercise R. L. G. and L. G.* For blank charges of all descriptions of rifled and smooth bored ordnance.

*Blank, or Exercise R. F. G. and F. G.* For blank small arm cartridges of every description. These powders may, if it be considered advisable, be used for blank charges for ordnance when there is a surplus store.

*Shell Powder.* *L. G.* for the bursting charges of all shells, rifled, or smooth bore, except Shrapnel (*see above*), and 6, 9, 12, and 20-pr. segment shells, for which *F. G.* is to be used. *F. G.* or *L. G.* in Class II. may be taken if no *F. G.* or *L. G.* in Class III. be available, and service *F. G.* or *L. G.* if no blank *F. G.* or *L. G.* be available.

91. *Service* powder will never be issued for *blank* or *exercise* cartridges, when any powder classed under the latter head is available. This rule is intended to apply strictly to the non-issue of *Service R. L. G.* and *R. F. G.* powders for blank charges. *Exercise* powder will not be issued for filling shells when shell powder is available.

92. The proof officer will be careful to note at his issuing and receiving examinations, the numbers of the lots, as also the marks and dates that have been placed on the various barrels of powder submitted for his inspection, before being issued to, or on being received from Her Majesty's Land or Naval Forces. All these particulars will be entered in the report made to the Commissary, in order that they may be available for future reference in case of necessity.

## VII.—LABORATORY OPERATIONS.

93. The following instructions will be strictly observed by all persons engaged in work connected with combustible stores.

94. When any laboratory operation, such as making up ammunition, removing fuzes and filling or emptying shells, is required to be performed, the Commissary in charge will inform the Controller. The Controller will then report the same to the General Officer Commanding, who will direct the commanding officer of the Royal Artillery to take steps for the performance of this duty.

95. These operations will be carried on in accordance with the following extract from the Queen's Regulations, 1868 (Para. 664). The detailed application of these instructions must depend upon the means available at each station.

“(a.) No laboratory operation which involves risk of an explosion is to be carried on within a distance of 400 yards from a magazine in which large quantities of gunpowder are stored.

“(b.) No accumulation of gunpowder or other explosive material is to be allowed on any account in the workshops, or in close proximity to the laboratory buildings. A small expense magazine in a safe position is to be provided, the stores are to be drawn from this magazine in small quantities as required, and the finished work is to be returned to the magazine in the same way. This is a most important point, for notwithstanding every precaution an accident may occur.

“(c.) All the arrangements should therefore be made with a view to reduce as far as practicable the amount of explosive or combustible material in a building at any one time where laboratory operations are being carried on.

“(d.) The



“(d.) The destruction of combustible stores by fire, or by breaking up, is on no account to be effected within the precincts of a laboratory.

“(e.) All persons engaged in work connected with combustible stores are to change their outer clothes, viz., coat, waistcoat, trousers, cap, and shoes, and to wear suits specially provided for this purpose.

“(f.) The change of clothes to be effected in a shifting house, where the ordinary clothing is to be deposited.

“(g.) Only steady and intelligent men are to be employed on laboratory work, and the preference is to be given to those who have passed through a course at Woolwich.”

96. In removing fuzes from shells only such tools as are provided for this purpose will be used, and with respect to the pillar fuze especial care will be taken not to press unduly upon the head on account of its very close proximity to the detonating composition.

97. To reduce the risk in extracting pillar fuzes as far as possible, a special extractor will be supplied.

98. In cases in which the fuze will not yield to the authorised means of extraction, the shell, if not provided with an unloading hole, will be placed under water, and in this condition, namely, *under water*, a small hole will be bored through the side for the admission of water. The powder will be thoroughly saturated before any further steps are taken to remove the fuze.

99. When this operation cannot be conveniently performed, the shell will be thrown into the sea, or otherwise safely disposed of.

100. If the shell has an unloading hole, the unloading hole plug will be unscrewed, the papier-mâché wad forced into the interior, and water poured in until the powder is thoroughly saturated.

101. The operation of removing the fuze from the shell will be performed in a separate building, and in the absence of special reasons to the contrary, only one shell will be operated upon at a time.

102. When the fuze is removed a service metal fuze hole plug will be screwed in to secure the powder, and the shell then conveyed to another building to be emptied.

103. To empty the shell a wooden frame or cradle will be used to rest the shell upon, and the greatest care will be taken that every portion of the bursting charge is removed before the shell is returned into store as empty, water being used to wash out any trace of powder which it may be difficult to remove with the copper scraper.

104. Shells thus emptied will be marked on the head with an E, in white paint at Woolwich, and red paint at other stations, also with a letter to denote the stations. The powder obtained will be treated as directed in paragraph 56, and in general any powder which, during laboratory operation, has been spilt on the floor, or otherwise exposed to admixture with iron filings, grit, or dirt of any description, will be at once swept up, wetted, and reserved for extraction.

#### VIII.—CONVEYANCE OF AMMUNITION AND GUNPOWDER BY LAND.

105. No ammunition or gunpowder will be sent to any station at home, until the officer who has to receive it has been communicated with by the officer who has to make the supply, and the consignee has replied that he is prepared to receive it.

106. At the time the issue is made, a proper invoice will be sent to the consignee.

107. When small-arm ammunition or gunpowder has to be removed by the troops, in their own waggons, or in the waggons belonging to the War Department, a requisition will be made on the general or other officer commanding the district or garrison, by the officer in charge of the depôt, stating the number of waggons required, and the day on which the ammunition or powder will be ready for removal. It will be left to the officer commanding the troops to fix the day and hour on which the ammunition or gunpowder shall be removed.

108. At the time and place appointed, a control officer or a serjeant conductor will be in attendance to hand the packages over to the officer commanding the party. Should wad-miltits be required for the security of the ammunition, they will be lent to the military party, and the control officer will take care they are duly returned when the service has been completed. In order, however, that there may be no divided responsibility, it is to be clearly understood that the officer in command will be responsible for the due delivery of the packages, as well as for the waggons being in all respects suitable, properly stowed, and not overladen.

109. When large quantities have to be forwarded, otherwise than by military conveyance, the control officer making the issue will take care that the contractor by whom the packages are forwarded, provides proper conveyance for the same; that the carts or

Appendix, No. 4. waggons are not overladen; and that they are properly secured both from danger and damp, and for this object wadmiltits and hides may be lent to the contractor on the terms laid down in § 108.

110. As all ammunition and gunpowder sent by railway is placed in properly constructed powder vans (except when secured in iron safety cases, as alluded to in § 113), no further precautions against danger are necessary, the railway authorities and contract carrier being responsible; but the contract carriers will have to see that the packages are handed over to the railway officials in proper order and condition. They will have also to make all arrangements with each railway company for the due forwarding of the ammunition or gunpowder, without delay, after receipt at the station, and will, therefore, have to give due notice to such company of the day and hour on which it is to be forwarded. The contract carriers will further be responsible, that, when the ammunition reaches the railway station, proper conveyances are at hand to convey it to its final destination.

111. Volunteers and other corps may draw their own ammunition and convey it to their own magazines, the officer in charge of the depôt taking care that the conveyances are in all respects suitable, and are not overladen. Wadmiltits may also be lent on the terms laid down in § 108.

112. In the absence of special orders from the War Office, escorts will not be required to accompany ammunition or gunpowder, unless the general or other officer commanding the district or garrison considers it necessary, and in the event of such being the case, he will duly inform the control officer, who will, in such a case, invariably apply to such officer for the proper escort, stating in his application the quantities of ammunition or gunpowder to be forwarded, by what conveyance to be sent, as also the day and hour fixed for its departure. It will be for the officer commanding the troops to determine the strength and description of the escort required.

113. In the conveyance of small quantities of small-arm ammunition by railways in the United Kingdom, in order to expedite issues to regiments and also to reduce the expense of the employment of powder vans, *metal cylinders* adapted for containing half and quarter barrels will be used.

114. These cylinders will be conspicuously marked with the name of the station to which they belong, and with the letters W  $\wedge$  D, and will be held on charge as articles in use, notwithstanding their being sent away from time to time with ammunition.

115. Commanding officers and others will, immediately on receiving these cylinders, empty and return them, with the spanners and bags, to the control officer at the station from which they are sent, by the same mode of conveyance by which they arrived.

116. Every instance of unnecessary delay in the return of the cylinders, &c., will be immediately reported by the commissary in charge to the Controller.

#### IX.—CONVEYANCE OF AMMUNITION AND GUNPOWDER BY DEPARTMENTAL VESSELS.

117. On arrival at any control station, the master of the vessel will immediately report himself to the control officer, and, if any stores are on board, deliver the bills of lading.

118. The master will keep a log book, inserting the daily occurrences, and also the receipts and deliveries. The tally of all stores passing into or out of the vessel will be taken by the master or mate, who will be held strictly accountable for the delivery of all the stores according to the receipt tally, and any deficiency must be immediately reported by the control officer to whom the stores are consigned.

119. The master will attend daily at the control office at the station where the vessel may be lying, to receive such orders as the control officer may find it necessary to give. The master will receive his instructions from the control officer only.

120. The master will frequently examine the hold, and be particularly careful that all iron bolts, nails, &c., are covered with sheet lead or tanned hide, and that any defects in the vessel or stores are immediately reported, in writing, to the control officer at the station.

121. Previously to receiving any gunpowder, ammunition, &c., the master or mate will take especial care to examine the hold, and see that it is clean swept, free from grit or dust, and in a fit state to receive the stores. He will report the fact to the Controller.

122. As a general rule, no combustible stores will be conveyed in the same hoy with powder and ammunition. In special cases, however, where combustible stores of an unexceptionable description are forwarded with proper precaution as to their stowage and security, this restriction may be omitted.

123. On receiving gunpowder, ammunition, &c., the master will see that the platform in the vessel's hold, the gangways and comings of the hatchways, are covered with tanned hides, that the barrels or boxes are carefully stowed, the hatches properly secured and locked, and that the key remains in his own possession.

124. A cushion

124. A cushion (stuffed with white oakum) covered with leather, will be used for landing all powder barrels or cases upon, whether in the hold of the vessel or on the wharf, when loading or discharging powder.

125. In stowing powder in the hold of the vessel the barrels will be carried, and on no account rolled over each other, unless tanned hides are laid down for the purpose of protection.

126. No leaky or badly coopered barrel will be received on board, and should such be offered, the master will refuse to receive it, and will report the circumstance to the control officer in charge at the station immediately.

127. After the vessel has been discharged, the hides, haircloths, &c., will be removed, and the hold carefully cleaned out.

128. On delivery of the above-mentioned stores, the same caution will be used as in loading, and if any barrels or boxes should have been unavoidably broken, any powder which may have become loose will be carefully swept up, and the circumstances reported by the master to the Controller before delivery to the magazine.

129. No fires, other than the engine-room fire, will be lighted on board any vessel, barge, or craft conveying gunpowder, or combustible stores, to any place in the River Thames within one mile below Gravesend, or in either of the canals leading to Aldershot or Weedon; nor between the Nore and Chatham in the River Medway; nor within two miles of the Spit, or outer Buoy, leading to Harwich Harbour.

130. When gunpowder or ammunition is shipped, and the vessel is within the limits of any port, neither fires, lights, nor smoking will, under any circumstances, be permitted on board.

131. Fires will be provided in the cook houses at the several stations when requisite, for cooking the provisions.

132. When at anchor at night, in a roadstead, or in the track of shipping, a masthead light will be shown, and, when under weigh, the side lights, according to Admiralty regulation.

133. When the vessel, barge, or other craft is one mile below Gravesend, and not nearer than half-a-mile of any inhabited place or magazine, a fire may be lighted on board for cooking purposes only, and the master will see it carefully extinguished at sunset, and one hour previously to going alongside any ship or magazine. The engine-room fires in the steamers must also be put out one hour previously to going alongside any ship or magazine.

134. Smoking below is strictly prohibited.

135. When a vessel has received gunpowder, ammunition, or combustible stores on board, a red flag will be hoisted at the mast-head, and kept flying until the cargo is discharged. The master or mate and all the crew will remain on board until all the stores are discharged, unless it may be necessary to procure water or provisions, in which case notice will be given to the control officer, but the vessel is not to be left without either the master or mate and one seaman.

136. No lucifer matches will at any time be used on board any of the War Department vessels, and any person found to be in possession of the same, will be immediately dismissed. The usual tinder-box, &c., will be kept by the master, and used for the purpose of striking a light when actually necessary.

137. At Priddy's Hard, Purfleet, and Tipner, when in consequence of want of water, a vessel laden with powder or combustible stores is unable to be unloaded on the day of arrival, she will be moored in the safest position at the wharf, and the hatchways secured and covered with tarpaulins, and no other vessel will be allowed alongside of her. At all other stations the vessel not unloaded will haul into the stream a distance of 900 yards from the Magazine Wharf, but if empty a distance of 400 yards is sufficient.

138. No vessel having powder or ammunition on board will be left without a responsible watchman in charge.

#### X.—GUNPOWDER VESSELS.

139. The following regulations for receiving powder and ammunition, are for the guidance of persons employed on board the Store Department vessels and in the laboratory craft used for the conveyance of the same to and from the receiving vessels, &c.

140. All persons employed in the receiving vessels, barges, boats, and magazines, will change their outer clothes, viz., coat, waistcoat, trowsers, cap and shoes, and wear the suits specially provided for them.

141. The change of clothes will be effected in a shifting house, where the ordinary clothing will be deposited.

## Appendix, No. 4.

142. Smoking is strictly prohibited, and any man found with a lucifer match in his possession will be immediately dismissed.

143. No fire is on any account to be allowed either in the receiving vessels, barges, or boats.

144. The receiving vessels, barges, and boats, will be kept scrupulously clean, and free from loose gunpowder.

145. In shipping or unshipping ammunition or gunpowder, tanned hides or wadmiltits will be laid over that portion of the vessel over which the cases or barrels pass.

146. A red flag will be kept flying when there is any gunpowder or ammunition on board the receiving vessel.

147. At Woolwich the gunpowder will be received daily from the receiving vessel at the lower causeway, and transported in railway trucks to the Royal Laboratory; the made-up ammunition will be transported in railway trucks from the East Laboratory to No. 1 Magazine, each truck being laden by the Laboratory and handed over to the Control Department for removal.

148. Gunpowder or ammunition required to be sent from the Arsenal, by land carriage, will be brought from No. 1 Magazine in trucks to within the walls of the Arsenal, or if immediately required, will be handed over by the Royal Laboratory to the Control Department on the bank of the canal.

149. The suits of clothing provided for and required to be worn by the persons employed in the receiving vessel and Laboratory barges, are as follows:—

*In Summer.*

Cap.  
Lasting jacket.  
Cloth trousers.  
Woollen shirts.  
Shoes, Magazine.

*In Winter.*

Cap.  
Lasting jacket.  
Cloth trousers.  
Woollen shirts.  
Woollen drawers.  
Great coat.  
Shoes, Magazine.

The persons employed must provide themselves with woollen shirts and drawers.

(signed) *H. Vivian.*

## APPENDIX.

## MEMORANDUM respecting the VENTILATION of MAGAZINES.

1. THE dampness complained of in buildings will frequently be found to arise from condensation of the watery vapour of the air which enters the building. Buildings with thick walls and vaulted roofs, and especially those covered with earth, are particularly liable to dampness from this cause.

2. Air always contains some proportion of watery vapour. When the proportion is small the air is said to be dry, and when large the air is said to be damp; when the proportion is the greatest that can be diffused through air at a given temperature, the air is said to be saturated at that temperature.

3. The proportion of watery vapour which saturated air contains varies with the temperature, being greater for high than for low temperatures. Air containing a particular proportion of moisture is rendered less capable of depositing moisture by its temperature being raised, and the reverse when it is lowered.

4. Air may be brought to a state of saturation by reducing its temperature. If the air contain but little moisture, the reduction of temperature must be considerable; but if it contain much, a slight reduction will bring it to a state of saturation.

5. If air be cooled below the degree of temperature at which it will be in a state of saturation, a portion of the watery vapour contained therein will be deposited on any cold substance with which it may come in contact. The degree of temperature at which air will thus begin to deposit moisture is called its *dew-point*.

6. When warm air enters a comparatively cold building the temperature of the air is reduced by coming in contact with the interior walls and other cold surfaces; and if its temperature be thus reduced below the *dew-point*, condensation will take place. In the latter case it is obvious that the admission of fresh air will not tend to dry a building, but to render it damp.

7. If a magazine 40 feet by 24 feet by 12 feet, the temperature of whose internal walls, &c., is 45 degrees, were to be filled with saturated air having a temperature of 50 degrees, and the magazine were then closed, nearly a pint of moisture would be deposited during the cooling of the fresh air to the temperature of the walls. The pint of moisture would result from the quantity of air sufficient merely to fill the magazine; but if the ventilators were open, the air might be renewed many times in the course of a day, and very much more than a pint of moisture be deposited.

8. Air entering a building whose temperature is higher than its own, becomes capable of absorbing moisture from damp surfaces.

9. The efficiency of the ventilation of a magazine will depend upon the degree of dryness which the fresh air admitted into it possesses, and the rapidity of the current of dry air passing through the building.

10. The dryness of the air is indicated by the number of degrees by which its temperature exceeds its dew-point.

11. The ventilators of magazines should in all cases be constructed so as to exclude or admit the external air at discretion, and the instructions for their use should be framed with a view to the exclusion of the external air, when the temperature of its dew-point is above that of the interior of the building, and the admission of the air when its dew-point is below the temperature of the interior of the building.

12. For the foregoing reasons, the common practice by which, under Article 491, Ordnance Regulations, 1855, magazines are open for purposes of ventilation on "every fine day," is considerably modified.

13. The interior of a bomb-proof magazine with thick walls and a vaulted roof, is commonly colder than the outside air in summer, and warmer in winter. Winter is therefore the more favourable season for ventilation; but in the climate of England the exceptions to this rule are numerous, owing to the prevalence during winter of warm damp winds from the south and west, and during summer of cold dry winds from the north and east.

## Appendix, No. 5.

PAPER handed in by Dr. Abel, 12 May 1874.

## Appendix, No. 5.

## DEFINITIONS OF EXPLOSIVE SUBSTANCES.

1. THE term "gunpowder" to apply to any preparation which is a mechanical mixture of a nitrate with any form of carbon, or with any carbonaceous substance not of itself explosive, with or without the addition of sulphur.

Such a preparation would still come under the definition of "gunpowder" if mixed with other non-explosive substances, but if mixed with a "nitro-explosive," a "chlorate-explosive," or a "fulminate-explosive," such admixture would determine the particular head under which the preparation would be classed.

2. The term "nitro-explosive" to apply to any chemical compound possessed of explosive properties, or capable of combining with metals to form explosive compounds, which is produced by the chemical action of the nitric acid (whether mixed or not with sulphuric acid), or of a nitrate mixed with sulphuric acid, upon any carbonaceous substance.

Any mixtures of such a compound with a chlorate, or with a "chlorate-explosive," should be classed under the head of "chlorate-explosives," but all other mixtures containing such a compound should be included under the head of "nitro-explosives."

The class of "nitro-explosives" would be susceptible of sub-division; the one sub-division would include such liquid explosive agents as nitro-glycerine and nitrate of methyl, and preparations containing these as an ingredient, such as dynamite, Horsley's powder, lithofracteur, &c. (exclusive of chlorate preparations); the other sub-division would include all solid nitro-compounds, such as gun-cotton, nitromannite, picrates, and preparations containing such compounds as ingredients, exclusive of chlorate preparations.

3. The term "chlorate-explosive" applies to any preparation consisting of a mixture of a chlorate with any form of carbon or any carbonaceous substance, including the substances classed as "nitro-explosives," with or without the addition of a nitrate or a sulphide, or sulphur.

Any "chlorate preparation" consisting of a chlorate in admixture with phosphorus, with or without the addition of carbonaceous matter, or of sulphur or a sulphuret, either separate or together, but without addition of some form of carbon or carbonaceous matter, to be classed under the head of "fulminate-explosives."

4. The term "fulminate-explosive" to apply to any chemical compound or mechanical mixture, which, from its great susceptibility of detonation, is suitable for employment in percussion caps or other appliances for producing detonation, or which, from its extreme instability, or susceptibility of violent decomposition by concussion or heat, is of specially dangerous character.

The explosive substances included under this head must obviously be divided into two classes: the first would comprise such compounds as the fulminates of silver and of mercury, and preparations containing these substances: also the special preparations containing a chlorate which have been specified as being excluded from the "chlorate class."

The second division under this head would include such substances as the chloride and the iodide of nitrogen, and fulminating gold and silver. The substances comprised in this second division would have to be subjected to special restrictive regulations.

F. A. Abel.

## Appendix, No. 6.

PAPERS handed in by Mr. Curtis, 13 May 1874.

**RULES, ORDERS, and REGULATIONS, to be observed by the Workmen and Others  
Employed on these GUNPOWDER WORKS.**

Appendix, No. 6.

Hounslow, Middlesex; Tunbridge, Kent; Glyn-Neath, Glamorganshire; and  
Clyde Mills, Argyleshire.

**RULES, ORDERS, and REGULATIONS.**

1. ALL persons employed in the manufacturing department will be provided by the proprietors with shoes, slippers, and leather aprons, to be used in and about the powder buildings. No person is allowed to wear such shoes, slippers, or aprons off the factory, and if any one is detected destroying them in an unusual or unfair manner, such person will be discharged.

2. No person (excepting those who have residences within the factory grounds, and then only for their use within their own houses) is permitted to bring into the works any lucifers, matches, &c., steel or iron, tobacco or snuff boxes, or any other thing or material which may endanger the safety of the premises, on pain of either immediate dismissal or being dealt with according to law.

3. No person will be permitted to enter or leave the premises except by the general entrance, or to loiter thereon after his or their special employment is finished, excepting those who have residences within the factory grounds.

4. Oil, tallow, and other articles used for the safe working of the machinery and appliances, will be delivered out of store by the several foremen on application.

5. Watering-pots, water scoops, brooms, mops, and other utensils, shall be kept alongside each powder building, for the purpose of wetting the platforms, roads, and outside of such powder buildings; and liquoring pots, paddles, and oil cans, shall be kept within each mill.

6. If, at any time, the machinery, or appliances, should appear to the workmen to be in an unsafe or doubtful condition, the machinery is at once to be stopped, and the man in charge is immediately to report the same to the manager or foreman, and the work is not to be resumed until the defective machinery has been made safe and perfect, and authority given to that effect.

7. When any of the buildings or machinery are about to be repaired, such buildings shall first be cleared out of all gunpowder, sweepings, and dust, and well swamped with water, and kept continually wet until such repairs are completed; the persons engaged in preparing the same are liable to these rules, and will be discharged for neglect of the same; and every person is cautioned not to commence working in such building until satisfied that the repairs are safe and perfect, and have been inspected by the manager, chief mechanic, or foreman.

8. The worked charge of each mill shall be carefully taken off the bed of the mill, and conveyed to the charge house, before the unworked charge, next to be incorporated, shall be brought from the charge house into the mill.

9. The quantity of materials, or charge to be made into gunpowder, shall not at any one time exceed 50 pounds, as respects sporting and Government powder, and 60 pounds, as respects all inferior powders, in any one mill, or under any single pair of runners.

10. The press-houses shall never contain more than 20 barrels of gunpowder at one time, and not more than 10 barrels of this quantity shall be subject to pressure at once.

*N.B.*—This rule is subject to any printed notices placed in the buildings.

11. Not more than 24 barrels of gunpowder shall be allowed in any corning-house at one time (including what is already in grain, and in pressed stuff on hand), and when a quantity of 12 barrels of corued and dusted powder shall have accumulated, it shall be immediately removed, before further corning shall be proceeded with.

*N.B.*—This rule is subject to any printed notices placed in the buildings.

Appendix, No. 6. 12. No greater quantity of gunpowder shall, at one time, be dried in any one stove, or lodged therein, than 50 cwt.

13. If any person is detected allowing greater quantities of powder to accumulate in any of the powder buildings, than those specified in the foregoing rules, the foreman is ordered to report the same to the manager, and the delinquent will be liable to be dealt with as the law directs.

14. Smoking is strictly prohibited on the premises.

15. Any person detected bringing into the factory beer, gin, or any spirituous liquors, except under authority of the manager, will be discharged, or dealt with according to law.

16. Any person found within the premises in a state of intoxication will be liable to either immediate dismissal, or to be dealt with summarily as the law directs.

17. Every basket, bag, or parcel, brought into or taken off the factory premises, will be subject to the inspection of the manager, or such other person as may be appointed by him to inspect them.

18. In case of accident by fire during the night, the bell is to be violently rung.

19. No strangers shall be admitted on the factory, or in the buildings, except the proprietors or manager be present.

20. Any person or persons detected destroying the fences, stealing or removing the property of the proprietors from the factory, will be dealt with as the law directs.

Finally, any person acting in violation of or failing to comply with these rules, orders, and regulations, or committing any act within the premises by which the safety of the factory could be endangered, will either be subject to immediate dismissal, or will be dealt with as the law directs.

74, Lombard-street, London, July 1869.

(signed) *Curtis's & Harvey.*

#### NIGHT REGULATIONS to be observed by MILL KEEPERS on these GUNPOWDER WORKS.

The General Rules, Orders, and Regulations are not altered or relaxed by the following Instructions.

No. 1.—All mill-keepers are provided with lanterns properly constructed.

No. 2.—All mill-keepers are to trim and clean their own lamps and lanterns. The lanterns, except when in use, are to be kept in the mill-keepers' watch-houses, and never to be removed without being securely locked, and the keys left in the watch-houses.

No. 3.—Lanterns taken into the mills are to be always hung up on pegs or nails, provided for the purpose, but never over the doorways, and are not to be removed from the mills until the mill-keeper in attendance has finished the inspection of the charge, or the duties necessary inside the buildings.

No. 4.—As the charge houses are lighted by fixed lamps *outside* the windows, mill-keepers are prohibited from taking their lanterns inside under any pretence whatever.

No. 5.—Mill-keepers are ordered not to carry either green or worked charges, when they have their lanterns in their hands.

No. 6.—Mill-keepers found sleeping or lying down in the watch-houses during their garrison duty will be suspended, and, if found on a second occasion disobeying this rule, will lose the privilege of night working.

Office, 74, Lombard-street, London, E.C.,  
December 1868.

By order,  
(signed) *Curtis's & Harvey.*



RULES to be observed in this MIXING HOUSE.

It is hereby ordered that no greater number than TWELVE MIXED CHARGES be allowed to remain in this building at one time; as soon as that quantity is weighed up they are to be removed to the charge-house.

It is also ordered that all charcoal, ground or unground, be removed to the store or other proper place when the day's work is completed.

*Curtis's & Harvey.*

SPECIAL NOTICE.

WORK-PEOPLE employed in this factory are desired to conform to the printed rules, orders, and regulations affixed to the notice boards, and, in order to secure greater safety in the conduct of the works, and to prevent the introduction of prohibited articles, the searching on entering and leaving the premises will be more rigidly enforced.

All working suits are to be made without pockets.

All persons employed are required to assist the manager, by doing the utmost to secure a general compliance with the regulations in every respect.

The manager has power to appoint any person he may think fit to act as a searcher.

74, Lombard-street, London,  
November 1873.

*Curtis's & Harvey.*

## Appendix, No. 7.

PAPERS handed in by Major *Majendie*.

Appendix, No. 7.

## MEMORANDUM ON FOREIGN LAWS Relating to EXPLOSIVES.

THE following Abstract has, at my request, been compiled by Major Ford, R.A., of the various laws relating to the manufacture, storage, sale, and transport of explosive substances in France, Austria, Sweden, and Norway.

It will be observed,—

1. *As to the Manufacture*, that in France and Austria the manufacture of explosive substances is a State monopoly; while in Sweden and Norway it can only be carried on under license, and in accordance with certain statutory provisions as to distances, quantities, &c.

In Sweden such a license is not granted, except the applicant can produce a certificate of personal qualification. The premises are required to be inspected by a Government Inspector before use; Government rules must be observed, and the licenses are revocable under certain conditions.

2. *As to Storage and Sale*, the quantities allowed to be kept without license are limited—

	Gunpowder.	Other Explosives.
	<i>Lbs.</i>	<i>Lbs.</i>
In France - - - -	4	?
In Sweden - - - -	?	2
In Norway - - - -	5	10

No persons are allowed to sell explosives in France and Sweden without a license, and in Norway only when registered.

The quantities allowed to be kept by dealers are limited, but variable in Sweden and Norway on the report of inspectors, and the manner and places of storing are in those countries subject to minute regulations, which include elaborate provisions for preventing exudation, and for keeping the detonators apart.

In Sweden, nitro-glycerine preparations are forbidden to be stored with gunpowder.

In Austria, dealers are required to conform to the Government regulations.

3. *As to Transport*, the regulations as to the carriage of explosives are exceedingly stringent; for example, in France they may only be carried on under escort, and the vehicles may halt only in enclosed places away from towns.

In Austria, a certificate must be obtained from the Polytechnic institute at Vienna, before any explosive can be sent by rail, that the substance is not dangerous; while in Sweden and Norway the regulations are very minute and elaborate, and include the provision at the expense of the sender of an escort to be provided by the civil authorities where any quantity about a certain limit is sent, the avoidance of routes through towns and populous neighbourhoods, the giving (in Sweden) of eight days' notice to the civil authorities of the district through which the transport is to take place, the prohibition of transport by passenger vehicle or vehicles, and (in Sweden) the distinction of the vehicle by means of a red flag. Further power is (in Norway) vested in the King to make regulations for the transport of explosives with regard to vehicles, packing, conveyances, intermediate deposits, and anchoring of vessels.

*F. D. Majendie*, Major R.A.  
H.M.'s. Inspector of Gunpowder Works.

Home Office, Whitehall,  
May 1874.

## NOTES ON FOREIGN LAWS relating to GUNPOWDER and EXPLOSIVES.

## 1.—MANUFACTURE.

- France. In *France* the manufacture of gunpowder is a State monopoly.
- Austria. In *Austria* the manufacture of both gunpowder and explosives is also a State monopoly.
- Sweden. In *Sweden* a license is required for the manufacture of nitro-glycerine or dynamite; nitro-glycerine may be made only for immediate use in blasting operations or for conversion into dynamite. The applicant for a license must obtain a certificate of qualification (from schools, &c.), or have a manager holding such a certificate. The factory must be over three miles (English) from a city or market town, and not near churches, powder magazines, &c.
- The premises must be previously inspected and approved by a government inspector; government rules must be observed in the factory; manufacturing licenses may be revoked for abuse, &c.

In *Norway* explosives may not be made (? without a license,\* or) within a mile (English) of market towns, or wharfs, or a public road; † or within half a mile of neighbouring property (except exemption is allowed on recommendation of local authorities). Appendix, No. 7-  
Norway.

### 2.—STORAGE AND SALE.

In *France* up to 1834, only about 10 lbs. (English) of gunpowder could be kept by private individuals; this amount was then reduced to about 4 lbs. It is allowed to be sold by licensed dealers, the price being fixed by Government. France.

In *Austria*, gunpowder is allowed to be stored only under similar regulations to those which must be observed in Government artillery magazines, and the precautions to be observed are the same. Regulations for the storing of dynamite and explosives are laid down in instructions bearing date 1872. Austria.

In *Sweden*, minute regulations are laid down for the storage of dynamite and nitro-glycerine compounds. Packets or cartridges must not contain more than 5 lbs.; not more than 20 such packets (100 lbs.) to be placed in a strong and tight case of wood, or malleable metal lined with a waterproof material, the lid being screwed down; or, if for retail sale, being placed in another suitable covering; infusorial earth to absorb any exuding nitro-glycerine must be placed inside. The cases must be marked with a red cross, and "Blasting Agent, Dangerous," in legible letters also in red. Detonators and fuze not to be packed in the same case, unless enclosed in a separate box, legibly marked. Nitro-glycerine compounds are not to be stored in a magazine with gunpowder, or (except with special permission) any other explosive materials. They must be kept at a distance from fireplaces, and precautions against fire must be taken. Sweden.

No unauthorized person to have access to the store; no packing, unpacking, or delivery to take place by artificial light; no smoking or matches to be allowed.

Only manufacturers and dealers holding a license are allowed to sell dynamite and nitro-glycerine preparations.

Two licensed dealers are allowed for Stockholm, and only one in any other place, unless more are recommended by the parish authorities. The dealers may not keep over 10 lbs. at the place of sale, or more than 50 lbs. in a separate store carefully closed and securely locked. Private consumers are not allowed to keep more than 2 lbs. in any city, market town, or house near, and not more than 20 lbs. anywhere else. But exceptional permission to store a larger quantity in a place pronounced fit and suitable by a competent inspector may be given.

In *Norway*, no nitro-glycerine, and no more than 5 lbs. of dynamite or 10 lbs. of gunpowder may be kept within half a mile of a town or wharf. But the police may allow the use of nitro-glycerine, and local authorities may permit dealers to keep up 25 lbs. of dynamite, or 100 lbs. of gunpowder in a warehouse apart from the place of sale. The King also can grant licenses to store an unlimited quantity of dynamite or gunpowder for a term of years under certain regulations. Norway.

Outside the above limit (half a mile of a town or wharf) no nitro-glycerine, but up to 500 lbs. of dynamite or gunpowder may be kept; also a larger amount in a magazine under police supervision. Nitro-glycerine to be put only into tight wrought iron vessels. Dynamite to be kept in tight closed cases or boxes, lined inside with asphalt, cement or other water-tight material; not more than 100 lbs. to be in each case, divided into packets containing not more than 5 lbs. each, surrounded by a layer of earth or other fire-proof pulverized material, to absorb any exuding nitro-glycerine. The detonators are to be kept separate. Dealers in nitro-glycerine, dynamite, or gunpowder must be registered as such. Power is given to the Crown to increase the amount which may be stored should experience recommend it.

### 3.—CARRIAGE.

The regulations for the transport of powder in *France* require that the vehicles must be "escorted," and must be halted in enclosed places away from towns. The local authorities must be warned. When the amount exceeds about 4 lbs., the conductor must have a bill of lading and written authority to proceed. France.

In *Austria*, regulations for the transport of powder and explosives by rail are laid down. Before the railway transport of an explosive is permitted, a certificate that it is not dangerous must be obtained from the Polytechnic Institution at Vienna. The transport of powder and explosives by water and land is also provided for by special regulations. Austria.

In *Sweden* there are special regulations for the carriage of nitro-glycerine compounds by rail. It is not allowed to be sent by passenger steamers, stage coaches, post packet boats, or other post office conveyance. If over 20 lbs. is sent by public road, a bill of lading must accompany; the cases must be secured in the vehicle to prevent shifting; no powder or other combustible material may be taken with it, except detonators and fuze; the vehicle must be distinguished by a red flag, and not left for an instant without proper supervision; Sweden.  
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\* The necessity for a license, or for some permission equivalent to a license, is implied by the fact that certain details with regard to situation, arrangement, and fencing in of the buildings, are left to be fixed by the police and local authorities.

† 1,000 Ells = 1,700 yards English, or a mile nearly.



## Appendix, No. 8.

PAPER handed in by Mr. *Keightley*, 15 May 1874.

REGULATIONS to be observed by the WORKMEN employed at the GUNPOWDER MILLS, Appendix, No. 8.  
GATEBECK.

It is strictly forbidden—

1. To smoke on any part of the premises, without exception.
2. To carry matches of any description.
3. To bring strong drink of any sort on the works.

The breach of any of these three rules will be punished by a fine of 5 s. for a first offence, and immediate discharge without notice for a second.

REGULATIONS FOR POWDER HOUSES.

1. Proper slippers and clothing for inside work, and overshoes for outside wear, will be provided for the use of all powder men during work hours, and shall always be left after work in the regular place appointed for that purpose.

2. All powder machinery will be properly inspected every morning, and its condition reported to the office.

3. The powder hands must not attempt to remedy any wrong action of the machinery, but must stop their work, and report to the general foreman.

4. Each powder house shall be swept out every morning, and shall be thoroughly cleaned down every Saturday.

5. The approaches and platforms of every powder house shall be kept continually moist with water. The inside shall be sprinkled at least once daily in dry weather.

6. The quantities of powder to be kept at one time in the following buildings shall not exceed—For a press house, 20 cwt., equal to two presses and a half; for a corning house, 24 cwt., equal to three boxes; for a stove, 50 cwt., equal to 37 tubs.

The foreman of each powder house shall be responsible to the general foreman for the proper carrying out of these orders. The breach of the regulations will be punished by a fine of 2 s. 6 d. on each occasion.

7. No strangers allowed on any pretence to come on the works without special permission of the firm.

8. No workman allowed to be on the works after work hours, or to carry away property of any description. All transgressors are liable to be searched.

These rules are intended for the protection of the workpeople's lives and the property of their employers, and will be strictly enforced. A copy will be given on application to every person employed.

*W. H. Wakefield & Co.*

Appendix, No. 9.

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PAPERS handed in by Mr. *Pigou*, 15 May 1874.

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Appendix, No. 9.

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GUNPOWDER MILLS, DARTFORD.

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REGULATIONS for the COMPOSITION HOUSES.

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*Mixing Room.*

1. THE floor is to be kept perfectly clean and free from grit, and to be swept up carefully every morning before commencing work, and every evening when the day's work is done.
2. The workmen are cautioned to change their clothes and shoes before entering the room, and to treat the room in every respect as if it were a press house or other building liable to dangerous explosion.
3. Not more than eight pairs of mixed charges are ever to be in the room at one time, and fewer if possible.
4. All charges and all charcoal are to be removed at the close of each day's work.

*Charcoal Mill.*

5. The whole of the charcoal ground is to be used up each day, as far as possible, but should any small quantity remain unused, it must be removed from the building for the night, and carefully examined before being brought into it again.
6. The house, and especially the reel bin, must be thoroughly cleared and swept out every night.

*Engine Room.*

7. Before leaving work, the man having charge of the engine must see that the supply cock at the boiler is closed, and that the water in the cold water pipe is all drawn off. Before commencing work, he must see that the supply cock at the boiler is open, and that there is a free passage for cold water from the tank to the boiler, as any neglect of this would cause a serious accident.

*General Rules.*

8. Care must be taken by the men in charge of each department to keep the machinery properly oiled and in working order, and not to throw the clutches in except when the speed of the engine has been reduced to "dead slow."
9. No oiled rag or engine waste is to be kept, except a small quantity for immediate use, and this is on no account to be allowed to remain in any part of the building except in the engine room, in charge of the engine driver, as accidents have occurred through its heating.
10. The workmen are earnestly requested to observe all the above rules, and to try in every way to preserve and keep in thorough working order the machinery entrusted to their care.

Dartford.

By order,  
*F. Pigou*, Manager.

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**RULES, ORDERS, and REGULATIONS to be observed in this GUNPOWDER  
MAGAZINE.**

1. Strangers are not allowed to enter the buildings.
2. Magazine shoes are always to be worn by every person, whether workman, magazine keeper, or visitor, when in the buildings.
3. The workmen employed are cautioned and desired to examine their pockets and clothes, and to change their shoes before entering the buildings, and to ascertain that there is nothing about them which will cause danger.
4. The workmen are to take care that there is no smoking near the building, and are desired to prevent strangers from coming on the premises or near the entrances.
5. During storms the workmen are ordered to leave the buildings, taking care to secure and fasten all doors and windows before doing so.
6. The magazine keeper, or in his absence, the foreman, is desired to keep the doors and windows closed and fastened, excepting during the receiving and delivering of gunpowder.
7. The floors, rolling ways, and stages, are, at all times, before and after work, to be kept well swept and washed down, and if any loose gunpowder is seen, it is at once to be damped and put into a receptacle kept for the purpose.
8. When the doors are opened the magazine is never to be left unattended by either the magazine keeper, foreman, or other responsible person.
9. The stocks of gunpowder are to be carefully assorted and placed in the rooms selected for the different descriptions; and it is the duty of the workmen to examine every barrel or box before it is received into store, in order to ascertain whether it is in sound and clean condition. Defective packages are not to be received.
10. All tools or implements used in the magazine must be made of either wood, copper, or brass, and when not in use must be removed to the tool house.
11. Barges and vessels lying alongside the magazine must be carefully watched. No fires or smoking allowed on board any of them under any pretence whatever. Bargemen and others disregarding this rule will be liable to be prosecuted.
12. All persons employed in this building are desired to use every means in their power to protect it from danger, and they are also cautioned to attend rigidly to the regulations.
13. These regulations are to be placed in a conspicuous position in the building, and a copy given by the magazine keeper to all workmen employed in and about it.

Dartford.

By order,  
*F. Pigou, Manager.*

**RULES to be observed by every PERSON employed in the Manufacture of GUNPOWDER.  
at the GUNPOWDER MILLS, at DARTFORD.**

**RULES AND REGULATIONS.**

Rule 1.—Every person employed in any stage of the manufacture or packing of gunpowder, shall be supplied with a pair of shoes, which must always be worn on the premises.

Rule 2.—Every person employed in the manufacture of gunpowder shall be provided with a special suit of clothes, which shall be worn always during working hours; and with a pair of slippers which must be worn at all times in the houses, and nowhere else.

Rule 3.—No person is allowed on any account to bring lucifer matches on to the premises. All lamps requiring to be lighted or trimmed are to be taken to the watchman at one of the watch-houses.

Rule 4.—Smoking is strictly prohibited in every part of the premises. No pipes or lights are to be brought on to the premises.

Rule 5.—Water-pots, mops, and brooms are to be kept in every powder-house, for the purpose of keeping platforms and the outsides of such houses clean and wet.

Rule 6.—If at any time the machinery shall appear to be out of order, such machinery shall be instantly stopped, and on no account shall it be put in motion again until it shall have been certified by a foreman to be in safe working order.

Appendix, No. 9.

Rule 7.—The quantity of powder in the press-house at any one time shall be kept under, or as nearly as possible to, 20 cwt.

Rule 8.—The quantity of powder in the corning-house at any one time shall never exceed 20 cwt.

Rule 9.—No steam boiler shall be allowed to work for a longer period than three months without being cleaned out.

Rule 10.—In taking powder from the barge, no cask or box of powder weighing more than 50 lbs., shall be removed without the copper hooks and hoisting tackle.

Rule 11.—No strangers shall be admitted to the factory, or to any of the buildings, unless the proprietor or manager be present.

Rule 12.—Any person found removing the property of the proprietors from the factory or wilfully destroying such property, will be dealt with as the law directs.

Rule 13.—In cases of accidents by fire during the night, the alarm bells shall be rung violently.

Rule 14.—All persons employed on the premises are liable to be searched at any time, at the order of the proprietors or foreman.

Rule 15.—The penalty for any infringement of the above rules and regulations is instant dismissal. But in cases of gross negligence, the proprietors will further avail themselves of the Act of Parliament known as the Gunpowder Act, 23 and 24 Vict. c. 139, which declares that any workman, or any other person, who does, or attempts to do, any act tending to cause an explosion, may be apprehended by the proprietors, or their servants, or any person authorised by them, and taken at once without a warrant before a magistrate to be dealt with as the law directs.

Rule 16.—No person who shall be dismissed for any cause affecting the safety of the works, shall ever again be employed on the premises.

*N.B.*—The men are encouraged to make complaints and suggestions that may add to the safety of themselves or others. These will receive every attention from the manager. The men are urged to use every means to increase the security of all, and to preserve the property of the proprietors.

Dartford, 1868.

Frederick A. P. Pigou.



## Appendix, No. 10.

PAPER handed in by Colonel *Smith*, 19 May 1874.

## CIRCULAR.

Appendix, No. 10.

Metropolitan Police Office,  
Dublin Castle, January 1874.

THE Commissioner of Police desires to draw the attention of dealers in gunpowder, &c., to the following extracts of a report made by Her Majesty's inspector of gunpowder works as to the danger of explosion from storing Schultze's powder, or other explosives (whose safety from spontaneous ignition is dependant on their chemical purity), with ordinary gunpowder:—

## EXTRACTS.

1. "Schultze's powder (and all chemical explosives) should always be stored apart from ordinary gunpowder, or so separated from it, that in the event of spontaneous ignition taking place the gunpowder could not be affected thereby."

2. "Schultze's powder (and all chemical explosives) should be stored in some place where, while reasonably protected from external risks, it would not, in the event of its igniting spontaneously, be so confined as to produce an explosion, and where the effects of its ignition would be at a minimum."

The Commissioner of Police requests that, in accordance with these instructions, you will take care that any of Schultze's powder, no matter how small the quantity may be, or any other chemical explosives kept on your premises, be stored altogether apart from your stock of ordinary gunpowder.

The police, in their inspections, have been directed to see that the above suggestions of Her Majesty's inspector of gunpowder works, &c., are duly observed by all dealers in so dangerous an explosive as Schultze's powder.

To George J. Alexander, Esq.,  
Mary Abbey.

(signed) *H. J. Atwell Lake*,  
The Commissioner of Police.

Dear Sir,

Eyeworth, 16 February 1874.

1. I have been requested to give my opinion as to how far the charge laid against the Schultze gunpowder, in a circular issued by the Commissioner of Police, Dublin, concerning the storage of explosives, is correct, viz.: that it is liable to spontaneous ignition, "and is a dangerous explosive."

2. Regarding the former charge of liability to spontaneous ignition, I would deny its greater liability than black powder. Spontaneous ignition is the result of elevated temperature produced by chemical action at normal temperatures; the prime causes may be various, but are all attributable to chemical action, and in the generality of cases to continuity of chemical action; therefore, to establish the charge of spontaneous ignition against any substance, proof must be made that chemical action continues, or may at any time arise in that substance at ordinary temperatures, which is most improbable in the case of Schultze.

3. *Gunpowder*.—It is not an admixture of chemicals of strong affinities at normal temperatures, acidulous or otherwise, eager to enter into violent chemical combination on the least provocation, nor is it a compound so nicely balanced that the slightest external change can upset the equilibrium, as is the case with some of the most violent chemical explosives and detonates; the cellulin compound used being rendered perfectly free from any trace of free acid by an alkali; this is combined by mechanical admixture with perfectly neutral salts, all containing the same acidulous radical; therefore, even when moistened, no chemical action can ensue by interchange of bases, &c.; in fine, when carefully prepared, no chemical action can ensue in this gunpowder at ordinary magazine temperatures, therefore no elevation of temperature, and no spontaneous ignition; moreover, the powder is in a granulated form, each grain composed of loose cellular tissue, among the interstices between which the air has free circulation (in the loose storage condition, which is without the slightest compression), rendering any continuous chemical action impossible at normal temperatures.

Appendix, No. 10.

4. In long fibrous substances (cotton, flax, jute, hay, &c.), often tightly compressed, and excluding circulation of air, chemical action and consequent elevation of temperature may arise, but in loose granulated substances, no two grains can be in such exact juxtaposition as to exclude circulation of air between them, and even should chemical action commence in one grain, it would not be transmitted to the whole mass, thus preventing any sensible elevation of temperature.

5. Regarding the latter charge of the Schultze gunpowder being a dangerous explosive. The dangers arising from an explosion of this powder are less than those from black powder, the rending force and rapidity of ignition of the Schultze (unless tightly compressed) being far inferior to those of black powder, it consequently is not so likely to transmit the ignition from case to case as with black powder; in fact, not in the loose storage state, not until highly compressed, does it assert its true character as a powerful explosive.

6. In fine, I am of decided opinion that Schultze gunpowder, as manufactured by your Company, is quite innocent of the charge of "liability to spontaneous ignition," and is not a "dangerous explosive," as intimated in the circular.

I am, &amp;c.

(signed) *R. W. S. Griffith.*

Colonel Gompertz, Secretary,  
The Schultze Gunpowder Company (Limited),  
62, Bishopsgate-street Within,  
London, E.C.

College Laboratory, London Hospital,  
15 April 1874.

Dear Sir,

My absence from England has prevented me from replying at an earlier date than this to your letter of the 3rd March last, asking me, on the part of the Directors of the Schultze Gunpowder Company (Limited), to consider the circular issued by Colonel Lake, the Commissioner of Police in Dublin (dated January 1874), respecting the storage of Schultze gunpowder, in which an opinion is expressed, on the authority of Her Majesty's Inspector of gunpowder works, that such powder, in common with other chemical explosives, is liable to spontaneous ignition, and is therefore a dangerous explosive.

My own experience of Schultze's gunpowder, dating from the time of its introduction into this country, is quite conclusive to my mind as to the non-liability of such powder to spontaneous ignition. I have had specimens of the powder in my laboratory for many years, and I have not perceived the least indication of a tendency to such a change; and, indeed, the fact of the powder having been submitted to the action of a fixed alkali, for the purpose of neutralizing any trace of acid which may remain in it after thorough washing, is, in my opinion, a means of ensuring its safety.

I have received the report of Mr. R. W. S. Griffith on the subject, and I quite concur in the observations which he makes on the non-liability of Schultze's gunpowder to spontaneous ignition or combustion, and I am of opinion that it may be safely stored with ordinary black powder.

I remain, &amp;c.,

(signed) *Henry Letheby, M.B., M.A., &c.*, Professor of Chemistry in the College of the  
London Hospital, and Public Analyst for the City of London, &c.

To Lieutenant Colonel S. Gompertz, Secretary, &c.

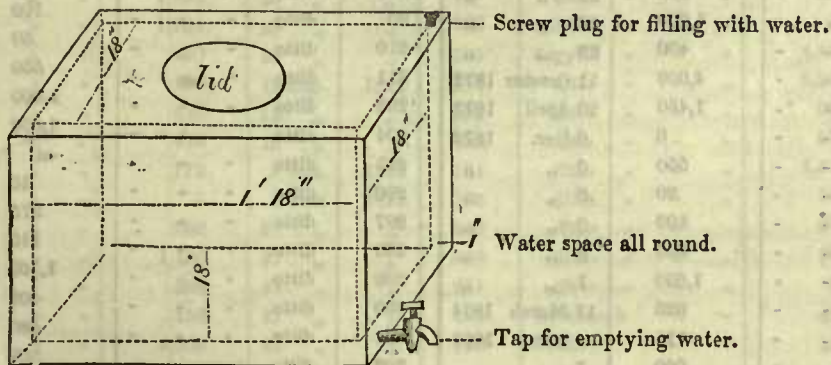
Appendix, No. 11.

PAPER handed in by Major *Beaumont*, 19 May 1874.

Appendix, No. 11.

INSTRUCTIONS WITH REFERENCE TO DYNAMITE.

1. ONLY the day's consumption to be taken from the magazine on to the barge.
2. The detonating caps are not to be kept near the dynamite.
3. Double boxes of tin and lined with felt (as per sketch) are to be used for throwing and keeping the dynamite for the day's consumption.
4. Each box to be cleared out every day and wiped clean. Any residue of dynamite remaining over is to be put into a special wooden box to be kept on board the barge under lock, and the dynamite in this box is invariably to be first used for the next day's work.
5. The water used in the tin box for thawing the dynamite must never be hotter than will permit of a man's hand being put into it.



Made of tinned sheet-iron and lined inside with felt.

## Appendix, No. 12.

PAPER handed in by Major Majendie.

## QUANTITIES of GUNPOWDER in 190 MINE MAGAZINES Inspected between September 1872 and 31st March 1874.

Index No. of Magazine.	County.	Amount.	Date of Inspection.	Index No. of Magazine.	County.	Amount.	Date of Inspection.
		<i>Lbs.</i>				<i>Lbs.</i>	
220	Carnarvon	500	18 August 1873	173	Cornwall	100	14 March 1874.
231	ditto	50	20 " "	174	ditto	1,525	14 Dec. 1872.
232	ditto	1,000	20 " "	175	ditto	50	14 " "
233	ditto	950	20 " "	176	ditto	25	14 " "
234	ditto	150	21 " "	196	ditto	1,500	17 April 1873.
235	ditto	nil	21 " "	196	ditto	600	18 March 1874.
236	ditto	nil	21 " "	197	ditto	500	22 April 1873.
237	ditto	25	21 " "	198	ditto	400	22 " "
238	ditto	1,150	21 " "	199	ditto	200	22 " "
239	ditto	350	21 " "	200	ditto	2,200	22 " "
240	ditto	45	22 " "	201	ditto	650	22 " "
241	ditto	1,000	22 " "	202	ditto	300	24 " "
242	ditto	160	22 " "	203	ditto	125	24 " "
243	ditto	400	22 " "	204	ditto	1,100	24 " "
244	ditto	300	22 " "	205	ditto	550	25 " "
245	ditto	1,600	22 " "	207	ditto	375	25 " "
246	ditto	375	22 " "	208	ditto	200	26 " "
247	ditto	1,000	23 " "	20	ditto	100	26 " "
248	ditto	400	23 " "	210	ditto	50	26 " "
138	Cheshire	4,000	11 October 1872	211	ditto	550	29 " "
86	Cornwall	1,450	23 April 1873	293	ditto	1,000	13 March 1874.
144	ditto	6	6 Dec. 1872	294	ditto	1,050	13 " "
145	ditto	550	6 " "	295	ditto	nil	14 " "
146	ditto	20	6 " "	296	ditto	10	14 " "
147	ditto	800	6 " "	297	ditto	375	16 " "
149	ditto	500	6 " "	298	ditto	110	16 " "
151	ditto	1,600	7 " "	299	ditto	1,100	16 " "
151	ditto	625	17 March 1874	300	ditto	400	17 " "
152	ditto	175	7 Dec. 1872	302	ditto	480	17 " "
153	ditto	600	7 " "	303	ditto	500	17 " "
153	ditto	265	17 March 1874	59	Cumberland	950	30 July 1873.
154	ditto	150	7 Dec. 1872	59	ditto	900	26 Feb. 1874.
156	ditto	550	9 " "	60	ditto	3,400	30 July 1873.
156	ditto	1,250	14 March 1874	61	ditto	2,600	29 " "
157	ditto	1,100	9 Dec. 1872	61	ditto	1,400	26 Feb. 1874.
158	ditto	800	9 " "	62	ditto	3,900	29 July 1873.
159	ditto	300	9 " "	63	ditto	2,000	29 " "
160	ditto	3,000	9 " "	64	ditto	350	29 " "
161	ditto	1,600	9 " "	65	ditto	2,500	29 " "
164	ditto	50	9 " "	66	ditto	275	29 " "
165	ditto	500	9 " "	68	ditto	3,600	30 " "
165	ditto	1,500	14 March 1874	68	ditto	1,600	26 Feb. 1874.
166	ditto	1,900	9 Dec. 1872	69	ditto	40	30 July 1873.
167	ditto	650	14 March 1874	70	ditto	2,500	29 " "
167	ditto	500	9 Dec. 1872	71	ditto	1,200	29 " "
168	ditto	750	10 Dec. "	73	ditto	1,000	2 May 1874.
170	ditto	300	10 " "	75	ditto	3,000	28 July 1873.
171	ditto	150	10 " "	213	ditto	350	30 " "
172	ditto	475	10 " "	214	ditto	75	30 " "
173	ditto	1,300	14 " "	291	ditto	450	26 Feb. 1874.

Index No. of Magazine.	County.	Amount.	Date of Inspection.	Index No. of Magazine.	County.	Amount.	Date of Inspection.
216	Denbigh	Lbs. 3,000	15 August 1873	194	Lancashire	Lbs. 100	1 April 1873
178	Derby	300	20 Feb. "	215	ditto	1,025	31 July "
179	ditto	nil	20 " "	217	Merioneth	1,500	15 August "
180	ditto	125	21 " "	218	ditto	2,000	15 " "
181	ditto	3,000	21 " "	219	ditto	500	16 " "
182	ditto	900	21 " "	221	ditto	4,500	19 " "
183	ditto	450	22 " "	222	ditto	500	19 " "
184	ditto	125	22 " "	223	ditto	500	19 " "
185	ditto	400	22 " "	224	ditto	800	19 " "
186	ditto	1,000	22 " "	225	ditto	350	19 " "
187	ditto	1,000	22 " "	226	ditto	1,500	19 " "
187	ditto	900	20 Jan. 1874	227	ditto	750	19 " "
188	ditto	1,500	22 Feb. 1873	228	ditto	325	19 " "
278	ditto	1,475	20 Jan. 1874	229	ditto	250	19 " "
279	ditto	310	20 " "	230	ditto	nil	19 " "
280	ditto	720	20 " "	230	Stafford	2,000	23 Jan. 1874.
304	Devon	450	20 March "	281	ditto	425	23 " "
305	ditto	400	20 " "	313	Somerset	50	24 March "
306	ditto	300	20 " "	137	York	2,050	28 Sept. 1872.
307	ditto	800	20 " "	253	ditto	425	18 Nov. 1873.
308	ditto	550	20 " "	254	ditto	2,000	19 " "
309	ditto	700	20 " "	255	ditto	30	19 " "
310	ditto	250	20 " "	256	ditto	1,500	20 " "
311	ditto	800	20 " "	257	ditto	50	20 " "
312	ditto	425	20 " "	258	ditto	500	20 " "
282	Durham	500	21 " "	259	ditto	1,500	20 " "
283	ditto	1,000	21 " "	260	ditto	300	20 " "
284	ditto	25	21 " "	261	ditto	700	20 " "
285	ditto	500	21 " "	262	ditto	2,000	20 " "
286	ditto	310	23 " "	263	ditto	2,000	21 " "
287	ditto	300	23 " "	265	ditto	50	21 " "
288	ditto	160	23 " "	266	ditto	500	21 " "
289	ditto	1,000	23 " "	267	ditto	230	21 " "
290	ditto	1,200	23 " "	268	ditto	90	24 " "
252	Glamorgan	400	23 " "	131	Argyll	4,450	7 Sept. 1872.
139	Gloucester	200	12 Dec. 1872	131	ditto	3,200	8 " 1873.
140	ditto	275	12 " "	132	ditto	925	10 " 1872.
141	ditto	475	13 " "	133	ditto	575	13 " "
277	ditto	175	8 Jan. 1874	134	ditto	1,400	13 " "
177	Kent	5	3 Feb. 1873	135	ditto	150	13 " "
189	Lancashire	300	27 " "	249	ditto	650	8 " 1873.
190	ditto	1,100	27 " "	250	ditto	400	18 " "
191	ditto	500	27 " "	251	ditto	50	18 " "
192	ditto	150	27 " "	195	Edinburgh	450	21 March "
194	ditto	4,000	27 " "	136	Perth	125	21 Sept. 1872.

SUMMARY.

	England.	Scotland.	Total.
No. of Magazines containing up to ¼ ton	97	5	102
Ditto ditto over ¼ up to ½ ton	36	3	39
Ditto ditto over ½ up to 1 ton	31	1	32
Ditto ditto over 1 up to 2 tons	14	1	15
Ditto ditto over 2 tons	1	1	2
TOTAL	179	11	190

Appendix, No 13.

PAPER handed in by Major *Majendie*, 2 June 1874.

Appendix, No. 13.

GUNPOWDER FACTORIES.

INSTANCES of Non-compliance with the Inspector's Suggestions with regard to—

		Number of Recommendations not complied with.
<b>(A.)—WORKMEN :</b>		
1. Working Clothes, and Pockets in Clothes :—Factories, No. 4, No. 12* (twice), No. 15*, No. 20 (twice), No. 23, No. 1, No. 5, No. 7, No. 13*, No. 19*	12	
2. Proper use of Magazine Shoes :—Factories, No. 2, No. 13	2	
	14	
<b>(B.)—BUILDINGS :</b>		
1. Bad condition :—Factories, No. 1, No. 4, No. 9, No. 22	4	
2. Dangerous proximity to one another, &c. :—Factories, No. 2 (4 recommendations), No. 3 (twice), No. 4, No. 6 (twice), No. 8*, No. 13*, No. 19*	12	
3. Technically Clean Floors, and Cleanliness generally :—Factories, No. 1, No. 4 (2 recommendations), No. 7 (twice), No. 14*, No. 20 (twice), No. 22 (twice), No. 15*, No. 23	12	
4. Exposed Iron :—Factories, No. 4, No. 5 (2 recommendations), No. 15*, No. 7, No. 20 (twice), No. 23, No. 1, No. 6, No. 9, No. 10, No. 14*, No. 13*	14	
5. Wood Lining :—Factories, No. 15*, No. 20 (twice), No. 22	4	
6. Lightning Conductors of Store Magazines :—Factories, No. 3, No. 4 No. 10, No. 13*, No. 12*, No. 19*	6	
7. Miscellaneous :—Factories, No. 15*, No. 19* (2 recommendations)	3	
	55	
<b>(C.)—WORK :</b>		
1. Reduction of Quantities in "Unlimited" Houses :—Factories, No. 1, No. 16*, No. 17*, No. 18*, No. 24	5	
2. Exclusion of Cotton Waste :—Factories, No. 2, No. 3, No. 4, No. 13*, No. 19*	5	
3. Rules :—Factories, No. 3, No. 4	2	
4. Miscellaneous :—Factories, No. 3, No. 4, No. 5, No. 6, No. 7 (2 recommendations), No. 17*, No. 19*	8	
	20	
TOTAL Recommendations found on re-inspection } not complied with		89

*Note.*—Those factories marked \* have not been visited since the recommendations which had not been attended to in the first instance were repeated ; it is therefore uncertain whether the renewed representations have in the case of those factories been attended with any effect.

SUMMARY.

From the foregoing it appears that, on re-inspection---

4	Factories (Nos. 8, 16, 18, 24)	were found each to have neglected to adopt	- -	1	recommendation.
5	ditto (Nos. 9, 10, 12, 14, 17)	- ditto - ditto -	- - -	2	recommendations.
3	ditto (Nos. 6, 22, 23)	- ditto - ditto -	- - -	3	ditto.
2	ditto (Nos. 5, 20)	- ditto - ditto -	- - -	4	ditto.
4	ditto (Nos. 1, 3, 7, 15)	- ditto - ditto -	- - -	5	ditto.
2	ditto (Nos. 2, 13)	- ditto - ditto -	- - -	6	ditto.
1	ditto (No. 19)	- ditto - ditto -	- - -	7	ditto.
1	ditto (No. 4)	- ditto - ditto -	- - -	10	ditto.

Total 22 factories which had each neglected to adopt one or more of the recommendations made.

The total number of Gunpowder Factories in Great Britain is 24 (exclusive of Ewell, closed) 12 of the foregoing 22 factories have been re-visited since the recommendations which had not been attended to in the first instance were repeated, and of these it was found that—

Four factories (No. 3, 6, 7, 22) had still neglected to adopt each one recommendation.

One factory (No. 20) had still neglected to adopt four recommendations.

And in regard to the 10 factories which have not been re-visited since the recommendations which were not attended to in the first instance were repeated, in one instance the proprietors have by letter (20, 3, 73) formally declined to adopt one of the recommendations; and in the case of, at least, three other factories (Nos. 17, 18, and 19) it is known that some important recommendations have in each case not been complied with. In some instances (as Nos. 7, 13, and 14) I have not even received an acknowledgment of the letters in which I called attention to the necessity for alteration: one of these letters called attention to 11 defects, and another to 10 defects.

OBSERVATIONS.

The foregoing Tabular Statement affords some indication of the extent to which the suggestions of the Inspector have not been complied with by the Gunpowder manufacturers.

It shows (1) that at least 89 formal recommendations have been found on re-inspection to be disregarded, and have had to be repeated; (2) that the recommendations so disregarded have frequently been of the most elementary description; (3) that this non-adoption of the Inspector's suggestions has occurred in 22 gunpowder factories out of 24; (4) that in the case of a large proportion of the factories which were re-visited after the recommendations which had not been attended to in the first instance were repeated, it was found that some (in one case the whole) of the recommendations so repeated were still not adopted.

It should further be observed that this statement fails to convey an idea of the full extent to which the Inspector's "suggestions" and "recommendations" have been disregarded, because (1) many recommendations have been made verbally or informally to manufacturers, of which no documentary record exists, and which are, therefore, not included in the foregoing list, but many of which have not been acted upon; (2) many recommendations which have been adopted have been adopted involuntarily, and under a sort of protest, in order to avoid prosecution for some observed illegality; (3.) the list of non-adopted recommendations only includes those which are *known* not to have been adopted, and takes no account of those which on account of the factories concerned not having been re-visited are merely *believed* not to have been adopted; but some of which at any rate, as the recommendation to apply lightning conductors to the larger powder buildings, it is certain still continue to be disregarded.

(signed) V. D. Majendie,

Major, Royal Artillery,

Her Majesty's Inspector of Gunpowder Works.

May 1874.

Appendix, No. 13.

## PARTICULARS and DATES of Instances of NON-COMPLIANCE with the INSPECTOR'S SUGGESTIONS in GUNPOWDER FACTORIES.

## (A. 1.)—Working Clothes; Pockets in Clothes to be forbidden.

SUITABLE clothes without pockets, and people to be searched, were recommended to *No. 4 Factory* in 1871; printed suggestions in the same points were sent in 1872. These recommendations had not been attended to at the next inspection in 1872.

6 August 1872.  
16 December 1871.  
19 December 1871.  
12 February 1873.  
20 March 1873.  
22 December 1871.  
30 June 1873.

In December 1871 we pointed out to *No. 12 Factory* that the magazine keeper should wear clothes without pockets, but the proprietors objected to alter. The printed suggestions were sent in 1872. He had pockets in February 1873, and attention was again called; the proprietors again objected to alter.

I suggested to *No. 15 Factory*, in December 1871, that pockets should be forbidden, and in 1872 sent printed suggestions to this effect. But in June 1873 I still found clothes with pockets.

14 March 1872.  
2 January 1873.

In *No. 20 Factory*, the proprietors agreed, in March 1872, that the men should have no pockets in their working clothes, on condition that heavy penalties should not be asked for. In December 1872, and again in October 1873, they had pockets.

14 February 1872.  
18 March 1874.

In *No. 23 Factory* I complained of pockets in clothes in February 1872; in March 1874 a rule forbidding pockets had been adopted, but it was not universally enforced.

In addition to the above, whose attention was directly called to these points by letters, the printed suggestions above referred to were sent to all the factories early in 1872; yet—

13 October 1873.

In *No. 1 Factory* I found pockets worn by the women in the packing room in September 1873.

20 September 1873.

In *No. 5 Factory* I found wearing clothes with pockets still the practice in September 1873.

20 July 1873.

In *No. 7 Factory* pockets in the trowsers were still worn in 1873; the men were not required to change their clothes, and no system of search was adopted.

2 October 1872.  
17 July 1873.

I found clothes with pockets in *No. 13 Factory* in September 1872; and in *No. 19 Factory*, in July 1873, where the men argued that they required them.

## (A. 2.)—Proper use of Magazine Shoes.

In *No. 2 Factory* I called attention, in October 1871, to their imperfect system with regard to magazine shoes. I also sent printed suggestions on this point early in 1872. The same system was in force in July 1872.

6 August 1872.

I sent the printed suggestions also to *No. 13 Factory*, but found the same state of things in September 1872 as when Captain Smith visited it in December 1871.

2 October 1872.

## (B. 1.)—Bad Condition of Buildings, &amp;c.

Printed suggestions in keeping the various buildings in order were sent to the different factories in 1872; yet I found the packing room in *No. 1 Factory* in a thoroughly unsatisfactory state in September 1873.

6 August 1872.

The general condition of *No. 4 Factory* was pronounced unsatisfactory in the first inspection in 1871, and so it continued in 1872.

(*N.B.*—The state of this factory had been previously remarked upon by Captain Smith in 1866.)

Smith, 2 August 1872.  
12 August 1872.

The general condition of *No. 9 Factory* was unsatisfactory in 1871, and commented on; there was no marked improvement in 1872.

In *No. 22 Factory* I called attention to the bad condition of the store magazines in February 1872; Captain Smith found them still in a bad condition in December 1872.

## (B. 2.)—Dangerous proximity of Buildings to one another, &amp;c.

In *No. 2 Factory* I called attention, in October 1871, to the dangerous proximity of the magazine to the workmen's houses and working buildings. The magazine was still there in 1873.

In the same factory the dangerous proximity of the stoves to the glazing house (only 44 yards distant) was pointed out in August 1872. There was no alteration in September 1873.

Also, in the same factory, I pointed out, in 1872, the dangerous proximity of the stoves to one another (only four yards apart). There was no alteration in 1873.

5 October 1871.  
7 September 1872.  
9 September 1873.

In *No. 3 Factory* I pointed out, in October 1871, the dangerous position of the stoves and glazing and dusting houses, one of the stoves being contiguous to some work houses, and the other being merely a wooden building, and close to an engine and boiler house. In 1872 this was not rectified, and I again called attention to it. Nevertheless, in September 1873, there was no alteration.

In *No. 4 Factory* I pointed out in 1871, the dangerous proximity of the buildings to



one another, and of the magazine to the manager's house and main road. There was no alteration in 1872. Appendix, No. 13.

In *No. 6 Factory* the press and corning house exploded conjointly in 1871, and I officially called attention to the danger from their being so near together; up to this time these buildings stand where they did, though I have recently been in correspondence respecting their projected removal. Meanwhile another explosion has occurred in the corning house, but as at the time it contained very little powder the press house escaped.

In *No. 8 Factory* I drew attention by letter, in November 1871, to the dangerous position of the charge house. This was admitted in the reply I received, but in August 1872 it had not been altered, only was about to be altered.

In *No. 13 Factory* I pointed out, in 1872, the dangerous proximity of the buildings. I have not yet received even a reply to my letter.

In *No. 19 Factory* I pointed out, in July 1873, the dangerous proximity of the stoves. This is still under consideration.

(B. 3.)—Technically Clean Floors, and Cleanliness of Powder Buildings generally.

In *No. 1 Factory* grit on the floors was complained of in October 1871; the same defect was found in September 1873, although printed suggestions had been sent in 1872.

In *No. 4 Factory* attention was drawn to grit found on the floors in 1871. Printed suggestions were sent in 1872, but grit was again found in July 1872. The generally filthy state of the buildings was also pointed out in 1871, but they were in the same state in 1872.

In *No. 7 Factory* grit was found and commented on in 1871. This was uncorrected and attention was again drawn to it in 1872. It was still uncorrected in 1873.

To *No. 14 Factory* I wrote on the exclusion of grit from powder buildings in January 1872; the proprietors replied that they "quite concur." I afterwards sent them printed suggestions on this point; yet the same defect was found existing in 1873.

In *No. 20 Factory* the proprietors agreed, in March 1872, to keep their buildings clean. In December 1872, and again in October 1873, the same fault was found.

In *No. 22 Factory* the floors of the working buildings were not kept clean and free from grit in February 1872, and complained of; Captain Smith found the same in December 1872, and the attention of the proprietors was again called to it. Nevertheless I again had to complain of grit and want of cleanliness in some of the buildings in March 1874.

In addition to the above, after printed suggestions had been sent to the factories in 1872, I found that cleanliness of the buildings was not observed, in June 1873, in *No. 15 Factory*; and in *No. 23 Factory* it was still a subject of complaint in March 1874.

(B. 4.)—Exposed Iron in Powder Buildings.

Exposed iron was complained of in *No. 4 Factory* in 1871; printed suggestions were sent in 1872, but it was still there in July of that year.

The same was found in *No. 5 Factory* in 1872, and not rectified in 1873; also iron-nailed vessels in a powder house.

Letters on this subject were sent to *No. 15 Factory* in 1871, and to *No. 7 Factory* in 1872. Printed suggestions were also sent, but exposed iron was found in both factories in 1873.

In *No. 20 Factory* the proprietors agreed in March 1872 to cover up or remove exposed iron and iron and steel implements, on condition that heavy penalties should not be pressed for. In December 1872, and again in October 1873, I found that it had not been done.

In *No. 23 Factory* exposed iron in the powder buildings was complained of in February 1872; it was again a subject of complaint in 1874; indeed, they had added to it, for they had put up wood linings with iron nails.

In addition to the above factories, which were communicated with by letter, printed suggestions on this subject, sent early in 1872 to all the factories, failed to have any effect on the following, exposed iron being found in *No. 1 Factory* in 1873, *No. 6 Factory* in 1873, *No. 9 Factory* in August 1872, *No. 10 Factory* in August 1872, *No. 14 Factory* in 1873, and iron keys in *No. 13 Factory* in September 1872.

(B. 5.)—Buildings unlined.

The powder buildings of *No. 15 Factory* were not lined with wood in June 1873, although I had sent printed suggestions on this point in 1872.

In *No. 20 Factory* the proprietors agreed, in March 1872, to wood-line their buildings; it was not, however, done in December 1872, when the factory was again inspected; nor in October 1873, when it was inspected for the third time.

In February 1872 I recommended wood lining for the powder houses in *No. 22 Factory*; in some of the buildings this had not been done in 1874.

(B. 6.)—Lightning Conductors should be attached to, not detached from, Store Magazines.

At *No. 3 Factory* and *No. 4 Factory* I pointed out that this should be done in 1871. I found no alteration in 1872, though I had also sent printed suggestions to these factories in the meantime.

	4 November 1871.
	2 October 1872.
	6 August 1872.
	8 October 1872.
	29 July 1873.
	2 January 1872.
	4 January 1872.
	14 March 1872.
	2 January 1873.
	8 February 1872.
	20 December 1872.
	6 August 1872.
	26 July 1872.
	30 September 1873.
	8 October 1872.
	29 July 1873.
	26 July 1873.
	14 March 1872.
	2 January 1873.
	18 March 1874.
	30 June 1873.
	14 March 1872.
	2 January 1873.
	8 February 1872.
	17 March 1874.
	7 September 1872.

Appendix, No. 13. The same printed suggestions, sent in 1872 to all factories, failed to have any effect on *No. 10 Factory* and *No. 13 Factory*, in both of which detached lightning conductors were found at the next inspection.

12 February 1873. A letter to *No. 12 Factory*, in December 1871, and to *No. 19 Factory* in 1872, and in  
20 March 1873. addition the printed suggestions sent to both in 1872 had not produced any alteration in 1873.

(B. 7.)—Miscellaneous Recommendations with regard to Buildings.

22 December 1871. In 1871, I recommended the provision of a charcoal store at *No. 15 Factory*; in June 1873 it had not been provided, and its absence was the cause of an illegality.

27 January 1872. I recommended to *No. 19 Factory*, that the starting and stopping apparatus should be  
17 July 1873. removed to the outside of the mills in January 1872. It had not been carried out in July 1873.

27 January 1872. I pointed out to *No. 19 Factory*, that the covering of the floor should be improved in January 1872. There was no alteration in July 1873.

(C. 1.)—Reduction of Quantities in the "Unlimited" Houses.

13 October 1871. In *No. 1 Factory* there was a quantity of powder in the packing room largely in excess of what was necessary in October 1871. The same thing was found and complained of in September 1873.

21 June 1873. In *No. 16 Factory* I drew attention to the large quantity of powder in the glazing house in 1872; yet in 1873 there was again a quantity largely in excess of the requirements.

18 July 1874. The reduction of quantities in these houses at *Nos. 17 and 18 Factories* was urged by me in June 1873, but no alteration has taken place.

22 March 1872. In *No. 24 Factory* I urged on the proprietors in March 1872, that they should reduce  
4 July 1873. the quantity of powder in their dusting house by not packing them, but I found the same going on in July 1873.

(C. 2.)—Exclusion of Cotton Waste from Powder Buildings.

I sent printed suggestions on this point to all the factories early in 1872, drawing attention to its liability to spontaneous ignition; yet I found it in *No. 2 Factory* in July 1872; *No. 3 Factory* in September 1873; *No. 4 Factory* in July 1872; *No. 13 Factory* in September 1872; *No. 19 Factory* (in the stove) in July 1873.

(C. 3.)—Rules.

September 1873. The adoption of proper rules for each house was suggested by me to *No. 3 Factory* in September 1872. This had not been done in September 1873.

6 August 1872. In *No. 4 Factory* there were no Rules in 1871. Attention was drawn to it, but there were none in 1872.

(C. 4.)—Miscellaneous Recommendations with regard to Work.

In *No. 3 Factory*, I found it the custom to grind the charcoal in the mixing house, in September 1872; I drew attention to it, but it was not rectified in September 1873.

6 August 1872. In *No. 4 Factory*, I found repairs being carried on in the powder buildings without removing the powder, in 1871; I called attention to the danger of so doing by letter and printed suggestions, yet I found the same in 1872.

11 February 1873. I drew attention to the danger of chipping up powder from the bed of mills, and removing the incrustation when there is powder there, by printed suggestions early in 1872; yet in *No. 5 Factory* it was still the practice in December 1872, when it caused the loss of a man's life.

4 August 1873. By the same suggestions I drew attention to the danger of carrying powder about  
29 July 1873. the factory in open barrows or trucks; yet this was done in *Nos. 6 and 7 Factories* in 1873.

19 August 1872. In *No. 7 Factory*, I found ammunition containing its own means of ignition stored with gunpowder, in 1871, and specifically commented on its danger; yet the same practice prevailed in 1872.

I urged on the proprietors of *No. 17 Factory* the danger of having a large number of women in the packing house, in June 1873; no alteration has been effected.

I found it the custom, in July 1873, to allow dinners to be eaten in some of the powder houses in *No. 19 Factory*; I had sent printed suggestions on this point in 1872.

GENERAL OBSERVATIONS.

(1.) I wrote to *No. 3 Factory* in September 1873 a letter in which there were no less than 10 suggestions; to this I have received no reply.

Smith, 3 August 1872. (2.) Many suggestions were made to *No. 7 Factory* in 1871, and when Captain Smith  
19 August 1872. visited it in 1872, he reported, "I did not observe that any of the suggestions made on the occasion of our joint inspection last year had been carried out." I again visited this factory in 1873, and observed no improvement in its condition. This factory has resisted three inspections, and I have not even received a reply to my last letter of the 29th July 1873.

29 July 1873.

(3.) In

(3.) In October 1872 I sent a letter to No. 13 Factory setting forth 11 defects, and I Appendix, No. 13. have never yet received even an acknowledgment.

2 October 1872,  
18 February 1873.

(4.) I sent a letter containing 10 suggestions to No. 14 Factory in February 1873, and have not yet received a reply to it.

14 March 1872.

(5.) On condition that heavy penalties should not be pressed for in March 1872 for an offence committed by the proprietors of No. 20 Factory, they agreed to carry out the elementary recommendations for safety made by me. But nothing had been done in December 1872, when it was again inspected, and the proprietors then promised that they should have their "prompt attention." Yet, at the third inspection in October 1873, things remained *in statu quo*, and then they began to argue as to the inconvenience of carrying out some of them. I replied that the whole must be completed by the 10th January 1874. On the 8th January I wrote, reminding them, and receiving no reply, I wrote again on the 20th January, to which they replied on the 23rd January, complaining of hard treatment. I wrote again on the 27th January, and again on the 7th February, to which I received a sort of provisional and unsatisfactory reply. I therefore sent them notice on the 26th February that proceedings would be taken if everything had not been done by the 10th March. This is the worst case which has come under my notice.

9 January 1873.

(signed) V. D. Majendic.

Appendix, No. 14.

Appendix, No. 14.

PAPER handed in by Mr. Taylor, 2 June 1874.

NEW WILDBERG (RHENISH PRUSSIA) MINING COMPANY, LIMITED.

OCTOBER 1873.

Dynamite, Nobel's Patent :	£. s. d.	£. s. d.
Cost at Wildberg, 15 sgr. per German pound - - - -	- 1 6	or - 1 4½
Powder - ditto - - - - -	- - 3½	
	£.	- 1 2½

Note.—5½ lbs. of Dynamite, consisted of—

88 ozs.	18 cartridges, 2½ inches long for holes, 12 to 14 inches deep.
22 "	3 " " " " 18 to 20 " "
16 "	4 " " " " 30 to 36 " "
<hr/>	
56 =	175 inches.

175) 88·0 (.502 = ½ oz. per inch.  
87·5

·500

Proportion of Cost per Pound.

Dynamite - - - - -	5·1
Powder - - - - -	1·

Number of Cartridges of Dynamite for 20-inch hole, ⅜ diameter, per pound, say - 10  
(Length of cartridge, 3 inches).

Number of Cartridges of Powder, for ditto - - - - - 6  
(Length of cartridge, 8 inches).

Cost, per charge, of Dynamite, 1·65 d. - 2·5 d. proportion of cost.  
" " of Powder, ·683 d., or 1 d. "

Relative cost of Explosives, per lachter of ground (level, 7 feet high, 4½ feet wide):

Dynamite consumed, 17½ lbs. - - - - -	£. s. d.	£. s. d.	£. s. d.
100 caps - - - - -	- 1 9	1 5 6	
5 coils of safety fuse - - - - -	- 3 -	- 4 9	
		<hr/>	1 10 3
Powder consumed, 100 lbs. - - - - -	- - -	1 9 2	
Fine Powder, 2 lbs. at 2 s. 6 d. - - - - -	- - -	- 5 -	
		<hr/>	1 14 2
Relative cost of driving one lachter of ground with Dynamite - - - - -	- - -	- - -	9 - -
" " " with Powder - - - - -	- - -	- - -	18 - -

Rock, short and drusy, associated with hard opaline quartz.

Note.—Length of a lachter, 6' 10½ English inches.

## Appendix, No. 15.

PAPER handed in by Major *Majendie*, 5 June 1874.

MEMORANDUM with reference to the CONVEYANCE of DYNAMITE by RAIL, furnished Appendix, No. 15.  
by Major *Majendie*, R.A., to the Clearing House Committee.

1. THE reference contained in the letter from Mr. Houghton, Chairman of the Committee of Goods Managers, on the carriage of explosives, dated 3rd June 1873, relates only to that particular nitro-glycerine preparation which is known as "dynamite," and the following observations are therefore limited to that material:—

2. It is clearly necessary to deal only with that particular description of "dynamite," which has been licensed by the Home Secretary under the Nitro-Glycerine Act of 1869 (32 & 33 Vict. c. 113), for the reasons—

(a) That it would at present be illegal to transport any other sort of "dynamite."

(b) That no opinion can be prudently expressed with regard to the safety of a "dynamite" of uncertain and indefinite composition.

3. The only "dynamite" as yet licensed is specified in the licenses granted as follows:—

"Dynamite consisting of thoroughly purified nitro-glycerine, thoroughly mixed with not less than 25 per cent. of an infusorial earth known as 'Kieselguhr,' and sufficiently absorbent in quality to prevent exudation of the nitro-glycerine;" and the following observations therefore relate only to dynamite of that particular composition and quality.\*

4. It will be observed that the above specification carefully provides against the two defects which were referred to in a former memorandum on this subject, dated April 1872, viz.:—

(a) Chemical impurity, and

(b) Exudation of the nitro-glycerine; and therefore if this specification be strictly observed, those defects may be assumed to be non-existent.

5. The best way of dealing with the question of the transport of dynamite of the above specified composition will be—

1st. To adopt some other explosive as a standard of comparison.

2nd. To tabulate the risks to which explosives are more or less exposed in transport, and to consider in what degree these risks relatively attach to dynamite and to the explosive selected for comparison.

6. The most convenient explosive which can be selected as a standard of comparison is gunpowder packed in barrels, because—

(a) Gunpowder packed in this way is at present carried in very large quantities by the railway companies.

(b) The material is one of definite composition and well-known qualities.

7. The risks to which explosives are liable in transport may be grouped into—

(a) Risks from without.

(b) Risks from within.

8. Risks

\* Other varieties of dynamite are under consideration, and can be dealt with as soon as they are licensed, and can be lawfully used and transported in this country. Horsley's blasting powder (another nitro-glycerine preparation) is already licensed, but this is not included in the reference.

Appendix, No. 15. 8. Risks from without include the following :—

- (a) Explosion by fire from adjacent conflagration or explosions.
- (b) Explosion by sparks.
- (c) Explosion by wilful incendiarism.
- (d) Explosion by lightning.
- (e) Explosion by collision.

9. It must be assumed that the same protection against these various risks would be provided in the case of dynamite as at present existing in the case of gunpowder; and the former explosive would certainly offer no greater attraction, so to speak, to external risks, than gunpowder.

10. As in the event of any of the foregoing external risks overcoming the protection provided against them in the case of gunpowder an explosion would follow, it is obvious that no worse consequences could follow in the case of dynamite.

11. But there are good grounds for believing that with regard at least to some of the external risks, the consequences might be less serious with dynamite than with gunpowder.

For example: It is known that a considerable quantity of dynamite may be burnt without explosion, while in the case of gunpowder even a few pounds, if ignited, will produce an explosion more or less serious, according to circumstances.

Again: a collision which would almost certainly produce an explosion of gunpowder would be far less certain to produce an explosion of dynamite, which is a plastic body, and which thus, when present in any mass, absorbs a good deal of the energy of a given blow by virtue of such plasticity. Again, while a single grain of gunpowder exploded in contact with other grains, or (unless artificially or sufficiently separated therefrom) in close proximity thereto, would certainly explode the whole, such a result would by no means certainly follow in the case of the explosion of a particle of dynamite under similar conditions.

12. It appears, therefore, that with regard to the liability to accident from external causes, dynamite of the specified composition and quality is somewhat less dangerous than gunpowder in barrels.

13. Risks from within include the following :—

- (a) Accident from fire-giving or explosion-producing agents.
- (b) Accident from spontaneous ignition or explosion due to (1) the presence of foreign substances, or (2) to the chemical instability of the explosive itself.
- (c) Accident from sparks.
- (d) Accident from friction or percussion.
- (e) Accident from elevation of temperature.

14. With regard to risk (a), it may be assumed that the same protection against these sources of accident would be produced in the case of dynamite as at present exists in the case of gunpowder, that is to say, that all artificial lights, matches, percussion caps, detonators, or similar articles tending to cause fire or explosion, would be as strictly excluded from vans containing dynamite, as they are now excluded from vans containing gunpowder.

Such articles of this class as would explode dynamite would certainly explode powder; but, on the other hand, some articles of this class which would explode gunpowder would probably not explode dynamite.

15. With regard to risk (b 1), the same observation holds good as under 14 above. With regard to risk (b 2), the terms of the specification expressly exclude *impure* dynamite; and with regard to *pure* dynamite, such experience as has accumulated with regard to that substance has been increasingly favourable, and has tended to show that the substance is possessed of the requisite chemical stability.

This is strictly a chemical question; but the opinion of some eminent chemists, including, if I am not mistaken, that of Professor Abel, may be quoted in favour of the chemical stability of well-made dynamite under all ordinary conditions of temperature, &c., and I am not aware of any opinion to the contrary.

Gunpowder is well known to be absolutely stable in its chemical character; but if pure dynamite is also permanently stable (and the evidence, as above stated, is, as far as it goes, favourable in this respect) it is not inferior to gunpowder in this respect.

16. With regard to risk (c), a spark which would fire dynamite would certainly explode gunpowder; on the other hand, it is far from certain that every spark which would explode gunpowder would easily fire dynamite; while it is possible, as above stated, for dynamite under certain conditions, and in moderate quantities, to be fired without being exploded.

17. With

17. With regard to risk (*d*), I am not aware of any strictly accurate comparison having ever been made on this point. It would be necessary that the conditions should be identical for the experiment to be thoroughly reliable, and in all the experiments that I am acquainted with the conditions have not been really comparable. But while explosions have been produced with gunpowder by a weight of 25 lbs. falling freely through 2 feet, "lithofracteur,"\* which is a kindred substance to dynamite, has, I believe, never been exploded by a falling weight of 20 lbs. through a space of less than 3 feet.

"Dynamite" is probably not more sensitive than the "lithofracteur" above referred to, and may therefore be regarded as not more sensitive than gunpowder.

The results of some experiments which were carried out near Llanberis in 1872 seemed to show that dynamite is not unduly liable to explosion by percussion, and presents no special risk on this score.

18. As regards risk (*e*), such elevation of temperature might proceed from causes external to the van, or from causes within.

From whichever cause the elevation might proceed, it is certain that dynamite could be more easily fired or exploded by such elevation than gunpowder, its igniting or exploding point being lower. What the exact ignition or exploding point of dynamite is has not, to my knowledge, been *accurately* ascertained.

It is, however, certainly below 560° Fahrenheit, the exploding point of powder; but there are no grounds for believing that the point is so low as to be reached except by artificial agency,† which should be as carefully and as easily excluded in one case as in the other.

19. It appears, therefore, that with regard to the liability to accident from internal causes, the risk would be somewhat less with dynamite in regard to (*a*), (*b* 1), and (*c*); probably less, also, with regard to (*d*); probably not greater with regard to (*b* 2); somewhat greater, though scarcely in any practical degree, with regard to (*e*).

20. It may, therefore, be taken broadly, that "dynamite" of the *specified composition and quality* is, on the whole, safer to transport than gunpowder packed in barrels.

21. It is, however, necessary to insist upon the strict and faithful observance of the specification, or other risks, of indefinite magnitude, might arise, due to impure material, with a possible liability, also to exudation, getting into circulation.

22. Such observance can only be effectively guaranteed by means of a careful system of independent supervision.

23. Such a system of supervision it is the desire of the Government to establish, in the public interests, by the taking of samples, and submitting them to chemical and other analysis.

24. But the system cannot be worked unless facilities are afforded for the transmission of the requisite samples by the railways, as already proposed in former correspondence.

25. It will now be obvious that such a system of transmission and examination of samples will become necessary also in the interests of the railways themselves, as soon as dynamite is carried by them.

26. The system might be usefully supplemented by including in the consignment notes a right to the railways to take occasional samples, and to submit them to the Government Inspector for examination; and, if desired by the railways, arrangements could be effected for carrying this out, which would to some extent be a *quid pro quo* for the facilities which the companies are invited to afford for the transmission of Government selected samples.

27. The consignment note which accompanies Mr. Houghton's letter of the 3rd instant will, in any case, require considerable revision to bring it into correspondence with the existing licenses.

I do not, however, gather that I am desired to suggest propositions in detail for the revision of these notes, but rather to express an opinion on the general question of the carriage of dynamite. This I have done. I shall be happy, if desired, to consider in detail—in writing or in consultation with the Committee—the question of the exact form of consignment note to be adopted.

V. D. Majendie, Major, R.A.,

H.M. Inspector of Gunpowder Works.

9 June 1873.

\* I now refer to a "lithofracteur" which was submitted for trial to the Committee on Gun Cotton in 1872. The "lithofracteur" since submitted has proved slightly more inert.

† And except, perhaps, direct exposure to the rays of a tropical sun, or to intense refracted natural heat.

## Appendix No. 16.

PAPER handed in by Mr. Brock, 5 June 1874.

Appendix, No. 16.

## R U L E S.

## FIREWORK FACTORY, C. T. BROCK &amp; Co.

THESE Rules being for the benefit and safety of all, will be strictly enforced. The foreman has strict orders to see them carried into effect.

1. Any workman smoking, or carrying matches about him, within or near the factory, will be instantly discharged.
2. No light, fire, matches, &c., shall on any account be taken inside any of the sheds, except the Rolling Shed and the Great Shed. Matches may be kept in a fixed place in either of these sheds, or outside; if left elsewhere, a fine of 6d. will be incurred.
3. Larking, playing, carelessness, or neglect of orders will subject the offender to a fine of 1s.
4. All doors to be kept unfastened, except by thin string or latch, while people are within.
5. Anybody using or emptying a pail of water is to see that it is at once refilled and replaced in its proper position.
6. No one is to stay on the premises after working hours.
7. None but those actually employed in the factory are allowed on the premises.
8. No one to enter the following sheds except the people here mentioned:—

Chemical shed _____	Fitting shed _____
Charging shed    Men charging.	Magazine _____
Mixing shed _____	

Any girl or boy entering these will be instantly dismissed; anybody else will be fined 1s.

9. No coloured fire to be allowed inside any shed, except the coloured fire-shed, and then only while needed for charging lights. Fine, 1s.

10. Any person taking a brush, sieve, weights and scales, &c., out of its proper shed into another will be fined 1s.

The sheds shall be thoroughly cleaned out, washed and sawdusted as often as they need it, at the least once a month. The first thing each morning is to see that pails of water stand close to the door of each shed.

*N.B.*—By Act of Parliament, workpeople in firework factories breaking rules made by a master for the safety of such place, can be immediately taken before a magistrate and fined 5*l.*; and by the same Act any person whatever, doing any act tending to cause an explosion can be at once brought before a magistrate and fined 5*l.*



Appendix No. 17.

PAPER handed in by Major *Majendie*, 12 June 1874.

SUGGESTED CLASSIFICATION OF EXPLOSIVE SUBSTANCES.

Appendix, No. 17

1. *Gunpowder*, consisting of any preparation formed by the mechanical mixture of a nitrate with any form of carbon, or with any carbonaceous substance not possessed of explosive properties, whether sulphur be, or be not, added to such preparation, and whether such preparation be, or be not, mechanically mixed with any other non-explosive substance; and whether such preparation be loose or packed, or be made up into cartridges or charges for cannon or blasting, or be in shells or torpedoes.

This class comprises such explosives as—

- Gunpowder, ordinarily so called.
- Pyrolithe.
- Pudrolithe.
- Poudre-saxifragine.

Any preparation of this class, if mechanically mixed with any nitro-explosive, or chlorate-explosive, to be deemed to be included in the nitro class or chlorate class respectively, and not in this class.

2. *Nitro-explosive Class*, viz., any chemical compound possessed of explosive properties, or capable of combining with metals to form an explosive compound, which is produced by the chemical action of nitric acid (whether mixed or not with sulphuric acid), or if a nitrate mixed with sulphuric acid, upon any carbonaceous substances, whether such compound is mechanically mixed with other substances or not; and whether the same be loose or packed, or be made up into cartridges or charges for cannon or blasting, or be in shells or torpedoes.

This class consists of two divisions.

The first comprises such explosives as—

- Nitro-glycerine, ordinarily so called,
- Dynamite.
- Lithofracteur,
- Dualine,
- Glyoxiline,
- Nitrate of methyl,

and any chemical compound, or mechanically mixed preparation which consists, either wholly or partly, of nitro-glycerine, or of some other liquid nitro-explosive.

The second division comprises such explosives as—

- |                                  |                    |
|----------------------------------|--------------------|
| Guncotton, ordinarily so called. | Cotton gunpowder.  |
| Gunpaper.                        | Schultze's powder. |
| Xyloidine.                       | Nitro-mannite.     |
| Gunsawdust.                      | Picrates.          |
| Nitrated guncotton.              | Picric powder.     |

Where any explosive of this class consists partly of a nitro-explosive and partly of a chlorate-explosive, it should be deemed to belong to the chlorate-explosive class.

3. *Chlorate-explosive Class*.—This class comprises all preparations containing a chlorate mechanically mixed with any form of carbon, or carbonaceous substance, either with or without the addition of a nitrate or a sulphuret, or sulphur; whether such preparation be loose or packed or be made up into cartridges or charges for cannon or blasting, or be in shells or torpedoes.

This class consists of two divisions. The first comprises such preparations as—

- Horsley's blasting powder,
- Brain's blasting powder,

and any preparation which consists partly of nitro-glycerine or of any liquid nitro-explosive.

The second division comprises such explosives as—

- |                                     |                                 |
|-------------------------------------|---------------------------------|
| Horsley's original blasting powder. | Hochstadter's blasting charges. |
| Erhardt's powder.                   | Reichen's blasting charges.     |
| German gunpowder.                   | Teutonite.                      |
| Revely's powder.                    | Chlorated guncotton.            |

Appendix, No. 17.

4. *Fulminate Explosives*.—This class comprises any chemical compound or mechanical mixture, which, from its great susceptibility to detonation, is suitable for employment in percussion caps or any other appliances for developing detonation; or which, from its extreme sensibility to explosion and from its great instability (that is to say, readiness to undergo decomposition from very slight exciting cause), is especially dangerous; whether the same be loose or packed, so that it be not made up into percussion caps.

This class is divided into two divisions.

The first division comprises such compounds as the fulminates of silver and of mercury, and preparations of these substances such as are used in percussion caps, and any preparations consisting of a mixture of a chlorate with phosphorus or certain descriptions of phosphorus compounds, with or without the addition of carbonaceous matter, and any preparation consisting of a mixture of a chlorate with sulphur, or with a sulphuret, with or without carbonaceous matter.

The second division includes such substances as the chloride and the iodide of nitrogen, fulminating gold and silver, diazobenzol, and the nitrate of diazobenzol.

5. *Ammunition*.—This class includes any explosive of any of the foregoing classes when enclosed in any case or contrivance, so as to form a cartridge for small arms, or for any weapon other than cannon, or to form any fuze for blasting or for shells; or to form any tube for firing guns; or to form a percussion cap, a detonator, or similar contrivance other than the following:—

A cartridge or charge for cannon or blasting.

A shell, a torpedo, or a manufactured firework.

This class has two divisions. The first division comprises—

Safety cartridges for small arms,	Railway fog signals, and
Safety blasting fuzes,*	Safety fuzes for shells.
Percussion caps,†	

The second division comprises—

Non-safety cartridges for small arms.	Non-safety fuzes for shells.
Detonators.	War rockets.
Non-safety fuzes for blasting.	Tubes for firing guns.

6. *Fireworks*.—This class is divided into two divisions. The first division comprises "firework composition," viz., any chemical compound or mechanically mixed preparation which is of a combustible or inflammable nature, and is used for the purpose of making manufactured fireworks, and which is not included in the former classes of explosives; and also any coloured fire composition, whether such compound, preparation, or composition, be loose or packed.

The second division includes any "manufactured firework," and comprises every explosive of the four first of the foregoing classes, and any firework composition, when such explosive or composition is enclosed in any cases or contrivance, or is otherwise manufactured, so as to form a squib, cracker, or other article adapted to the production of pyrotechnical effects or pyrotechnic signals.

\* Safety blasting fuzes should be regulated only as to the manufacture and mode of packing.

† Percussion caps should be regulated only as to the manufacture, as to the mode of packing, and as to their storage or carriage with other explosives.

## Appendix, No. 18.

PAPERS handed in by Major *Majendie*.

## SPECIAL COMMITTEE ON GUNCOTTON AND LITHOFRACTEUR.

Appendix, No. 18.

## REPORT ON LITHOFRACTEUR.

4 May 1872.

1. In the last paragraph of the instructions conveyed to them by War Office letter, 20th September 1871 (74-9-61), the committee were directed to undertake, as a separate subject, an investigation, which the Secretary of State for the Home Department had requested, as to the question of the safety for transport and storage of the substance called lithofracteur.

Subsequently, on 23rd October 1871, a letter from Mr. France to the Secretary of State for the Home Department, requesting authority to import a quantity of lithofracteur for experimental purposes, was referred to the committee for consideration.

2. In their remarks on the above, the committee suggested that as nothing definite had been brought to their notice as to the precise nature of the material called lithofracteur, Messrs. Krebs should be called upon to describe and define the substance they proposed to import.

They also thought it necessary that specific authority should be obtained from Messrs. Krebs of the appointment of Mr. France, or some other person, as their recognised agent in this country. This led to the correspondence detailed in Appendix A.

3. Messrs. Krebs, 14th November 1871, duly appointed Mr. France their agent; and 17th November 1871 declined to furnish further details of lithofracteur than those given before to Dr. Williamson (Appendix B).

4. On 1st December 1871 the committee recommended that authority should be given to import 5 cwt. of lithofracteur for experimental purposes; and on the 13th December, at the request of Mr. France, they further recommended the importation of 1 cwt. of dynamite, manufactured by Messrs. Krebs (Appendix C).

5. On the 20th December Mr. France informed the committee that the 5 cwt. of lithofracteur was on its way to this country, and requested an interview. This was fixed for the 2nd of January (Appendix D).

6. Mr. France attended 2nd January 1872, and gave evidence before the committee.

At his suggestion it was agreed that Professor Engels should be communicated with on the part of Messrs. Krebs; and at the request of the committee he undertook that a programme of experiments to test the safety of lithofracteur in transport and storage should be drawn up.

7. On the 16th January Professor Engels attended with Mr. France and submitted a programme of experiments, and it was arranged that the committee should witness them at Mr. France's quarries at Nautmaur, near Shrewsbury, on Tuesday the 30th January.

8. On the 25th of January Mr. France informed the Secretary that owing to adverse winds the lithofracteur had not arrived, and that it would be necessary to postpone the experiments.

They were accordingly postponed until the 13th February.

On the 6th February Mr. France informed the Secretary that owing to the non-arrival of the vessel in the Thames the experiments must necessarily be again postponed. A further postponement was accordingly made to the 20th February.

9. On the last-named day the committee attended at the Nautmaur quarries and witnessed the experiments detailed in Appendix F.

10. The results of these experiments at Nautmaur tended to show that under ordinary conditions of temperature lithofracteur might be safely subjected to exceptionally severe 0.84.

Appendix, No. 18. concussion, and that it is not liable to accidental explosion by rough handling, or by any violence to which it might be subjected in usual transport.

11. These experiments, however, had been carried out under the conditions of temperature in the month of February, and it was necessary to ascertain whether the substance would be equally safe under the highest and lowest conditions of temperature to which it might be subjected in transport and storage. Whether, for instance, it would endure the same shock in a frozen as in a plastic state.

12. For this purpose a case of lithofracteur, at the request of the committee, was reserved, and was delivered at the Royal Arsenal, Woolwich, by Mr. France, on 2nd March 1872 (Appendix G).

13. On the 5th March the committee carried out a series of preliminary experiments with various explosive substances, including lithofracteur, dynamite, and guncotton.

Cartridges of the several materials under different conditions of temperature were subjected to the action of a weight falling from a definite height; the results are detailed in Appendix H., and proved that lithofracteur in the frozen state is more inert than in the plastic state, and thus less liable to accidental explosion by concussion.

14. In continuation of these experiments the committee proceeded to thaw some of the frozen lithofracteur, and for this purpose placed some frozen cartridges in the sun, and others in indiarubber bags immersed in warm water from 70 degrees to 100 degrees Fahrenheit. During this process it was found that nitro-glycerine freely exuded from several of the cartridges placed in the sun.

The indiarubber bags, upon examination, also showed that nitro-glycerine had exuded from the cartridges contained in them (Appendix I).

15. The separation of the nitro-glycerine from lithofracteur at a moderate temperature appeared to the committee so serious a point that they determined to repeat the experiments, and to invite Mr. France, Professor Engels, and Mr. Kirkman to be present.

Mr. France's reply to the committee's invitation is given in Appendix K., but as they were anxious that he should be present, as the representative of lithofracteur in this country, at the experiments they had in contemplation, the committee delayed these trials to give him an opportunity of attending, of which, however, he did not avail himself. The correspondence on this head is given in full in Appendix K.

16. Under these circumstances the committee, 26th March 1872, proceeded to repeat the experiments as to the influence of changes of temperature on lithofracteur, using for the purpose part of the box of lithofracteur mentioned in para. 12, which, since its receipt in the Arsenal, had been in charge of Colonel Milward, the superintendent, Royal Laboratory, and a member of the committee.

17. The committee also took the opportunity of making similar experiments with another nitro-glycerine compound, using for this purpose a box of dynamite manufactured by Mr. Nobel, and in the possession of Colonel Milward. These experiments are detailed in Appendix L.

18. From a careful review of the whole of the trials with lithofracteur, and on full consideration of the case in all its bearings, the committee are of opinion that the substance provided for the experiments under the name of lithofracteur has imperfectly fulfilled the absolutely necessary property of retaining its proportion of nitro-glycerine under circumstances which might be met with during ordinary transport or storage.

19. It appears that nitro-glycerine readily exuded from a proportion of the cartridges of the lithofracteur under trial after a comparatively short exposure to a temperature not exceeding 100 degrees Fahrenheit; and although such a temperature may not in an English climate be sustained for any length of time, either during a railway journey or in a magazine, it must be borne in mind that the nitro-glycerine once exuded may not be re-absorbed, but that fresh exudation would probably take place on each fresh application of heat, and that this tendency to leakage might be facilitated by the shaking inseparable from railway transit.

20. The capacity of lithofracteur for retaining nitro-glycerine is very seriously interfered with by its becoming wetted. The nitro-glycerine is readily expelled from a lithofracteur cartridge immersed in water.

The readiness with which the lithofracteur parts with its nitro-glycerine under the influence of water is dependent probably on the presence of nitrate of soda as one of its constituents, a substance exceedingly soluble in water, and in the event of a box of cartridges getting wet, water would replace part of the nitro-glycerine which would thus collect in a liquid form at the bottom of the box.

21. The committee regret they cannot make a more favourable report upon a substance which may possess many valuable properties for industrial purposes, but they regard the tendency of some of the lithofracteur submitted to them to part with its nitro-glycerine, under conditions that can only be regarded as ordinary, as a defect too serious to be ignored. They hope the manufacturers may succeed in overcoming the difficulties thus indicated, and enable this explosive, so useful for many purposes, to be admitted without restriction.

The committee have no hesitation in recording their opinion that a safe and unobjectionable nitro-glycerine compound, possessing valuable explosive properties for many useful purposes, and fully meeting all the requirements of quarry owners, can be manufactured, transported, and stored in this country.

Appendix, No. 18.

(signed) *C. W. Younghusband*, Colonel, R.A.,  
President, Special Committee on Gun-cotton, &c.

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APPENDICES TO REPORT ON LITHOFRACTEUR.

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APPENDIX A.

LETTER from the Under Secretary of State, Home Office, to Under Secretary of State for War, 19th October 1871.

I am directed by Mr. Secretary Bruce to acknowledge the receipt of your letter of the 18th instant, notifying the formation of the Committee on Gun-cotton and Lithofracteur, and I am to request that you will move Mr. Secretary Cardwell to cause the enclosed copy of a letter received from Mr. R. S. France to be referred to them.

I am to add that Mr. France has been informed that the Secretary of State will, of course, grant a license to Messrs. Krebs to transport to this country as much of their explosive as shall be deemed necessary to the Committee above-mentioned.

Letter from Mr. *France*, 6, Bloomfield Terrace, Hyde Park, W., to the Secretary of State for the Home Department, 17th October 1871.

I have the honour to state that I duly forwarded to Messrs. Krebs a copy of your letter, dated 2nd instant, and in acknowledging the receipt Messrs. Krebs say:—

“There is one thing, however, you must not forget, viz., to obtain permission from the Home Office for us to send to England enough of our explosives to carry out all necessary experiments; of course the Home Secretary will grant this directly he has information from the War Office of the appointment of such Committee. We mention this so that no time may be lost, because if proper experiments are to be carried out before military authorities a few pounds of lithofracteur will be of no use, and besides which it would be ridiculous to run the risk of a heavy fine, and great unpleasantness, by our Herr Engles bringing it over with him as before.”

In accordance, therefore, with the foregoing abstract from Messrs. Krebs' letter, I now beg to make final application for such permission to import from 15 cwt. to 1 ton of lithofracteur for such experimental purposes, and I shall feel much obliged by receiving such license at as early a date as practicable, so that I may advise Messrs. Krebs without any delay.

Director of Artillery to President of Committee, 23rd October 1871.

For consideration and report.

President of Committee to Director of Artillery, 1st November 1871.

The Committee will be prepared to carry out all necessary experiments to test the safety in transport and storage of the substance called “Lithofracteur,” but think the attention of the Home Office should be drawn to the circumstance that nothing definite has been brought to their knowledge of the nature of this material, and especially as they are aware that conflicting opinions have been pronounced by eminent authorities as to its safety, they can express no opinion at present as to the advisability of importing even a small quantity for the purpose of experiments.

They beg to suggest that, in the first place, Messrs. Krebs should be called upon to describe and define the substance they propose to import.

The Committee also think it very necessary that specific authority should be obtained from Messrs. Krebs of the appointment of Mr. France, or some other person, as their recognised agent in this country.

Appendix, No. 18. Letter from the Under Secretary of State, Home Office, to Mr. *France*, 19 October 1871.

I am directed by Mr. Secretary Bruce to acquaint you that the War Office Committee on Gun-cotton and Lithofracteur has now been formed, and consists of:—

Colonel Younghusband, R.A., President.  
 Colonel Milward, C.B., R.A., Superintendent Royal Laboratory.  
 Colonel Galloway, R.E.  
 Lieutenant Colonel Nugent, R.E.  
 Captain Field, R.N.  
 Captain Noble, R.A., Secretary;

and upon which the following gentlemen, viz.:—

W. Odling, Esq., F.R.S.  
 H. Bauerman, Esq., School of Mines.  
 G. Bidder, Esq., C.E.,

have also been invited to attend, and that the committee have been instructed to proceed with the inquiry forthwith.

I am at the same time to acquaint you that the Secretary of State will, of course, grant a license to Messrs. Krebs to transport to this country as much of their explosive as shall be deemed necessary by the above-mentioned committee, to whom your letter of the 17th instant has been referred by Mr. Bruce's directions.

Letter from Mr. *France* to the Secretary of State for War, 21 October 1871.

I have the honour to enclose copy of a letter I have this day received from the Home Office, and in accordance therewith I shall feel much obliged by hearing from Colonel Younghusband, R.A., as president of the committee, in reference to the importation of lithofracteur required for the purposes of experiments. I will then immediately communicate with Messrs. Krebs, and they will arrange that no delay shall arise through the necessity for importation.

With reference to the meeting of the committee, I shall be happy to attend any preliminary appointment the president may deem necessary, in order to arrange the nature and extent of the evidence to be adduced.

#### APPENDIX B.

Dear Sir,

Cöln, 14 November 1871.

WE hereby respectfully request you to represent us at the War Office Committee now sitting, to decide on the safety of our explosive compound "Lithofracteur," and further authorise you to act for us in every way before such committee, as we recognise everything you may say or promise as valid and binding upon us.

R. S. France, Esq.,  
 London.

We are, &c.  
 (signed) *G. Krebs & Co.*

Dear Sir,

Cöln, 17 November 1871.

WE duly received your favour of 11th instant, with enclosures.

In reply to the demand of the committee now sitting on gun-cotton and lithofracteur, for an accurate description of our explosive, we regret we can only furnish them with the same details as those given before to Professor Williamson, viz.:—

52½ per cent. nitro-glycerine.  
 22½ „ silica.  
 25 „ mineral bodies.

As you are aware, our secret, and consequently our property, entirely consists in the last indefinitely described item; and many have been the attempts of rival manufacturers of nitro-glycerine compound in Germany to discover the exact nature of these mineral substances, and our mode of incorporating them. The entire immunity from accident at our works during the four years we have been manufacturers, and the superior strength of lithofracteur, combined with its increased safety in transport, storage, and use, both in high and low temperatures, proceed from the mixture of these additional substances (what dynamite does not possess), and form the important element in our manufacture.

We are now asked by the committee to define accurately these ingredients, and while we could offer no objection to specify them, if we were protected by patents, it is obvious that to do so in the absence of such protection would simply be to sacrifice all the time, care, and chemical research we have brought to bear upon so important a manufacture, and we feel confident that the Home Secretary, and also the Secretary of State for War in your country, will see it in this light.

R. S. France, Esq.,  
 London.

We are, &c.,  
 (signed) *G. Krebs & Co.*

## APPENDIX C.

Letter from the Under Secretary of State, Home Office, to Under Secretary of State for War, 15 November 1871.

I AM directed by Mr. Secretary Bruce to acknowledge the receipt of your letter of the 4th instant, stating that the Special Committee on Explosives can express no opinion as to the advisability of importing "lithofracteur" until a definite statement of the nature of that material has been communicated to them, and also suggesting that specific authority should be obtained from Messrs. Krebs of the appointment of Mr. France as their recognised agent in this country, and I am to transmit to you a copy of a letter from Mr. France, who has communicated the wishes of the committee to Messrs. Krebs, and also the original letter from Messrs. Krebs, authorising Mr. France to act for them, and I am to request that you will lay the same before the Secretary of State for War.

Director of Artillery to President, Gun Cotton, &c., Committee, 20 November 1871.

FOR remarks of your committee.

President, Gun Cotton, &c., Committee, to Director of Artillery, 1 December 1871.

REFERRING to Mr. France's letter, 17th October 1871 (Appendix A.), the committee recommend that Mr. France be authorised to procure from Messrs. Krebs a small quantity of lithofracteur, say five cwt., for experimental purposes; in the absence, however, of full particulars as to the composition of lithofracteur, the committee think that all responsibility connected with the importation of this first supply should rest entirely with Mr. France as the recognised agent of Messrs. Krebs. I attach a copy of a letter which the committee have addressed to Mr. France.

Letter from Mr. France to the Secretary, Special Committee.

Sir,

6, Bloomfield-terrace, Hyde Park, W.,  
2 December 1871.

I BEG to acknowledge the receipt of your letter of the 30th ultimo, and in accordance therewith I have this day applied to the Secretary of State for the Home Department for a license to import the five cwt. of lithofracteur, as specified by the committee.

I agree to accept all the responsibility in connection with such importation, and I will also take care that you receive from Messrs. Krebs their written assurance that the 5 cwt. specified is an exact sample of their ordinary manufacture of lithofracteur.

Will you be good enough to inform me when the president would wish me to attend the committee in order to arrange for the necessary experiments and the requisite evidence, as I am desirous of meeting the views of the committee in these respects.

I have, &c.  
(signed) R. S. France.

Letter from the Under Secretary of State, Home Office, to Under Secretary of State for War, 5 December 1871.

I AM directed by Mr. Secretary Bruce to transmit herewith, to be laid before Mr. Secretary Cardwell, the enclosed copies of a letter from Mr. France, and of its enclosures, applying for a license to import five cwt. of lithofracteur and one cwt. of dynamite; and I am to request that you will move Mr. Cardwell to obtain, with as little delay as possible, the opinion of the Guncotton, &c., Committee on Mr. France's application.

Letter from Mr. France to the Secretary of State for the Home Department,  
2 December 1871.

I HAVE the honour to enclose herewith a copy of a letter I have this day received from Captain Noble, R.A., as Secretary to the War Office Committee on Explosives, and in accordance therewith I have now to ask you to be good enough to grant me the requisite license for the importation, storage, and transport of five cwt. of lithofracteur, and I agree to accept all the responsibility of such importation, as specified in Captain Noble's letter.

I have also further to ask you to grant me a license to import one cwt. of the dynamite, also manufactured by Messrs. Krebs. In my letter to you of the 11th ultimo I stated that, pending the inquiry into lithofracteur, I would suggest to Messrs. Krebs that they should apply to you for a license to import their dynamite, and which, like that of Mr. Nobel and others, contained from 70 to 75 per cent. of nitro-glycerine, the remaining per centage consisting of infusorial earth.

I beg to inclose a letter which Messrs. Krebs then wrote me in reply, and which will show how the question stands. So far as relates to the one cwt. of dynamite, I wish to have

Appendix, No. 18. that over at the same time as the lithofracteur, in order that the committee may see the obvious difference in the two compounds which Messrs. Krebs manufacture; but as I find these nitro-glycerine compounds are so much more effective than gunpowder in my quarries, I am anxious to obtain a further supply of *dynamite* for immediate use; and I shall therefore feel much obliged if you will inform me whether, as regards dynamite, it is necessary for me to do anything beyond applying to you for a license to import such quantities as I and other quarry proprietors who are in communication with me, require for immediate use in our respective quarries.

Director of Artillery to President, Special Committee, 7 December 1871.

YOUR opinion is requested as early as possible in regard to the dynamite.

President, Special Committee, to Director of Artillery, 13 December 1871.

THE Committee recommend that the Secretary of State for the Home Department authorise Mr. France to import one cwt. of dynamite for experiments, under the same conditions as the five cwt. of lithofracteur are to be imported.

Letter from the Under Secretary of State, Home Office, to Under Secretary of State for War, 12 December 1871.

I AM directed by Mr. Secretary Bruce to acquaint you, for the information of Mr. Cardwell, that he has this day transmitted a license to Mr. France, authorising him to import five cwt. of lithofracteur for the purpose of experiment by the Committee on Explosive Substantives, as suggested in your letter of the 7th instant.

Letter from the Under Secretary of State, Home Office, to Under Secretary of State for War, 20 December 1871.

I AM directed by Mr. Secretary Bruce to acknowledge the receipt of your letter of the 18th instant, and to acquaint you, in reply, for the information of Mr. Secretary Cardwell, that on receipt of the recommendation of the Guncotton Committee, transmitted in your letter of the 7th December, licenses were made out granting permission to Mr. France to import a certain quantity of both lithofracteur and dynamite for experimental purposes.

#### APPENDIX D.

6, Bloomfield-terrace, Hyde Park,  
20 December 1871.

Sir,

REFERRING to my letter to you of the 2nd instant, I have now the honour to inform you, that I last week received from the Home Secretary the formal license to import the specified five cwt. of lithofracteur; and as it is on its way to this country, I shall feel obliged if you can now inform me when the Committee will be prepared for the preliminary meeting I have asked for.

Captain Noble, R.A., Royal Arsenal.

I have, &c.  
(signed) R. S. France.

Sir,

IN reply to your letter, 20 December 1871, I have the honour to inform you that the Committee will be happy to meet you at the War Office on Tuesday, the 2nd January, at 12.30 o'clock.

R. France, Esq.  
6, Bloomfield-terrace, Hyde Park.

I have, &c.  
(signed) W. H. Noble,  
Captain, R.A.

Nautmaur Lime and Fluxing Stone Quarries,  
28 December 1871.

Sir,

I BEG to acknowledge the receipt of your letter of the 23rd instant forwarded to me here, and to inform you that I will attend the Committee on Explosives at 12.30 on Tuesday, the 2nd proximo, in accordance with the appointment made.

Captain Noble, R.A., Artillery Department.

I have, &c.  
(signed) R. S. France.



## APPENDIX E.

Letter from Mr. *France* to Secretary, Special Committee, 25 January 1872.

Dear Sir,

As yours reaches me by this evening's post, I am able to reply by letter to-night more fully than I could by wire to-morrow.

As I had a telegram from Rotterdam on Tuesday that the vessel with the explosives was leaving there that morning, under favourable sailing she ought to reach the Thames in 20 hours; but the weather is so exceptionally rough and the winds adverse, that her arrival is uncertain.

I have not seen Mr. Engels to-day, but as this week is fast running out, I think I may say that it is practically impossible for the experiments to commence on Tuesday. I trust that a delay of two or three days will not inconvenience the president and the committee as regards other arrangements; but I do not want Mr. Engels to go back to Germany for a fortnight, as I fear he would not be able to return for the experiments, and there are many which he will conduct that I should be unable to attempt in his absence.

You may rely upon the earliest possible intimation from me as to the explosives reaching the quarries.

I am, &c.  
(signed) *R. S. France.*

Letter from Mr. *France* to Secretary, Special Committee, 6 February 1872.

Dear Sir,

I RETURN herewith the printed evidence which you courteously forwarded to me for correction. I hope you will kindly give instructions for the corrections I have made to appear in the revised print.

I regret to say that, owing, as I assume, to the prevailing contrary winds, the vessel with the lithofracteur and dynamite has not yet reached the Thames. Of course, if she does not arrive before the latter end of the week, the experiments must necessarily be again postponed.

It is, however, not yet certain that a further postponement is inevitable.

I am, &c.  
(signed) *R. S. France.*

Letter from Mr. *France* to Secretary, Special Committee, 9 February 1872.

Dear Sir,

I AM obliged by your courtesy in telegraphing me in reply to mine from Gravesend, and on coming here I also find Lieutenant Rainbird's letter stating the postponement of the experiments to Tuesday, the 20th instant.

Now that the explosive is in this country, such appointment for Tuesday the 20th, may be taken as a definite arrangement.

I know that it will suit Messrs Krebs' convenience, and I have written to them fixing Tuesday the 20th, definitely.

I am, &c.  
(signed) *R. S. France.*

## APPENDIX F.

THE following experiments bearing on the question of the safety of lithofracteur in transport and storage, were witnessed by the Special Committee, 22nd February 1872, at Nautmaur Quarries.

(1.) To demonstrate that the substance may be heated up to a high temperature without any explosion taking place.

About one grain of lithofracteur was placed in a small china vessel floating on oil.

The temperature of the oil was raised by a spirit lamp to 450 degrees Fahrenheit. There was no explosion, as the nitro-glycerine evaporated and left an ash.

(2.) A cartridge and a half cartridge of lithofracteur were placed upon a wooden plank and beaten with a large wooden handspike. There was no explosion. When lighted by a match the lithofracteur burnt away.

(3.) A cardboard or ordinary box used for packing lithofracteur, containing about 50 charges (5 lbs.), was placed in the centre of a bonfire of straw and sticks.

The result was a large fire in which the box of lithofracteur was harmlessly consumed.

Appendix, No. 18. (4.) Half a charge was placed upon some loose sheet-iron plates which rested on the ground.

A stone and an iron shot (35 lbs.) allowed to fall on the material from heights varying from two to seven feet produced no explosion.

(5.) A 5 lb. cardboard box was placed inside a rough wooden box and nailed down. This was then walled up in a cleft of the rock, covered over with an iron plate and heaped with stones and sods.

On being ignited by means of a Bickford fuze, the lithofracteur merely burnt out.

(6.) A charge enclosed in an india-rubber tube merely burnt out when ignited by an ordinary match.

(7.) A cardboard box of cartridges (5 lbs.) was enclosed in a wooden box which was then thrown from the top of the quarries on to the rocky ground below, a height of about 150 feet. The box was broken and some of the cartridges thrown out, but no explosion occurred.

(8.) A railway 500 yards long, with an incline of one in eight, runs from the quarry to the main line below; at the top of this incline a mineral waggon, about  $1\frac{1}{2}$  tons in weight, had cartridges of lithofracteur tied on to its wooden buffers.

Two cartridges were tied on the rails about half way down the incline, and at a short distance lower down some lithofracteur was smeared on the rails. At the bottom of the incline another mineral waggon was scotched on the line, and three cartridges were tied on each of the wooden buffers.

The upper waggon was then set in motion. In passing over the cartridges tied on the rails, one exploded, but the moving waggon fairly struck and overturned the stationary waggon without causing any explosion. The cartridges were merely broken up and the lithofracteur scattered on the ground.

(9.) No. 8 experiment was repeated, iron plates having previously been attached to the buffers of both moving and stationary waggons, and cartridges placed on the rails as before. This time none of the cartridges on the rails were exploded, but the charges on the buffers exploded.

(10.) The experiment was again repeated, the buffers of the stationary waggon being faced with iron, while those of the moving waggon were faced with wood, but the buffers did not strike fair. The experiment was consequently valueless.

(11.) A railway engine, in passing over them, exploded two cartridges of lithofracteur which were placed on the rails of the main line.

A number of other experiments were shown on the same occasion, but as these were made with a view of demonstrating the explosive power of the material apart from the question of its safety in storage and transport, the Committee have not recorded them.

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#### APPENDIX G.

Letter from Mr. *France* to Captain *Noble*, 24 February 1872.

MR. KIRKMAN wrote me to Nautmaur that Colonel Younghusband wished to have the spare case of lithofracteur at the War Office, Pall Mall, on Monday next. As I have returned to town to-day I have brought it with me, and it shall be at the War Office by 12.30 on Monday.

Should you be there at that hour I shall doubtless see you, but if not, kindly write me here, stating whether the Committee would like to have some of the fuze, and also some detonators, as I have both.

Letter from Mr. *France* to Captain *Noble*, 1 March 1872.

ON coming home to-night I find a telegram from Lieutenant Rainbird relative to the case of lithofracteur. I am sorry it has not reached the Arsenal before, but I have been so much engaged that I could not attend it myself; and looking to the restrictions on transport by railway, I preferred keeping it under my own charge until I could personally deliver it.

As you stated the other day that the War Office authorities in Pall Mall would not like it to remain there, I brought it away in a cab, and it has been in my house here since Monday afternoon. I will arrange to deliver it at the Arsenal to-morrow morning.

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APPENDIX H.

EXPERIMENTS carried out by the Special Committee on Guncotton and Lithofracteur, 5th and 6th March 1872.

To ascertain the behaviour of various explosive substances under the action of a weight falling from a definite height. From the 1st to the 45th trial the weight (gun-metal) was 50 lbs.; from the 46th to 58th it was 20 lb. From the 1st to the 4th experiment the specimen under trial rested upon a block of wood five inches square and three inches thick; a similar wooden block was attached to the bottom of the falling weight. In the 5th experiment a plate of gun-metal was laid on the top of the lower wooden block, and the specimen was placed on the gun-metal.

In the 6th, 7th, and 8th trials a gun-metal plate was also attached to the wooden block on the falling weight. In all subsequent experiments the wooden blocks were removed. From the 9th to the 23rd trial, the specimens were placed between two small plates, the lower one of which rested upon an iron anvil; the falling weight fell on the upper plate. From 24th to 28th, the upper plated was removed, and the gun-metal weight fell direct on the specimen. From the 29th to the 30th the circumstances were the same as from the 9th to 23rd.

Number of Experiment.	Conditions.	Nature of Substance under Trial.	Height of Fall.	RESULT.
<i>Falling weight 50 lbs.</i>				
1	Wood on wood	1 inch ( $\frac{3}{4}$ oz.) of lithofracteur at 32°.	5	No explosion.
2	- - ditto	- - ditto	10	- ditto.
3	- - ditto	- - ditto	20	- ditto.
4	- - ditto	- - ditto	38 $\frac{1}{2}$	- ditto.
5	Wood on gun-metal	- - ditto	39	- ditto.
6	Gun-metal on gun-metal	- - ditto	39	- ditto.
7	- - ditto	- - ditto, unfrozen	20	- ditto.
8	- - ditto	- - ditto	39	- ditto.
9	- - ditto, without wood	- - ditto	19 $\frac{1}{2}$	Exploded.
10	- - ditto	- - ditto	9 $\frac{1}{2}$	ditto.
11	- - ditto	- - ditto	4 $\frac{1}{2}$	ditto.
12	- - ditto	- - ditto	3	ditto.
13	- - ditto	- - ditto	2	Just sounded.
14	- - ditto	2nd fall on No. 13	2	Exploded.
15	- - ditto	1 inch lithofracteur at 32°	3	No explosion.
16	- - ditto	2nd fall on No. 15	3	Moderate explosion.
17	- - ditto	1 inch lithofracteur at 32°	4 $\frac{1}{2}$	No explosion.
18	- - ditto	- - ditto	9 $\frac{1}{2}$	Moderate explosion.
19	- - ditto	1 inch lithofracteur at 27°	9 $\frac{1}{2}$	- - ditto.
20	Stone on stone	- - ditto, unfrozen	4 $\frac{1}{2}$	No explosion; stones smashed.
21	Iron on iron	1 inch lithofracteur unfrozen	2	Exploded; one plate ruptured.
22	- ditto	- - ditto	1	No explosion.
23	- ditto	2nd fall on No. 22	1	Mild explosion.
24	Gun-metal on gun-metal	1 inch lithofracteur unfrozen	2	No explosion.
25	- - ditto	- - ditto	3	Exploded.
26	- - ditto	- - ditto	2	- ditto.
27	- - ditto	- - ditto	1	No explosion.
28	- - ditto	2nd fall on No. 27	1	- ditto.
29	- - ditto	1 inch of gun-cotton cut from a mining charge.	3	- ditto.
30	- - ditto	2nd fall on No. 29, reduced about $\frac{1}{3}$ rd by first blow.	3	Faint explosion; part only exploded.
31	- - ditto	1 inch of guncotton	4	- - ditto.
32	- - ditto	- - ditto	5	Ditto, a little louder.
33	- - ditto	- - ditto	6	Ditto, rather louder, but most of gun-cotton merely scattered.
34	- - ditto	- - ditto	7	Ditto, still louder, but plates, quite uninjured.
35	- - ditto	- - ditto	8	Ditto, rather less than No. 34.
36	- - ditto	- - ditto	10	Same as No. 34.
37	- - ditto	- - ditto	12	Louder explosion, still no work on plates.
38	- - ditto	- - ditto	15	Rather less effect than No. 37.
39	- - ditto	- - ditto	20	Same as No. 37.
40	- - ditto	- - ditto	30	Somewhat sharper explosion; still no work on plates.
41	- - ditto	- - ditto	38 $\frac{1}{2}$	Same as No. 40.
42	- - ditto	1 inch lithofracteur, ordinary temperature.	3	The whole exploded; no work on the plates.

Number of Experiment.	Conditions.	Nature of Substance under Trial.	Height of Fall.	RESULT.
		<i>Falling weight 50 lbs.</i>	<i>Feet.</i>	
43	Gun-metal on gun-metal -	1 inch lithofracteur, ordinary temperature.	4	Same as No. 42.
44	- - ditto - - - -	- - ditto - - - -	4	Less effect than 43; the whole did not explode.
45	- - ditto - - - -	- - ditto - - - -	5	Same as No. 43.
		<i>Falling weight reduced to 20 lbs.</i>		
46	- - ditto - - - -	1 inch lithofracteur, ordinary temperature.	8	Sharp explosion; one plate cracked.
47	- - ditto - - - -	- - ditto - - - -	6	Very sharp explosion; both plates broken.
48	- - ditto - - - -	- - ditto - - - -	3	No explosion.
49	- - ditto - - - -	- - ditto - - - -	4	Sharp explosion; corner of 1 plate broken.
50	- - ditto - - - -	- - ditto - - - -	3	No explosion.
51	- - ditto - - - -	- - ditto - - - -	3½	Exploded.
52	- - ditto - - - -	- - ditto - - - -	3½	No explosion.
53	- - ditto - - - -	1 inch of lithofracteur at 70°	3½	- ditto.
54	- - ditto - - - -	- - ditto - - - -	3½	- ditto.
55	- - ditto - - - -	- - ditto at 85° - - - -	3½	- ditto.
56	- - ditto - - - -	- - ditto at 80° - - - -	3½	- ditto.
57	- - ditto - - - -	- - ditto at 100° - - - -	3½	Sharp explosion.
58	- - ditto - - - -	- - ditto - - - -	3½	No explosion.

The following experiments were carried out, 5th March 1872, in Woolwich Marshes, in presence of the committee:—

(a.) A five-grain detonator was inserted in the paper wrapper of a frozen cartridge of lithofracteur (32 degrees). The cartridge did not explode.

(b.) Experiment (a) repeated with a 15 grain detonator. The cartridge did not explode.

(c.) A five grain detonator was inserted in the paper wrapping of a lithofracteur cartridge at the ordinary temperature. The cartridge exploded and blew a hole in the plate of sheet iron on which the charge rested.

(d.) Two cartridges (3 oz. each) of lithofracteur at 27 degrees were placed on each side of a ¾ oz. disc of guncotton with a 15 grain detonator. The whole exploded and blew a hole in the iron plate.

(e.) ¾ oz. disc of guncotton with 15 grain detonator exploded, and merely indented the iron plate.

(f.) Three small mining charges of guncotton at 32 degrees and 15 grain detonator. The whole exploded.

(g.) 9 lbs. of lithofracteur at the ordinary temperature were packed in a wooden small-arm ammunition box, and fired at with a Snider rifle at 100 yards. The box exploded, on being struck by the bullet, with extreme violence.

(h.) A 5 lb. box of lithofracteur, as ordinarily packed in cardboard, was fired at as above. The box exploded violently.

The committee had previously witnessed experiments of the same nature with guncotton and gunpowder.

A 28 lb. box of guncotton was merely inflamed on being struck by a bullet.

A barrel of gunpowder was several times fired into without any explosion.

At 11 o'clock a.m. on Wednesday, 6th March 1872, the cartridges of lithofracteur that had been in the ice box since 4 o'clock p.m. on the previous Monday were taken out. These cartridges were subsequently kept in a room at a mean temperature of 55 degrees for 48 hours. When then examined several of them were still in a frozen condition.

Some of the frozen cartridges were, on being taken from the ice box on Wednesday, placed in the sun to thaw.

It was found, after a few hours, that the nitro-glycerine had exuded through the paper wrapper in several instances, and that the inside surface of the paper wrapper was wet with nitro-glycerine.

Some frozen cartridges were then placed in waterproof bags, and immersed in water at temperatures varying from 70 degrees to 100 degrees. When removed from the bags the paper wrappers of the charges were found to be wet with nitro-glycerine which had exuded.

A drop absorbed on paper exploded on being struck with a hammer.

## APPENDIX I.

EXPERIMENTS carried out 8th March 1872, in presence of Colonel *Milward* and Captain *W. H. Noble*.

(i.) A cartridge of lithofracteur, which had thawed after having been frozen, was placed in a glass vessel standing in water at a temperature of about 100 degrees. In one hour nitro-glycerine had escaped from the lower end of the cartridge. Further exudation took place so long as the cartridge was subject to the heat. In three hours about half a thimble full had exuded.

(i2.) Repetition of *i* for two hours; with the same result.

(i3.) Repetition of *i2* with cartridge of unfrozen lithofracteur at ordinary temperature. Two hours at 100 degrees. About half a thimble-full of nitro-glycerine had exuded. A drop placed on a piece of paper and struck with a hammer exploded.

(k.) Two small cartridges of lithofracteur at ordinary temperature were placed in a tin box on their sides and kept in a hot-air chamber, at a temperature of 100 degrees, for 30 minutes.

Nitro-glycerine had slightly exuded through the paper of the cartridge.

On the cartridge being opened, it was found that the nitro-glycerine stood in drops on the inner surface.

A drop absorbed on a piece of blotting paper exploded on being struck with a hammer.

EXPERIMENTS carried out 11th March 1872, in presence of Colonel *Miward*, Colonel *Nugent*, and Captain *W. H. Noble*.

(l.) A frozen cartridge of dynamite (32 degrees) was kept for  $1\frac{1}{2}$  hours at a temperature of 100 degrees. There was no appearance of exudation. After three hours, no exudation.

(m.) Repetition of *l* with a cartridge of ordinary dynamite. No exudation after three hours.

(n.) Repetition of *l* with a cartridge of ordinary lithofracteur. Examined after  $1\frac{1}{2}$  hours.

Exudation had commenced. Drops of nitro-glycerine stood on the lower end of the cartridge. The cartridge continued to exude so long as it was subjected to the heat.

(o.) Repetition of *n* with a cartridge of frozen lithofracteur (32 degrees). Same result as in *n*. A drop of the exuded oil, absorbed on blotting paper, exploded on being struck with a hammer.

## APPENDIX K.

LETTER from Secretary, Special Committee, to Mr. *France*, 13th March 1872.

I AM directed by the president to inform you that the committee are desirous of carrying out some experiments with respect to the safety of lithofracteur at different temperatures.

The trials will take place in the Royal Arsenal, Woolwich, on Friday the 22nd instant, commencing at 11 o'clock, and the committee would be glad if you could attend.

The would also be happy to see Mr. Engels and Mr. Kirkman, should those gentlemen wish to be present.

I have, &c.  
(signed) *W. H. Noble*, Captain, R.A.,  
Secretary.

Letter from Mr. *France* to Secretary, Special Committes, 14th March 1873.

I beg to acknowledge the receipt of your letter of the 13th instant, in which you inform me that the committee propose carrying out, at Woolwich Arsenal, further experiments with lithofracteur at different temperatures, and requesting the attendance of Mr. Engels, Mr. Kirkman, and myself.

In reply to such letter, it is my duty to inform you that last week my attention was directed to a paragraph in one of the daily papers, and from which it appeared, that on Tuesday the 5th instant, the committee had been carrying out, near Woolwich, a series of experiments with lithofracteur in the presence of Professor Abel, and also (it was added) in the presence of gentlemen interested in mines and quarries. So far as the latter are concerned, there may possibly be not much room for comment, but, with reference to Professor Abel, it is my duty to state that his being present at all at the request of the committee was in direct violation of the spirit, if not of the text, of the Home Secretary's letter to me of the 2nd of October last.

It is true that such letter only stated that Professor Abel would not be a member of the committee then about to be formed, but I hold that such communications ought to be carried out in good faith, and looking to Professor Abel's pecuniary connection with a rival explosive, and to the strenuous efforts he, in his official position, made to shut out all com-

Appendix, No. 18. peting explosives, and in which he succeeded through his letter to Sir. John Hay, M.P., urging the exclusion of these nitro-glycerine compounds, it does appear to me that the committee ought not to have asked Professor Abel to be present without a similar invitation to Messrs. Krebs or their representative. Reversing the respective positions, I would ask what would Professor Abel as a rival manufacturer (for such he undoubtedly is in a pecuniary sense), have said had I been asked to be present at official experiments with gun-cotton, whilst he, the patentee, was excluded?

Although it is now six months since the Home Secretary wrote me that the committee was about to be appointed, no one connected with Messrs. Krebs has hitherto complained of what certainly appears a most unnecessary delay in the investigation. On the contrary, Messrs. Krebs have up to the present time complied with every requirement of the committee, inclusive of twice sending over from Cologne Mr. Engels and Mr. Kirkman. The experiments, both as regards heat and concussion, were all conducted by Mr. Engels with the utmost openness and fairness, and certainly Messrs. Krebs had a right to expect to be dealt with in the same straightforward manner. They have undoubtedly a right to complain that only their rivals were asked to be present at the experiments with lithofracteur last week, as being a recurrence to that system of secret testing, the objection to which, in the case of Dr. Williamson, led to the inquiry being delegated to this very committee.

Under these circumstances, I, on behalf of Messrs. Krebs, must decline to ask them to incur further cost and inconvenience in sending over their representative to these proposed experiments.

Letter from Secretary, Special Committee, to Mr. *France*, 19th March 1872.

With reference to your letter of the 14th instant, I am directed by the President to inform you that on the 6th instant the committee made some experiments with part of the lithofracteur supplied to them by you for that purpose.

These trials were not public, no members of the press were present, and the committee are not responsible for any observations made in the newspapers.

The committee are now desirous of repeating and extending these experiments in your presence and in that of Professor Engels, and have requested your attendance for that purpose on the 22nd instant; they will, however, postpone them, pending your further reply, until the 26th instant, in the hope that some person representing the manufacturers may still be able to attend.

At the conclusion of these experiments the whole results will be reported for the information of the Secretary of State for the Home Department.

Letter from Mr. *France* to Secretary, Special Committee, 21st March 1872.

I beg to acknowledge the receipt of your letter of the 19th instant, and I regret to state that I cannot see any reason for reversing the decision contained in my letter of the 14th instant.

In one sense the experiments in question were, as you say, not public, but you are aware that so far back as Dr. Williamson's report, I objected to any experiments being conducted otherwise than openly and publicly, and in this case we have the anomaly that, whilst the experiments were not public to anyone on behalf of Messrs. Krebs, yet Professor Abel, as representing the competitive gun-cotton interest, was amongst those who were asked to be present. As to the press, it is true that the committee may not be responsible for all that appears in the newspapers, but in this case we are indebted to the press for having revealed that which, according to your own letter, was withheld from us on the ground that the experiments were not public.

I further beg to say, it is not the fact (as may be inferred from your letter) that I supplied this case of lithofracteur for the purpose of these private experiments before Professor Abel; on the contrary, I beg to state that, if you had given me the least hint that the case was required for that purpose, it would not have been left at Woolwich Arsenal.

If, on this statement of facts, you say that I am unduly suspicious of what takes place within the Chemical Department of the Arsenal, I may point to the Treasury Minute just issued by the Prime Minister and the Chancellor of the Exchequer, and which you are aware strongly condemns the proceedings of these official patentees. Looking to that Minute, it must be admitted that the course I am pursuing is clearly one that common prudence would dictate.

Letter from Secretary, Special Committee, to Mr. *France*, 22nd March 1872.

I have the honour to acknowledge the receipt of your letter of the 21st instant, in which you adhere to your determination not to be present at the experiments with lithofracteur on Tuesday next, to which you were invited by the committee.

Letter from Mr. *France* to Secretary, Special Committee, 23rd March 1872.

In reference to your letter of the 22nd instant, I beg to inform you that I have this day written to the Secretary of State complaining of the breach of faith towards us as regards these private experiments with Professor Abel. I have pointed out that I agreed to attend the

the inquiry by the committee solely on the understanding that the system of secret testing, Appendix, No. 18. pursued by Dr. Williamson, would not be followed by the committee, and also on the faith of the assurance of the Secretary of State relative to Professor Abel.

I have stated that, at the request of the president, we consented to deposit a case of lithofracteur at Woolwich Arsenal on the understanding that it was required for a totally different purpose to that of private experiments with Professor Abel.

I have also added, that if further experiments are still necessary we shall apply that such experiments shall be conducted in public, and away from all Government premises whatever, and also that we shall be allowed to import, for the purposes of such experiments, another case of lithofracteur in lieu of that which has already been operated upon at Woolwich Arsenal.

Letter from Secretary, Special Committee, to Mr. *France*, 25th March 1872.

I have the honour to acknowledge the receipt of your letter of the 23rd instant, and to inform you that it will be laid before the committee at their next meeting.

Letter from Mr. *France* to Secretary, Special Committee, 29th March 1872.

I have received a letter from the Home Secretary, informing me that my letter of the 23rd instant has been forwarded to the War Office. There can, therefore, now be no misunderstanding, either at the Home Office or the War Office, as to our reasons for declining to attend any experiments with lithofracteur at Woolwich Arsenal, whilst at the same time we have expressed our readiness to attend any public experiments with lithofracteur if conducted elsewhere, as stated in my letter.

As the protracted character of this inquiry is now pressing very heavily on those mining and quarrying interests which I have been asked to represent, and which interests were, as you are aware, so largely represented at Nantmaur by gentlemen from all parts of the kingdom, I now beg to say that I shall feel obliged by you informing me of the course the committee intend pursuing as regards any further inquiry.

Letter from Secretary, Special Committee, to Mr. *France*, 4th April 1872.

I have the honour to acknowledge the receipt of your letter of 29th ultimo, and to inform you that it will be laid before the committee at their next meeting.

Should the committee pursue any further inquiry with respect to lithofracteur, due notice will be sent to you.

Letter from Mr. *France* to the Secretary of State for the Home Department, 23rd March 1872.

Referring to my correspondence with you relative to lithofracteur, I now beg respectfully to recall your attention to your letter to me of the 2nd October last, and in which you informed me of your arrangement with the Secretary of State for War, that Professor Abel should not be a member of the committee appointed to inquire into the question of explosives. I submit that it was only reasonable to conclude that the line of policy then adopted by the Government would have been carried out in good faith by the president of the committee entrusted with this inquiry. I regret, however, to state, that although Professor Abel has not been allowed to actually sit with the committee to the War Office, yet he has been invited to attend private experiments with lithofracteur at Woolwich Arsenal, and from which experiments Messrs. Krebs and their representatives were excluded, on the ground, as alleged by the president, that such experiments were "not public."

I further beg to recall to your notice that in consequence of the gun-cotton interest having, from the first, been arranged against any new explosive, I objected to that system of secret testing which Dr. Williamson pursued, and which the president of the committee has now adopted.

In reliance upon his good faith, a case of lithofracteur was, at his request, left at Woolwich Arsenal, he leading us to believe that it was for a totally different purpose to that of carrying out private experiments with Professor Abel, and I may add that it was by the merest accident we discovered these proceedings from which we were thus excluded.

The president now asks me to attend further experiments at Woolwich Arsenal with this case of lithofracteur, but which invitation we have declined. Up to this point we have complied with every requirement of the committee, inclusive of exhaustive experiments at Nantmaur as regards liability to explosion, both under intense heat and concussion; and we have no objection to still further experiments with lithofracteur, if conducted away from Professor Abel and all his contrivances. But after this breach of faith towards us, it is impossible to expect that we can consent to any experiments in or near Woolwich Arsenal or any other Government premises where the gun-cotton interests can intermeddle any further. I need not add also that if further experiments are required, we shall ask that a fresh case of

Appendix, No. 18. lithofracteur be imported for that purpose. I submit, Sir, that if the Government have found it necessary to issue during the past fortnight a Treasury Minute condemning the principle of Government officials being patentees of articles like these, it is scarcely to be expected that we can place any confidence in a class of experiments with lithofracteur conducted secretly with Professor Abel, the patentee of guncotton.

I submit that all experiments of this kind are only of value when conducted openly and fairly, as stipulated from the first.

Letter from Mr. *France* to Secretary, Special Committee, 6th April 1872.

I have the honour to acknowledge the receipt of your letter of the 4th instant. I must now ask you to be good enough to call the attention of the president to the very protracted character of this inquiry. As far back as last October the Home Secretary wrote me that the inquiry would commence forthwith, and I do not think that the public and those who, like myself, are interested in obtaining the best explosive available for quarrying purposes, will consider that I am at all hasty when I state that this delay is now assuming a vexatious character.

I further beg to point out to you that although guncotton and lithofracteur were referred to your committee practically at the same period, the report in favour of the continuance of the manufacture of guncotton has been made public a long time since.

To that course we offered no objection, but at the same time we submit that as regards lithofracteur anything beyond a reasonable time for the termination of the inquiry is fairly a matter for complaint on our part.

I do not wish to write anything like an angry letter, but I should feel obliged by your informing the president that the mine and quarry proprietors I have the honour to represent are men of business, and simply anxious to obtain the best explosives that can be procured, and our requirements are altogether outside the niceties of military competition.

Letter from Secretary, Special Committee, to Mr. *France*, 8th April 1872.

I have the honour to acknowledge the receipt of your letter of the 6th instant, and to inform you that it will be laid before the committee at their next meeting.

#### APPENDIX L.

THE following experiments were carried out by the committee, 26th March 1872:—

(a.) An ordinary 5 lb. box of lithofracteur had been placed in an oven, and kept at a temperature varying from 95 degrees to 98 degrees Fahrenheit for 19 hours.

When examined it was found that nitro-glycerine had exuded from several cartridges.

It stood in drops on the exterior of the paper covering of 10 cartridges.

A drop absorbed on blotting paper exploded on being struck with a hammer.

Some of the nitro-glycerine had stained the bottom of the box.

Twenty-six cartridges had no nitro-glycerine on the outside, but every cartridge opened exhibited the appearances of exudation on the inside of the paper covering.

(b.) Separate cartridges of lithofracteur laid in cardboard boxes, and kept at the same temperature for the same time, exhibited similar effects.

(c.) In order to ascertain the effect of water upon nitro-glycerine compounds, single cartridges (4 oz.) of lithofracteur and dynamite were placed in glass vessels which were filled with water, cold, 51 degrees; and warm, 100 degrees. Each cartridge was in its paper.\*

(c 1.) A cartridge of dynamite at the ordinary temperature; in cold water. No exudation of nitro-glycerine in 17 minutes.

(c 2.) A cartridge of dynamite at the ordinary temperature; in warm water. Nitro-glycerine commenced to exude in six minutes.

In 17 minutes, 30 minims had exuded.

(c 3.) A cartridge of lithofracteur at the ordinary temperature; in cold water.

Nitro-glycerine commenced to exude in three minutes.

Quantity exuded in 17 minutes, 100 minims.

(c 4.) A cartridge of lithofracteur at the ordinary temperature; in warm water. Nitro-glycerine commenced to exude in two minutes. Quantity exuded in 17 minutes, 60 minims.

(c 5.)

\* The paper wrapper of the lithofracteur was double the size of that of the dynamite.



(c 5.) A cartridge of lithofracteur which had previously been kept for 19 hours at a temperature of 95 degrees; in cold water. Appendix, No. 18.

Nitro-glycerine commenced to exude in two minutes.

Quantity exuded in 17 minutes, 84 minims.

(c 6.) A cartridge of lithofracteur which had previously been kept for 19 hours at a temperature of 95 degrees; in warm water.

Nitro-glycerine commenced to exude in one and a half minutes.

Quantity exuded in 17 minutes, 120 minims.

(c 7.) A cartridge of dynamite at ordinary temperature, taken out of its paper wrapper and immersed in cold water.

In 17 minutes no exudation had taken place, and the cartridge was still compact, and was lifted out of the glass without being broken.

(c 8.) A cartridge of lithofracteur at ordinary temperature, taken out of its wrapper and immersed in cold water.

In 17 minutes the cartridge had broken up completely, and the bottom of the glass was full of nitro-glycerine.

(c 9.) Repetition of c 1. A cartridge of dynamite at ordinary temperature; in cold water. After 21 minutes no exudation had taken place.

After two hours and eight minutes, 20 minims of nitro-glycerine had exuded.

(c 10.) Repetition of c 9.

After 21 minutes no exudation had taken place. After two hours and eight minutes, 10 minims of nitro-glycerine had exuded.

(c 11.) Repetition of c 3. A cartridge of lithofracteur at ordinary temperature; in cold water. Nitro-glycerine commenced to exude in six minutes. After two hours and eight minutes, 80 minims had exuded.

(c 12.) Repetition of c 11.

Nitro-glycerine commenced to exude in four minutes.

One hundred and thirty-five minims had exuded after two hours and eight minutes.

(d.) Four cartridges of lithofracteur taken from the box referred to in experiment a, from which nitro-glycerine had not exuded, were laid on gun-metal plates and placed in a hot-air chamber at 98 degrees. A 7 lb. weight was placed on the top of each two cartridges.

In one hour and 20 minutes no exudation had taken place.

(e.) Four cartridges of lithofracteur at ordinary temperature were placed in a glass vessel and shut up in a vapour bath at 98 degrees.

No exudation had taken place after one hour and 43 minutes.

(f.) Four cartridges of dynamite at ordinary temperature were placed in a glass vessel and shut up in a vapour bath at 98 degrees.

No exudation had taken place after one hour and 35 minutes.

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### SPECIAL COMMITTEE ON GUNCOTTON, &c.

President:—Colonel C. W. YOUNGHUSBAND, R.A.

MEMBERS:

Colonel T. L. J. Gallwey, R.E.

Bt. Colonel T. W. Milward, C.B., R.A.

Bt. Colonel C. B. Nugent, R.E.

Captain E. Field, R.N.

G. P. Bidder, Esq., C.E.

Dr. W. Odling, F.R.S.

H. Bauerman, Esq.

Captain W. H. Noble, R.A., Secretary.

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### SECOND REPORT ON LITHOFRACTEUR.

74—9—214.

1. In their report on lithofracteur, dated 4th May 1872, the committee drew attention to the readiness with which nitro-glycerine exuded from the explosive substance, submitted to them by Mr. France, as a defect too serious to be ignored. At the same time they recorded an opinion that a safe and unobjectionable nitro-glycerine compound could be made, and expressed a hope that the manufacturers of lithofracteur might succeed in overcoming the difficulty indicated.

2. It appears that a copy of their report was forwarded to Messrs. Krebs, who have thus been led to re-submit a further sample of lithofracteur.

In accordance with instructions conveyed by W. O. Minute, 19 November 1872, the committee placed themselves in communication with Mr. P. F. Nursey, the new agent appointed

Appendix, No. 18. appointed by Messrs. Krebs to represent them in this country; and, at the request of the committee, Mr. Nursey forwarded a Specification, No. 1509 of 1872, of lithofracteur, and a 5 lb. box of the material for trial.

3. The committee subjected this new material to a series of trials, similar to those which they made with France-lithofracteur and Nobel dynamite, the details of which are given in Appendix A.

4. In addition to these trials, the committee satisfied themselves that the lithofracteur now submitted is somewhat more inert, when subjected to the blow of a falling weight, than that originally submitted. Thus, on reference to the experiments reported in Appendix H, page 12, of the 1st Report on lithofracteur, it appears that a weight of 50 lb. falling through 3 feet, exploded 1 inch of unfrozen France-lithofracteur placed between two gun-metal plates. Under the same conditions a fall of 4 feet failed to explode Nursey-lithofracteur; but it was exploded by a fall of 6 feet.—See Appendix C.

5. It was observed during the course of the committee's experiments that the lithofracteur submitted by Mr. Nursey froze much more readily than the other nitro-glycerine compounds under trial.

6. From careful analysis, it has been found that the proportions of nitro-glycerine in the samples under trial are as follows:—

	<i>Nitro-glycerine.</i>
France-lithofracteur - - - - -	66·7 per cent.
Nursey-lithofracteur - - - - -	47·5 ”
Nobel's dynamite - - - - -	65·7 ”

See Appendix D.

#### *Conclusions.*

7. On a careful consideration of these results, the committee are of opinion—

(1.) That the specimen of lithofracteur submitted to them by Mr. Nursey is free from the defect pointed out in their former report.

(2.) That this lithofracteur may, subject to the existing regulations laid down for other nitro-glycerine compounds, be manufactured, stored, and transported, provided its general characteristics (the per-centage of nitro-glycerine not exceeding 47·5 per cent.), and freedom from liability to exudation, are the same as those of the sample on which the present report is based.

*C. W. Younghusband, Colonel, R.A.,  
President.*

8 April 1873.

#### APPENDIX A.

THE experiments commenced at Woolwich, 13th February 1873, in the presence of Colonel Milward, C.B., and Captain W. H. Noble, Royal Artillery.

The box of lithofracteur, which had been delivered under seal, was opened by Captain Noble.

Six cartridges, dynamite (D) (Nobel) in a tin cylinder, and six cartridges lithofracteur (C) (Nursey) in a tin cylinder, were placed in an ice box at 4.15 p.m.

Fifteen cartridges of each (A) and (B), in two ordinary card-board boxes, without covers, were placed, at 4.30 p.m., in a water oven, the inside temperature of which was 90° F.

The cartridges all rested on the bottoms of the boxes; the latter rested on pieces of wood an inch thick, which in their turn rested on the bottom of the oven.

All the cartridges felt hard or semi-frozen. The dynamite was taken from a Royal Laboratory magazine. The lithofracteur box had been kept in the Office of the Experimental Branch, at a temperature not under 45°.

The boxes were taken out of the oven at 11.30 a.m., 14th February 1873, and examined by Colonel Milward and Captain Noble.

(A) box, or that containing the lithofracteur, was in the following condition:—

Slight exudation from one of the cartridges had stained the bottom of the box in two places. All the cartridges, unwrapped, exhibited slight traces of exudation or dampness of some sort on the inside of the paper.

(B) box, or that containing the dynamite, was in the following condition:—

There was no appearance of exudation on the box, or on any of the cartridges, either inside or outside.

Single cartridges of lithofracteur, from box (A) were then placed in glass beakers with cold water, at a temperature of 50° F., and left for 17 minutes.

A 1. With paper wrapper, cartridge lying at bottom of beaker.  
No exudation.

A 2. With paper wrapper, cartridge lying at bottom of beaker.  
No exudation.

A 3. With

A 3. With paper wrapper, cartridge up-ended, about size of pin's head of exudation. Appendix, No. 18.

A 4. Without paper, cartridge lying at bottom of beaker.  
Cartridge broken in half and greatly swelled.

Single cartridges of dynamite, from box B, were placed in glass beakers with cold water, at a temperature of 50° F., and left for 17 minutes.

B 1. With paper wrapper, cartridge lying at bottom of beaker.  
Thirty minims of nitro-glycerine had exuded.

B 2. With paper wrapper, cartridge lying up-ended in beaker.  
Thirty minims of nitro-glycerine had exuded.

B 3. Without paper, cartridge lying at bottom of beaker.  
Cartridge, after 17 minutes, completely broken up and disintegrated.

The six cartridges of each were taken from ice box (C and D) at 12.15 p.m., 14th February 1873, and placed in the water oven; temperature, 50° F. All the cartridges were quite frozen. The oven was gradually heated from 50° F., and the thermometer stood at 90° (inside) at 11 a.m., 15th February 1873, when the cartridges were taken out and examined in presence of Colonel Milward and Captain Noble. There was no appearance of exudation in the dynamite.

One of the lithofracteur cartridges stuck slightly to the bottom of the tin cylinder, but there was no appearance of exudation. All the cartridges were quite soft to the touch. Both specimens were placed in the ice box again at 3 p.m., 15th February 1873.

The cartridges (tins) were taken out of the ice box at 12 o'clock on 17th February 1873; they were then hard frozen; the temperature recorded by a thermometer inserted among the cartridges in the tins was 28° F. The tins were placed in the water oven at 12.15 p.m., the temperature in which was 58° F. The gas was turned off, and the door of the oven shut; thus the temperature inside rose very gradually, and was 60° at 4 p.m. the same evening. The gas was then turned on, and the temperature allowed gradually to rise to 90°.

The cartridges were examined at 11 a.m., 18th February 1873, in presence of Colonel Milward and Captain Noble; they were thoroughly thawed. There was no appearance of exudation on any of them. The tins containing the cartridges were again placed in the ice box at 4 p.m., 18th February 1873. They were taken out 12.15 p.m., 19th February 1873, in presence of Colonel Milward, Captain Field, R.N., and Captain Noble. All the lithofracteur cartridges were frozen hard; two of the dynamite cartridges were also hard, but the four others were soft to the touch. The temperature in the ice box was 28°. The tins were placed in the oven 12.30 p.m.; temperature, 65°. The temperature was gradually raised to 90°, and stood at 88° at 10.45 a.m., 20th February 1873, when the cartridges were taken out of the oven and examined in the presence of Colonel Milward and Captain Noble. There was no appearance whatever of exudation; all were thoroughly thawed.

The cartridges were replaced in the ice box, 4 p.m., 20th February 1873. They were taken out at 12 o'clock, 21st February 1873, in presence of Colonel Younghusband, Colonel Milward, and Captain Noble, and put in the oven. All the lithofracteur cartridges were frozen hard, but four out of the six dynamite cartridges, as before, were soft to the touch. The temperature was gradually raised and stood at 90°, at 11 a.m., 22nd February 1873, when the cartridges were examined. There was no appearance whatever of exudation in either case.

#### APPENDIX B.

THE following experiments were carried out at proof butt, 27th February 1873, in presence of Colonel Milward and Captain Noble, to ascertain the comparative explosive effect of equal charges of the following explosive substances, previously thawed in the oven:—

1. Nobel dynamite, similar to that used in the Committee's Experiments at Llanberis.
2. Lithofracteur, submitted by Mr. France in March 1872.
3. Lithofracteur, submitted by Mr. Nursey in 1873.

The various substances were exploded by a five grain detonator, on an iron plate, 12 ins. × 12 ins. × 1 in. resting on a mortar muzzle, so that the centre of the plate was unsupported.

- (1.) 4 oz. dynamite; very little result on plate.
- (2.) 8 oz. dynamite; plate just perceptibly bulged.
- (3.) 8 oz. of France-lithofracteur; less result than No. 2.
- (4.) 8 oz. of Nursey-lithofracteur; slightly better effect than No. 3.

At 4.30 p.m., 27th February 1873, the following charges were placed in the water oven and kept at 90° until 2 p.m., 28th, when they were examined:—

1. Six cartridges of France-lithofracteur. It was found that nitro-glycerine had exuded in considerable quantities. About 60 minims stood in bottom of glass beaker which held the cartridges; and all the cartridges were more or less wet with exuding nitro-glycerine.

Appendix, No. 18. This corroborated the previous experiments, which led to the rejection of this sample of lithofracteur.

2. Seven cartridges of dynamite; no exudation whatever.

3. Six cartridges of Nursey-lithofracteur; no exudation whatever.

On 28th February 1873, the experiments with iron plates were continued in presence of Colonel Younghusband, Colonel Milward, and Captain Noble. Major Majendie, R.A., attended on behalf of Home Office. The plates were 12 ins.  $\times$  12 ins.  $\times$   $\frac{5}{8}$ -in.

*5-grain Detonator :*

No. 5.  $\frac{5}{8}$ th inch iron plate. 4 oz. France-lithofracteur; plate broke in two, but very little local dent.

No. 6.  $\frac{5}{8}$ th inch iron plate. 4 oz. Nursey-lithofracteur, more local effect, but plate not broken.

No. 7.  $\frac{5}{8}$ th inch iron plate. 4 oz. dynamite; best effect; broke plate in half, and dented also.

No. 8. One cartridge, 2 $\frac{1}{2}$  oz., in paper. France-lithofracteur,  $\frac{5}{8}$ -inch plate; plate not broken; incipient crack across back of plate.

No. 9. One cartridge, 2 $\frac{1}{2}$  oz., in paper, Nursey-lithofracteur; plate not broken, but not cracked so much as No. 8 at back.

No. 10. Cartridge, 2 $\frac{1}{2}$  oz., dynamite, in paper; similar result to No. 8.

No. 11. France-lithofracteur, 8 oz., on 1 inch plate; 3 cartridges, in paper, with small piece added to make up weight; similar result to No. 3; very little appearance of dent.

No. 12. Nursey-lithofracteur, 8 oz. on 1 inch plate; 3 cartridges, in paper, and small piece. Slightly more effect than No. 11; corresponds somewhat with No. 4.

*20-grain Detonator :*

No. 13. Disc of ordinary guncotton, 8 oz.; deep indentation in plate; considerably broken away at back.

No. 14. Nursey-lithofracteur, 8 oz., in 3 cartridges, in paper; 1 inch plate; no greater result than with 5 grain detonator.

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APPENDIX C.

DETAIL of Experiment to ascertain at what height of fall a 50 lb. weight will *not* explode 1 inch of the lithofracteur, submitted by Mr. Nursey, when thawed and placed between two gun-metal plates, resting on an iron anvil, the weight to fall on top plate.

1. Lithofracteur taken direct from the box which had been kept in the office of Experimental Branch. The cartridges were rather hard, but could be cut into 1 inch pieces by a sharp wooden knife:—

1st.	1 foot fall	-	-	-	-	No explosion.
2nd.	2 feet fall	-	-	-	-	ditto.
3rd.	{ same piece left between plates, }					ditto.
	{ 3 feet fall	-	-	-	-	
4th.	6 feet fall	-	-	-	-	ditto.

2. Lithofracteur thawed in a warm room, about 20 hours, and then laid out in the sun's rays. The cartridges were very soft to the touch, but very dry and crumbled easily.

1st.	1 foot fall	-	-	-	-	No explosion.
2nd.	3 feet fall	-	-	-	-	ditto.
3rd.	6 feet fall	-	-	-	-	Exploded very violently.
4th.	4 feet fall	-	-	-	-	No explosion.

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APPENDIX D.

DETAILS of ANALYSIS.

THE proportions of nitro-glycerine in the samples of Nobel's dynamite, and of lithofracteur, have been determined with the following results:—

	Nitro-glycerine.
Lithofracteur, supplied by Mr. France	66.7 per cent.
Ditto - ditto Mr. Nursey	47.5 „
Nobel's dynamite - - - -	65.7 „

These numbers represent the *full* proportions of nitro-glycerine contained in the respective

tive preparations: *small* proportions of solid substances, extracted together with the nitro-glycerine by the solvent employed, were deposited from the liquid; in the case of the lithofracteur samples, they consisted of sulphur and apparently of some resinous matter. Appendix, No. 18.

The specimens of Nobel's dynamite were partly frozen when received, but were completely thawed after remaining for a few hours in a temperate atmosphere. The paper wrappings were perfectly dry. The dynamite was less plastic than specimens frequently examined, and exhibited a tendency to crumble when pressed.

The wrappings of Mr. France's lithofracteur were covered inside with nitro-glycerine, and the material itself was, comparatively, in a very moist condition. The cartridges were not frozen when received.

The lithofracteur sent by Mr. Nursey differed in many respects from earlier samples of this preparation. The cartridges were in a very hard (frozen) condition when received; they had not thawed, except in a few places, after 50 hours exposure to a temperate atmosphere, and they continued hard for two or three hours when exposed to a temperature of about 70°. Though they remained in a room which was thoroughly warmed until 6 p.m., they were found to have completely frozen during the ensuing night, the temperature not having fallen below 50°. The material when thawed was scarcely plastic, and presented considerable want of uniformity in appearance. The paper wrappings were quite dry. The solid ingredients included *no* coal (as in former samples), but a very small quantity of carbon (in a very finely divided state, either lamp black or bone black.) The other solid substances were sulphur, nitrate of soda (and a little nitrate and sulphate of lime), silica, clay, sand, and wood fragments.

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### SPECIAL COMMITTEE ON GUNCOTTON, &c.

President:

Colonel C. W. YOUNGHUSBAND, R.A., F.R.S.

Members:

Colonel T. L. J. Gallwey, R.E.

Bt. Colonel T. W. Milward, C.B., R.A.

Captain E. Field, R.N.

Bt. Colonel C. B. Nugent, C.B., R.E.

G. P. Bidder, Esq., C.E.

Dr. W. Odling, F.R.S.

H. Bauerman, Esq.

Captain W. H. Noble, R.A., Secretary.

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### THIRD REPORT ON LITHOFRACTEUR.

1. In their Second Report on Lithofracteur, dated 8th April 1873, the Committee reported favourably on a specimen of this substance which had been submitted to them by Mr. P. F. Nursey, the agent of Messrs. Krebs in this country, and which consisted of 47.5 per cent. of nitro-glycerine mixed with sulphur, silica, clay, sand, wood fragments, and *nitrate of soda*.

2. Although this sample had successfully passed the tests at that time applied by the Committee, it had not been subjected to one of the tests lately adopted, viz., that for exudation in a saturated atmosphere, produced by the spontaneous evaporation of water in a confined space.

3. The experience of the Committee had demonstrated that, in nitro-glycerine compounds containing a large per-centage of a deliquescent salt, such as nitrate of soda, considerable exudation of nitro-glycerine might take place under the ordinary conditions of transport or storage.

The sample of lithofracteur tried by them and favourably reported on, contained only about 16 per cent. of nitrate of soda, still the Committee thought it would be more satisfactory if an opportunity were afforded them of reconsidering the subject with a view of practically testing lithofracteur for exudation in a damp atmosphere.

4. The question was accordingly re-submitted, 22nd July 1873, on the papers in the margin, and at the request of the Committee Mr. Nursey undertook to supply a sample from a cargo of lithofracteur which was expected shortly to arrive in England.

This sample was delivered at Woolwich, 25th September 1873.

5. The trial was commenced during the following month, and the test for exudation when exposed to a damp atmosphere was satisfactorily passed, but as analysis had shown that this sample of lithofracteur differed in some important particulars from that on which the Second Report was based, the Committee determined to submit it to the heat test for exudation, namely, when exposed for some hours to a temperature not exceeding 100° F.

Appendix, No. 18. The differences alluded to consisted in the substitution of nitrate of barita for nitrate of soda, and in the per-centage of nitro-glycerine which proved to be about 59 instead of 47.5 as specified in the Second Report.

Appendix B.

Appendix C.

6. The test for exudation when exposed to heat resulted in the nitro-glycerine exuding freely, showing thereby that the substance contained a greater quantity of the explosive oil than it could retain.

7. The Committee therefore have now to report,—

I. As the present sample contained a non-deliquescent salt (nitrate of barita) instead of a deliquescent salt (nitrate of soda), they are unable to pronounce an opinion as to whether a lithofracteur similar to that on which their Second Report was based, would or would not pass the test for exudation when exposed to a saturated atmosphere, but they think the substitution of the barita for the soda salt constitutes an improvement.

II. The present sample contains a greater per-centage of nitro-glycerine than was found in the sample of lithofracteur previously reported on, and has failed to pass an important test; the Committee, therefore, have now to report that it has not fulfilled the absolutely necessary condition of retaining its proportion of nitro-glycerine under circumstances that might be met with during ordinary transport or storage.

(signed) C. W. Younghusband, Colonel, R.A.,

6 January 1874.

President.

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#### APPENDIX A.

##### *Test for Exudation in a Damp Atmosphere.*

MR. P. F. NURSEY left at the office of the Experimental Branch, Woolwich, on 25th September 1873, a box containing cartridges of lithofracteur.

14 October 1873.—Captain Field attended and examined the above; six large, three middling, and three small cartridges were placed in earthenware cups in the limber box which contained damp tow, in backyard of office. Cartridges quite soft. (4.20 p.m.)

15 October 1873.—Captain Field attended and inspected the cartridges. No exudation had taken place. Cartridges soft. Temperature 49°. (12.40 p.m.)

17 October 1873.—Captain Field attended and inspected the cartridges, unfolding half of each part. No exudation. Cartridges quite soft. Temperature 49°. (1.15 p.m.)

20 October 1873.—Examined by Captain Field and Captain Noble. No exudation whatever. Temperature 51°. (3 p.m.)

28 October 1873.—Examined by Colonel Younghusband, Dr. Odling, and Captain Noble; Major Majendie was also present. The cartridges exhibited no traces of exudation. (12.30 p.m.)

29 October 1873.—Captain Field attended and inspected the cartridges. No exudation whatever; but one medium and one smaller cartridges were found to be hard frozen, the remainder were soft. Temperature 44°. (3 p.m.)

31 October 1873.—Examined by Colonel Milward and Captain Noble. No exudation whatever. (11 a.m.)

12 November 1873.—Examined by Captain Field. No exudation, but only five cartridges soft, viz., three large, one medium, and one small. All the remainder hard frozen. Temperature 44°. (2 p.m.)

22 November 1873.—Examined by Captain Noble. No exudation whatever. Specimens removed. (2 p.m.)

24 November 1873.—Two cartridges placed in the limber box. Temperature 53°. (2.15 p.m.)

28 November 1873.—Examined by Captain Field and Captain Noble. No exudation whatever. Temperature 53°. (2.15 p.m.)

1 December 1873.—Examined by Captain Noble. No exudation whatever. Temperature 49°. (12.30 p.m.)

4 December 1873.—Examined by Captain Noble. No exudation whatever. Temperature 52°. The tow was re-wetted with lukewarm water. Temperature 70°. (1 p.m.)

8 December 1873.—Examined by Captain Noble. No exudation whatever. Cartridges soft. Temperature 51°. (12.30 p.m.)

13 December 1873.—Examined by Captain Noble. No exudation. Cartridges frozen. Temperature 42°. (12.15 p.m.)

20 December 1873.—Examined by Captain Noble. No exudation whatever. Cartridges soft. Temperature 55°. Specimens removed. (12.15 p.m.)

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## APPENDIX B.

Two specimens examined by Dr. Odling were found to contain, respectively, 59.16 and 58.48 of nitro-glycerine, and the following complete analysis was made by Dr. Dupré:—

No. 14 sample wrapped up in paper marked, "Sample of Lithofracteur as supplied to the W. O. Committee on Gun-cotton," received from Captain Noble, 28 October 1873.

General character, black, moist looking; mass contained in two cartridges, one long one short, respectively. Slight traces of exudation perceptible in both cartridges, but more particularly in the larger of the two. Aqueous extract neutral.

It consisted of—

Nitro-glycerine	-	-	-	-	59.55
Nitrate of barium	-	-	-	-	15.10
Carbon	-	-	-	-	2.80
Silicious earth	-	-	-	-	21.25
Moisture	-	-	-	-	1.30
					100.00

Westminster Hospital, 3 November 1873.

(signed) A. Dupré.

## APPENDIX C.

## I.—To ascertain the Effect of repeatedly Freezing and Thawing the Substance.

22 November 1873.—Six cartridges of lithofracteur, in a tin, were placed in the ice box at 12.30 p.m.

24 November 1873.—The tin was taken out in presence of Colonel Nugent, Mr. Bauerman, and Captain Noble, at 11.15 a.m., and placed in the water oven; temperature of oven 51°. All the cartridges were hard frozen. The gas was turned on, and the temperature allowed to rise gradually to 90°.

25 November 1873.—Examined at 11.15 a.m., by Colonel Milward and Captain Noble. Temperature—maximum, 96°, minimum, 89°. All the cartridges exhibited more or less traces of exudation. Some drops of nitro-glycerine had run out of one into the bottom of the tin. The tin was replaced in the oven with a view to an examination by the Committee in the afternoon. 3.30 p.m., examined by the Committee; cartridges in the same state. Some of the nitro-glycerine which had exuded into the bottom of the tin was absorbed on a piece of blotting paper, and readily exploded on being struck with a hammer. The Committee decided that it was unnecessary to continue the test.

10 December 1873.—A single cartridge was placed, in a tin, in the ice box at 12.30 p.m.

11 December 1873.—The tin was removed from the ice box at 11 a.m., in presence of Colonel Milward and Captain Noble. The cartridge was thoroughly frozen. It was placed, up-ended, in a glass beaker, and put in the water oven. Temperature 35°. The oven was gradually heated to 90°.

12 December 1873.—Examined at 11 a.m., by Captain Noble. Temperature—maximum 92°, minimum 85°. Cartridge quite soft, about a thimblefull of nitro-glycerine had run out into the glass beaker. A small quantity absorbed on a piece of blotting paper readily exploded on being struck with a hammer.

## II.—To ascertain the Effect of Heat on Samples taken direct from the Case in which the Substance was received.

24 November 1873.—Eight cartridges of lithofracteur in a cardboard box, without cover, were placed at 11.15 a.m., in a water oven, the inside temperature of which was 51°. The cartridges all rested on the bottom of the box; the latter rested on a piece of wood, an inch thick, which in its turn rested on the bottom of the oven. Colonel Milward, Mr. Bauerman, and Captain Noble were present.

25 November 1873.—Examined at 11.15 a.m., by Colonel Milward and Captain Noble. Temperature—maximum 96°, minimum 89°. All the cartridges exhibited more or less traces of exudation; on two the nitro-glycerine stood in drops on the outside of the paper wrapper; the bottom of the cardboard box was stained by exudation in several places. The cardboard box was replaced in the oven with a view to an examination by the Committee in the afternoon. 3.30 p.m., examined by the Committee; cartridges in the same condition. Some nitro-glycerine from the outside of one of the paper wrappers was absorbed on blotting paper, and exploded readily on being struck with a hammer.

27 November 1873.—A single cartridge was placed, up-ended, in a glass beaker and put into a hot oven. Temperature 100°, at 10 a.m. At 11.30 a.m. it was examined by Colonel Milward and Captain Noble, when it was found that nitro-glycerine was freely exuding from the cartridge in drops into the bottom of the beaker. The sample was removed, and subsequently submitted for the inspection of the Committee.

## SPECIAL COMMITTEE ON GUNCOTTON, &amp;c.

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 Bt. Colonel T. W. Milward, C.B., R.A.  
 Captain E. Field, R.N.  
 Bt. Colonel C. B. Nugent, C.B., R.E.

G. P. Bidder, Esq., C.E.  
 Dr. W. Odling, F.R.S.  
 H. Bauerman, Esq.  
 Captain W. H. Noble, R.A., Secretary.

## REPORT ON No. 1 DYNAMITE.\*

82—G.N.—95.

Appendix A.

1. THE Committee were informed, on the papers named in the margin, that it had been decided, 17th April 1872, to include dynamite among the explosive substances referred to them for investigation; the British Dynamite Company having requested that this might be done.

1st Report on Litho-  
 fracteur, 4. 5. 72.,  
 paragraphs, 6-7.

Appendix B.

2. In accordance with the course followed in the trial of lithofracteur, the Committee requested that the British Dynamite Company would submit a programme of experiments, on a scale sufficiently extended to afford trustworthy evidence of the safety, stability, and value of this explosive substance; and on 11th June 1872, Mr. Nobel, on the part of the Company, waited on the Committee, and discussed the programme, which was approved.

3. On the 25th June 1872, the Committee assembled at Llanberis, in Wales, and witnessed experiments with dynamite.

The results showed that under ordinary conditions of temperature, boxes containing dynamite might safely be subjected to severe concussion, and that the material is not liable to accidental explosion by rough handling, or by any violence to which it might be subjected in ordinary transport.

It was also proved that the accidental ignition of a small quantity of dynamite (such, for example, as a box containing 50 lbs.) would not be followed by an explosion, but that the material would explode violently under similar circumstances if the quantity were large. Thus, a wooden magazine containing 6 cwt. of dynamite exploded violently shortly after being set on fire.

Appendix C, D, E.

4. In addition to the above experiments, which constituted the Company's programme, the Committee subjected the material, from time to time, to a series of trials, similar to those which they have made with lithofracteur and No. 2 dynamite, the results of which were satisfactory.

Appendix C, III.

5. All nitro-glycerine compounds, including dynamite, are liable to become hard in cold weather from the freezing of the nitro-glycerine, which generally takes place at a temperature considerably above the freezing point of water.

In this state the material cannot be applied so effectively as in its plastic state. The Committee have made experiments with a warming pan proposed for the purpose of thawing dynamite cartridges by the British Dynamite Company. This arrangement appears to answer its purpose well, but the Committee think the water used should never exceed a temperature of 130°—as a rough rule it should not be hotter than could be borne by the naked hand.

6. On a careful consideration, the Committee are of opinion that No. 1 Dynamite, as manufactured by the British Dynamite Company, is a valuable explosive agent, and that it may be manufactured, stored, and transported, subject to the existing regulations laid down for other nitro-glycerine compounds, provided the per-centage of pure nitro-glycerine does not exceed 75, and that of absorbent earth does not fall short of 24.

9 December 1873.

(signed) C. W. Younghusband,  
 Colonel, R.A., President.

\* Composed of nitro-glycerine and "kieselgühr."



## APPENDIX A.

*John Downie*, Esq., Manager of the British Dynamite Company, to *A. F. O. Liddell*, Esq.  
29 March 1872.

"Our directors finding that the Guncotton Committee have instructions to report on the safety, stability, and value of litho-fracteur as an agent for blasting and other purposes, trust their reference may be extended, and that they will be asked in like manner to report on dynamite, so that each of those nitro-glycerine compounds may be subjected to the same kind of tests, and be treated with equal fairness. We feel assured, were such examination made, that dynamite would be found to be the safer, the more stable, and trustworthy, and the better article, seeing it has by its extensive use already proved to be a compound of the greatest service in mining and quarrying operations, and interesting as well in a scientific point of view.

"Our works, at Chidres, in Ayrshire, are now fast approaching completion, and we respectfully invite the fullest inquiries of the Committee should they be appointed to investigate this matter, so that their suggestions (if any) may be embodied along with other important precautions now being made for safety, and that, prior to our asking for Captain Majendie's inspection of all working details ere we commence the manufacture.

"Waiting to be informed whether dynamite will be so included that we may in such event meet the requirements of the Committee."

## APPENDIX B.

PROGRAMME OF EXPERIMENTS with DYNAMITE proposed to be made at *Llanberis*,  
*North Wales*.

## "To test its Safety against Fire."

"1st Experiment.—Six cwt. of dynamite, contained in the original packing, and shipped from Mr. Nobel's factory at Krummel, near Hamburg, will be stored in a magazine constructed exactly after same design (though of smaller dimensions), as the dynamite magazine of the British Dynamite Company, at Ardeer; a fire will be lighted inside the magazine to ascertain whether the dynamite stored therein will burn away, or explode. The dynamite used for this experiment will be heated up to 120° F.; \* should an explosion take place, the same experiment is to be made over again, but without heating the dynamite used."

## "To test the Safety of Dynamite against Concussion."

"1st Experiment.—A box of dynamite, containing 28 lb. weight, original packing, will be dropped from a height of 50 to 60 feet on the ground.

"2nd Experiment.—A box filled with sand or stones, weighing 2 cwt., will be dropped from the same height on a box containing 28 lb. of dynamite."

"To test the comparative power of Gunpowder, and Guncotton, and Dynamite, various blocks of wrought iron, as well as bore holes in the rock will be provided, the exact size and position of which cannot be positively fixed beforehand, but must be suited to the nature of the rock and surrounding circumstances."

*Results of Experiments with Dynamite carried out at Llanberis.*

The following experiments, suggested by Mr. A. Nobel, were witnessed by the Committee on Wednesday, 26th June 1872, at Glynrhowy Quarry, near Llanberis, North Wales.

President.

Colonel YOUNGHUSBAND.

MEMBERS.

Colonel Milward, c.B.  
Captain Field.  
Dr. Odling.

Mr. Bidder.  
Captain W. H. Noble.

Captain Majendie attended on behalf of the Home Office.

Mr. A. Nobel and Mr. Downie attended on behalf of the British Dynamite Company.

I.—*Experiments to test Safety against Fire.*

1. A wooden shed was constructed to represent, in design, the proposed dynamite magazines of the British Dynamite Company at Ardeer. The shed was 8½ feet square by 6½ feet high, made of single leather boarding without lining. There was no flooring. A ventilator

was

\* In the experiments made the dynamite was not heated.

Appendix, No. 18. was placed in the centre of the pointed roof, and a 2-inch deep opening was left under the eaves. Twelve boxes of dynamite, each containing 56 lbs., were arranged on trestles in the shed—six on each side: in two tiers, about 3 feet from the ground. The boxes were made of  $\frac{5}{8}$  inch deal, and were, 1 ft. 11 in. by 11 in. by 10 in. in depth, nailed together with 2 in. nails. One box on each side, in upper tier, was left open.

A bonfire of shavings, sprinkled with petroleum, was ignited by means of a Bickford fuze in the centre of the shed. In about three minutes the flame from the shavings appeared to have communicated with one of the open boxes of dynamite, as at this time a sudden burst of flame which no doubt proceeded from the dynamite, was observed. There was another burst of flame about half a minute afterwards. From the first burst of flame the building continued burning more or less fiercely for about six minutes, when its contents exploded with great violence. The dynamite was burning very fiercely for about half a minute previous to the explosion. The wooden shed was blown into fragments, and a crater formed on its site, 18 ft. in diameter by  $2\frac{1}{2}$  feet in depth.

2. A wooden packing case, containing 56 lb. of dynamite in the usual 5 lb. cardboard boxes, was ignited in the open by means of an ordinary Bickford fuze without cap.

The box burnt very fiercely for about five minutes; there was a burst of dynamite flame about half a minute before all went out. There was no explosion, and the box was merely charred.

3. A 5 lb. cardboard box was placed inside a wooden box and nailed down. This was placed in a space between a large rock and the side of the quarry, and built over with stones.

A bonfire of shavings and sticks sprinkled with petroleum was made round the box of dynamite. On being ignited the bonfire burnt for about 20 minutes before the dynamite caught fire. The latter merely flared up. There was no explosion.

## II.—Experiments to test Safety against Concussion.

1. A wooden packing case, of  $\frac{5}{8}$  in. deal, containing 56 lb. of dynamite packed in 10 cardboard boxes, was allowed to fall from the top of the quarry, a height of about 60 feet, on to the broken shingle below.

The box was slightly broken. No explosion.

2. The above was repeated from a height of about 130 feet. The box was allowed to fall on the solid rock. The box was broken to pieces, and the cartridges were scattered about, but there was no explosion.

3. A cardboard box, containing about 5 lb. of dynamite, was allowed to fall 130 feet on to rock. The box was broken, and the cartridges were scattered about, but there was no explosion.

4. A wooden box, weighted with slate rubbish to 2 cwt., was allowed to fall 60 feet on to a wooden packing case containing 56 lb. of dynamite. The box of dynamite was broken to pieces, and the cartridges crushed and scattered about, but there was no explosion.

## III.—Experiments to test Destructive Power.

1. Made with a cylindrical block of wrought iron, forged from scrap at the Parkhead Works, near Glasgow, and forming the end of a marine engine connecting shaft. The dimensions were 15.25 in. diameter, 9 in. depth. A hole of  $1\frac{1}{2}$  in. diameter was bored completely through the centre of the block. This was filled with dynamite, the charges being removed from the paper wrappers and pressed into the hole with a wooden rammer. In this manner six charges (about three-quarters of a pound) of dynamite (nitro-glycerine 75 parts, infusorial earth 25 parts) were introduced, untamped. The explosion was effected by detonation in the usual manner, viz., a detonating cap on the end of a piece of Bickford fuze.

The block, which was excellent in quality, was broken into two pieces, the split taking place through the hole. One piece was thrown 7 yards, the other 12 yards on to a bank 12 ft. high. The hole was considerably altered in shape; the extremities measured  $1\frac{1}{2}$  in. in diameter, and the centre from 2 in. to  $2\frac{1}{2}$  in.

2. A piece of girder iron,  $\frac{5}{8}$  in. thick at centre of web, 20 in. in length, and 9 in. in depth, was placed at 15 in. from the breech of a wooden gun. The gun was of  $2\frac{1}{4}$ -in. calibre, and 6 in. length of bore, with a breech formed of a plate of sheet tin. The object of the experiment was to ascertain to what depth the pieces of tin would be driven into the wrought iron on explosion.

1 lb. 4 oz. of dynamite was tightly rammed into the bore, and fired by detonation. The web of the girder was deeply pitted by the fragments of the tin, the deepest hole being about  $\frac{3}{8}$  in.

3. A block of wrought iron,  $7\frac{1}{4}$  in. by  $7\frac{1}{4}$  in. by 5 in., was laid on the ground. A hollow cylinder of thin wrought iron (about  $\frac{1}{20}$  in.) was placed on the top of the block and filled with dynamite (5 lb.) pressed in. The charge was fired by detonation.

The block was broken into two parts, and nearly the whole upper surface, where the charge had rested, was depressed to a depth of  $\frac{1}{4}$  in.

## APPENDIX C.

I.—*To Test the Effect of repeatedly Freezing and Thawing the Substance.*

13 February 1873.—Six cartridges in a tin cylinder were placed in the ice box at 4.15 p.m.

14 February 1873.—The tin was taken from the ice box at 12.15 p.m., and placed in a water oven; temperature 50°.\* All the cartridges were quite frozen. The oven was gradually heated to 90°.

15 February 1873.—At 11 a.m. the thermometer inside stood at 90°, when the cartridges were taken out and examined in presence of Colonel Milward and Captain Noble; there was no appearance of exudation; they were all quite soft to the touch. The tin was replaced in the ice box at 3 p.m.

17 February 1873.—The tin was taken from the ice box at 12 o'clock; all the cartridges were hard frozen. It was placed in the water oven at 12.15 p.m., inside temperature 58°. The temperature was raised gradually to 90°.

18 February 1873.—At 11 a.m. the thermometer stood at 90°, when the tin was examined by Colonel Milward and Captain Noble; all the cartridges were thoroughly thawed, and there was no appearance whatever of exudation. The tin was replaced in the ice box at 4 p.m.

19 February 1873.—The tin was taken out of the ice box at 12.15 p.m., and examined in presence of Colonel Milward, Captain Field, and Captain Noble. Two cartridges were hard, four were soft to the touch. Temperature in the ice box 28°. The tins were placed in the oven at 12.30 p.m., temperature 65°. The temperature was gradually raised to 90°.

20 February 1873.—At 10.45 a.m. the thermometer stood at 88°, when the cartridges were examined by Colonel Milward and Captain Noble; there was no appearance whatever of exudation, all were thoroughly thawed. The tin was replaced in the ice box at 4 p.m.

21 February 1873.—The tin was taken from the ice box at 12 o'clock, and put in the oven in presence of Colonel Younghusband, Colonel Milward, and Captain Noble. Four of the cartridges, as before, were soft to the touch. The temperature was gradually raised to 90°.

22 February 1873.—At 11 a.m. the thermometer stood at 90° when the cartridges were examined; there was no appearance whatever of exudation.

In addition to the above, two frozen cartridges were placed at 12.20 p.m. on 25th July 1872, on a table in a window fully exposed to the sun. Examined at 1.10 p.m. The temperature of the table exceeded 130°; both cartridges were quite soft. There was no exudation whatever.

II.—*To ascertain the Effect of Heat on Samples taken direct from the Case in which the Substance was received.*

24 July 1872.—An ordinary cardboard packing case, containing five pounds of dynamite cartridges, was placed in a water oven at 4 p.m. The temperature was gradually raised and kept at 95° to 98°.

25 July 1872.—The box was examined at 11 a.m. by the Committee. The cartridges were all found to be in perfect condition. In no case was there the least appearance of exudation, either outside or inside the paper wrappers, nor did they exude upon moderate pressure between the fingers.

23 February 1873.—Fifteen cartridges in an ordinary cardboard box, without cover, were placed at 4.30 p.m. in a water oven, the inside temperature of which was 90°. The cartridges all rested on the bottom of the box; the latter rested on pieces of wood an inch thick, which in their turn rested on the bottom of the oven. All the cartridges felt hard, or semi-frozen. The dynamite had been taken from a Royal Laboratory magazine.

24 February 1873.—The box was taken out of the oven at 11.30 a.m., and examined by Colonel Milward and Captain Noble. There was no appearance of exudation on the box, or on any of the cartridges, either inside or outside.

22 May 1873.—Three cartridges were placed in the water oven at 4.20 p.m., in a cardboard box; temperature 90°.

23 May 1873.—Examined at 11.15 a.m., in the presence of Captain Field, Mr. Bauerman, and Captain Noble; Major Majendie was also present; thermometer registered maximum

\* Fahrenheit scale was used throughout.

Appendix, No. 18. maximum  $102^{\circ}$ , minimum  $80^{\circ}$ . No exudation, cartridges dry inside and out, and in a perfectly plastic condition.

27 November 1873.—A single cartridge was placed on end in a glass beaker and put into a hot oven, temperature  $100^{\circ}$ ; it remained in this oven at this temperature for 24 hours. There was no appearance whatever of exudation.

### III.—To Test the Arrangement proposed by the British Dynamite Company for Thawing Frozen Cartridges.

In cold weather dynamite loses its pasty condition and becomes quite hard, in which state it cannot be so effectively applied as when it is plastic. To thaw it requires the application of heat, and frequent accidents have occurred through warming dynamite cartridges on or before stoves and fireplaces.

At ordinary temperatures, dynamite, when unconfined and in small quantities, will burn quietly away when ignited by a match or similar agency but it may explode violently; when so ignited, if the temperature of the mass has been greatly raised by roasting it before a fire.

To obviate these accidents the British Dynamite Company have invented a special portable warm-water heating pan, wherein the dynamite can be preserved warm, and in a soft pasty state for several hours in the coldest weather. The warming pan consists of a double case of block tin, on the same principle as a hot-water plate, surrounded by a packing of non-conducting substance.

The cartridges of dynamite are placed in an india-rubber bag, the mouth of which is tied with a string, and stowed away in the centre compartment, which is fitted with a lid. Hot water is then poured into the other compartment.

23 May 1873.—1st pan. Three hard cartridges, wrapped in linen, were placed in the pan at 7 a.m.; temperature of water  $120^{\circ}$ . Examined at 11.40 a.m.; temperature of water  $81^{\circ}$ , inside temperature  $78^{\circ}$ . Perfectly plastic, no exudation whatever. 2nd pan. Temperature of water at 7 a.m.  $95^{\circ}$ ; at 11.45 a.m.  $70^{\circ}$ , inside  $66^{\circ}$ . Perfectly plastic, no exudation whatever.

26 May 1873.—The following warming pan experiment was carried out in presence of Captain Field and Mr. Bauerman. At 11.40 a.m. three cartridges wrapped in a linen cloth were placed in the warming pan, surrounded by hot water. The inside temperature among the cartridges was  $120^{\circ}$ ; at 2 p.m. the inside temperature had fallen to  $100^{\circ}$ , and the cartridges were in the following condition:—

One cartridge—slight exudation at end and inside fold of paper wrapper.

One cartridge—small trace of exudation inside paper fold.

One cartridge—no exudation. The linen wrapper exhibited a mark of exudation where the nitro-glycerine had escaped from the end of the cartridge.

8 December 1873.—Five frozen and one unfrozen cartridges of dynamite were placed at 12.30 p.m. in an india-rubber bag and put in a warming pan. Hot water at a temperature of  $130^{\circ}$ , just so hot that the hand could not be held long in it, was poured in. The temperature of the water when in the pan was  $120^{\circ}$ , the temperature of room  $51^{\circ}$ . Examined 3.30 p.m., same day. Temperature of water in pan  $80^{\circ}$ ; temperature of room  $51^{\circ}$ . All the cartridges were thoroughly thawed, and there was no appearance whatever of exudation, except in the one soft cartridge, which exhibited under the paper wrapper faint indications of dampness of some sort.

### IV.—To ascertain the Effect of immersing the Cartridges in Water.

25 July 1872.—Two cartridges of dynamite, which had previously been kept for 19 hours at a temperature of  $95^{\circ}$ , were placed in separate glass beakers filled with water at the ordinary temperature of the room ( $74^{\circ}$ ).

Nitro-glycerine commenced to exude in 4 minutes. Quantity exuded in 17 minutes—

1	-	-	-	-	-	-	-	-	-	-	-	90 minims.
2	-	-	-	-	-	-	-	-	-	-	-	80 „

A cartridge which had previously been kept for 19 hours at a temperature of  $95^{\circ}$  was taken out of its paper wrapper and immersed in a vessel of water at  $74^{\circ}$ . After 17 minutes the cartridge had completely broken up.

14 February 1873.—Three cartridges of dynamite, which had previously been kept for 19 hours at a temperature of  $95^{\circ}$ , were placed in separate glass beakers with cold water, at a temperature of  $50^{\circ}$ , and left for 17 minutes.

One with paper wrapper, cartridge lying at bottom of beaker; 30 minims of nitro-glycerine had exuded.

One with paper wrapper, cartridge lying up-ended in beaker; 30 minims of nitro-glycerine had exuded.

One without paper, cartridge lying at bottom of beaker. Cartridge, after 17 minutes, completely broken up and disintegrated.

APPENDIX D.

V.—To Test the Effect of Concussion.

25 July 1872.—SPECIMENS of dynamite, taken out of the paper wrappers, were subjected to the following test with a falling weight, at Woolwich Arsenal, under the superintendence of the Committee.

The cartridges were cut into lengths of one inch. Each piece was placed between two gun-metal plates. The lower plate rested upon an iron anvil, and a 50 lb. gun-metal weight was allowed to drop on the upper plate. Some cartridges were taken from the oven in which they had passed the previous night at a temperature of 90°. They were thoroughly thawed. Other cartridges were taken thoroughly frozen from the ice box.

In the following remarks the oven cartridges are distinguished as "heated," the ice-box cartridges as "frozen."

Expl. No.	Nature of Specimen.	Amount of Fall.	Result.
		<i>Feet.</i>	
1	heated - - -	2	Exploded.
2	" - - -	1½	No explosion.
3	" - - -	2	Exploded.
4	frozen - - -	3	No explosion.
5	" - - -	4½	"
6	" - - -	5½	Moderate explosion.
7	at 74° - - -	2	Exploded.
8	" - - -	2	"
9	" - - -	1½	No explosion.

The following additional experiments were also carried out to ascertain the effect of receiving the blow upon an elastic substance, such as wood.

The cartridges were, as before, cut into lengths of one inch (no wrapper). A piece of wood 3 inches thick was laid upon the iron anvil, a gun-metal plate upon the wood, then the specimen, over the specimen a gun-metal plate, then a piece of wood 3 inches thick. The 50 lb. weight fell on the latter.

Expl. No.	Nature of Specimen.	Amount of Fall.	Result.
		<i>Feet.</i>	
10	at 74° - - -	20	Exploded.
11	" - - -	15	"
12	" - - -	10	No explosion.
13	" - - -	12	"

## APPENDIX E.

VI.—*Test for Exudation in a Damp Atmosphere.*

THIS test consists (I.) in the exposure of the specimens to a saturated atmosphere, produced by the spontaneous evaporation of water in a confined space. And (II.) in the exposure of the cartridges to the ordinary air.

I. As a convenient receptacle, the Committee made use of an ordinary limber box. The centre compartment was half filled with tow, well wetted, and the specimens were laid on the shot trays.

2 July 1873.—Six cartridges were placed in the box.

4 July 1873.—Examined by Colonel Milward and Captain Noble. No appearance whatever of exudation.

5 July 1873.—Examined by Captain Noble; Major Majendie was also present; temperature, 63°; no appearance whatever of exudation.

12 July 1873.—Examined by Captain Noble; no exudation whatever.

6 August 1873.—Examined by Captain Noble; Major Majendie was also present; no exudation whatever.

II. 2 July 1873.—Four cartridges of each and exposed in an open box, under shelter, in the back yard of the office of the Experimental Branch, Director of Artillery's Department.

12 July 1873.—The cartridges weighed—

	2 July 1873.	12 July 1873.
	<i>Grains.</i>	<i>Grains.</i>
1 - - - -	974	974
2 - - - -	946	946
3 - - - -	806	806
4 - - - -	816	815

It appeared, therefore, that no moisture had been absorbed.

## SPECIAL COMMITTEE ON GUNCOTTON.

President:

Colonel C. W. YOUNGHUSBAND, R.A.

MEMBERS:

Colonel T. L. J. Gallwey, R.E.  
Brevet Colonel T. W. Milward, C.B., R.A.  
Brevet Colonel C. B. Nugent, C.B., R.E.  
Captain E. Field, R.N.

G. P. Bidder, Esq., C.E.  
Dr. W. Odling, F.R.S.  
H. Bauerman, Esq.  
Captain W. H. Noble, R.A., Secretary.

## REPORT ON No. 2 DYNAMITE.

1. THE Committee were directed, 31<sup>st</sup> March 1873, to report on a preparation of nitro-glycerine submitted by the British Dynamite Company, and termed by them No. 2 dynamite.

2. The first sample was delivered to the Committee, 24<sup>th</sup> April 1873; the last sample 1<sup>st</sup> July 1873.

Altogether five varieties of the substance were from time to time submitted for trial, and were classed as follows:—

A. Consisting,

74

9

245

251

A. Consisting, according to the British Dynamite Company, of—

		Per Cent.			Per Cent.
Nitrate of soda	- - -	69	B. Nitrate of ammonia	- - -	75
Paraffin	- - -	7	Paraffin	- - -	4
Charcoal, or coal dust	- - -	4	Charcoal, or coal dust	- - -	3
Nitro-glycerine	- - -	20	Nitro-glycerine	- - -	18
		100			100
<hr/>					
A. Nitrate of soda	- - -	70	B. Nitrate of ammonia	- - -	70
$\frac{1}{2}$ Paraffin	- - -	7	$\frac{1}{2}$ Paraffin	- - -	7
Charcoal	- - -	8	Charcoal	- - -	10
Nitro-glycerine	- - -	15	Nitro-glycerine	- - -	13
		100			100

		Per Cent.
C. Nitrate of potash	- - - - -	71
Paraffin	- - - - -	1
Charcoal	- - - - -	10
Nitro-glycerine	- - - - -	18
		100

3. The trials concluded 19th July 1873, and the Committee submitted a preliminary report on 12th August 1873.

4. The results of the experiments have demonstrated that in dynamite compounds containing a large per-centage of deliquescent salts, such as nitrate of soda and nitrate of ammonia, considerable exudation of nitro-glycerine may take place under circumstances that might occur under the ordinary conditions of transport and storage. On this account the Committee consider that these particular preparations of nitro-glycerine are objectionable; but the last sample submitted (C.), in which nitrate of potash replaces the nitrates of soda and ammonia, is free from the above defect, and they consider that this preparation of dynamite may, subject to the existing regulations laid down for other nitro-glycerine compounds, be manufactured, stored, and transported, provided its general characteristics (the per-centage of nitro-glycerine not exceeding 18 per cent., or that of charcoal falling short of 10 per cent.) and freedom from liability to exudation are the same as those of the sample (C.) tried by them. The presence or absence of paraffin appears to be of no importance.

5. A full detail of the experiments is given in the appendices to this report.

(signed) *C. W. Younghusband*, Colonel, R.A.,  
President.

18 November 1873.

APPENDIX (A).

SAMPLES of No. 2 Dynamite were submitted to the Committee in April 1873.

THE specimens were said by the Dynamite Company to be of the following composition:—

A.	{	Nitrate of soda	- - - -	69 per cent.
		Paraffin	- - - -	7 "
		Wood charcoal, or coal dust	- - - -	4 "
		Pure nitro-glycerine	- - - -	20 "
B.	{	Nitrate of ammonia	- - - -	75 "
		Paraffin	- - - -	4 "
		Wood charcoal, or coal dust	- - - -	3 "
		Pure nitro-glycerine	- - - -	18 "

Appendix, No. 18. The above samples were packed in two of the Dynamite Company's patent "warming pans."

The dynamite had been kept since its delivery by Mr. Downie, 24th April 1873, in a store belonging to the office of the Experimental Branch, Director of Artillery's Department.

I.—*To ascertain the Effect of repeatedly freezing and thawing the Substance.*

28 April 1873.—THE pans, which had been delivered under seal, were opened by Captain Noble, and six cartridges of each, A. and B., in two tins, were placed in the ice box at 4.15 p.m.

All the A. cartridges, except one, felt hard to the touch, or semi-frozen. Some of the B. cartridges were soft, or crumbly to the touch.

29 April 1873.—They were taken from the ice box at 12 o'clock, and placed in the water oven. All the cartridges were quite frozen, with the exception of the one (A.) which had been noted as "soft" before commencing the trial.

30 April 1873.—The oven was gradually heated, and stood at 94° (inside) at 11.30 a.m., when the cartridges were examined in presence of Colonel Milward, Captain Field, and Captain Noble. There was no appearance of exudation with either; all the cartridges felt hard to the touch. The tins were replaced in the ice box at 1 p.m.

1 May 1873.—They were taken out of the box at 12 o'clock. All the cartridges were hard frozen. The tins were immediately placed in the water oven, the gas was turned on, and the temperature allowed to rise gradually to 90°.

2 May 1873.—The tins were taken out of the oven (temperature 93°) at 11.15 a.m., and examined in presence of Colonel Milward, Captain Field, and Captain Noble. The A. cartridges were thawed, and showed no appearance of exudation. The B. cartridges were still hard, but showed signs of exudation at the bottom of the cartridges.

3 May 1873.—The tins were replaced in the ice box at 1 p.m.

5 May 1873.—The tins were taken out of the ice box at 12 o'clock, and placed in the water oven. All the cartridges were hard frozen.

6 May 1873.—The tins were taken out of the oven at 10.15 a.m., and examined by Captain Noble. A small bead of nitro-glycerine which had exuded from one of the cartridges was in the bottom of A. tin. A piece of blotting paper, dipped in it, exploded readily on being struck with a hammer. There was no exudation in the B. tin, but all the cartridge wrappers were discoloured, and showed traces of dampness. The maximum temperature during the night had been 100°, minimum 85°.

II.—*To ascertain the Effect of Heat on samples taken direct from the case in which the Substance was received.*

28 April 1873.—NINE cartridges of each, A. and B., in two cardboard boxes without covers, were placed at 4.15 p.m. in a water oven, the inside temperature of which was 90°. The cartridges all rested on the bottom of the boxes; the latter rested on pieces of wood an inch thick, which in their turn rested on the bottom of the oven.

29 April 1873.—The boxes were taken out of the oven at 10 a.m., and examined by Colonel Milward and Captain Noble. The box with the A. cartridges, or that containing the nitrate of soda compound, was in the following condition:—

Slight exudation from one of the cartridges had stained the bottom in one place. All the cartridges unwrapped exhibited slight traces of exudation, or dampness of some sort on the inside of the paper. The box with the B. cartridges, or that containing the nitrate of ammonia compound, was in the following condition:—

Slight exudation from one or more of the cartridges had stained the bottom in three places. All the cartridges unwrapped exhibited a considerably greater amount of exudation than in the case of the A. cartridges.

It was accordingly determined to repeat the experiment, and fresh samples of A. and B. cartridges (nine of each) were taken from the warming pans, placed in cardboard boxes as before, and put into the oven (90°) at 4 p.m.

30 April 1873.—The boxes were taken out of the oven at 11.30 a.m. There was no appearance of exudation in the A. cartridges; the B. cartridges showed exudation, and several unwrapped exhibited traces of dampness inside. All were more or less hard to the touch.

1 May 1873.—In order to further test the B. cartridges four, in an ordinary cardboard box, were placed in the oven at 12 o'clock.

2 May 1873.—



2 May 1873.—The cartridges were examined at 11.15 a.m., in presence of Colonel Milward, Captain Field, and Captain Noble. They exhibited considerable appearances of exudation. The paper was quite wet, and the nitro-glycerine had apparently run out and stained the box. A drop absorbed on a piece of blotting paper, and struck with a hammer, exploded.

### III.—To ascertain the Effect of immersing the Cartridges in Water.

30 April 1873.—Single cartridges from box A. were placed in glass beakers with cold water, at a temperature of 50°, and left for 17 minutes—

- A. 1. With paper wrapper, cartridge lying at bottom of beaker. No exudation.
- A. 2. With paper wrapper, cartridge lying at bottom of beaker. No exudation.
- A. 3. With paper wrapper, cartridge up-ended. A small bead of exudation.
- A. 4. Without paper, cartridge up-ended. Cartridge did not disintegrate, and there was very little appearance of exudation.

Single cartridges from box B. were placed in glass beakers with cold water, at a temperature of 50°, and left for 17 minutes—

- B. 1. With paper wrapper, cartridge lying in bottom of beaker. No exudation.
- B. 2. With paper wrapper, cartridge lying in bottom of beaker. No exudation.
- B. 3. With paper wrapper, cartridge up-ended. No exudation.
- B. 4. Without paper, cartridge up-ended. Cartridge broke in two, but did not disintegrate. There was a little exudation.

### IV.—To test the Arrangement proposed by the Dynamite Company for thawing Frozen Cartridges.

1 May 1873.—To test the warming pan arrangement six A. cartridges, in a tin, were placed in the ice box to freeze, at 12 o'clock.

2 May 1873.—The six cartridges, thoroughly frozen, were wrapped up in a piece of canvas, and placed in that vessel about 12 o'clock, boiling water was poured in. At 12.15 p.m. they were still hard. At 2.30 p.m. they were thoroughly thawed, but exhibited the appearance of exudation both on the inside and outside of the paper wrappers.

5 May 1873.—The six A. cartridges which had been re-frozen were suspended, wrapped in a piece of linen cloth, in the warming pan at 12 o'clock; the temperature of the water was 145°, inside temperature 120°. At 1 o'clock these cartridges were just becoming soft; the temperature of the water had fallen to 120°, and inside temperature to 105°; there was no appearance of exudation. Examined at 3.20 p.m. by Captain Noble. The cartridges were thawed; temperature of water 90°, inside temperature 80°. All the cartridges exhibited traces of exudation, the inside of the paper wrapper was quite wet; a small piece of blotting paper was easily soaked, and readily exploded on being struck with a hammer. Examined at 4.20 p.m. by Captain Noble; temperature of water 82°, inside 70°. Cartridges still had appearance of exudation; a small piece of blotting paper soaked up sufficient nitro-glycerine from the outside of the wrapper of one of the cartridges to give a very distinct detonation on being struck with a hammer.

6 May 1873.—Examined at 10.15 a.m. by Captain Field and Captain Noble; the temperature of the water was 55°. The cartridges were not frozen, but felt hard to the touch. There was still an appearance of exudation.—See Appendix (C.).

### V.—To compare No. 1, or "Kieselguhr," Dynamite with No. 2.

22 May 1873.—In order to compare No. 1, or the original dynamite, with No. 2, three cartridges each of No. 1, No. 2 A, and No. 2 B, were placed in the water oven 4.20 p.m., in card-board boxes, temperature 90°.

23 May 1873.—Examined at 11.15 a.m., in presence of Captain Field, Mr. Bauerman, and Captain Noble; Major Majendie was also present; thermometer registered maximum 102°, minimum 80°.

No. 1. No exudation, cartridges dry inside and out, and in a perfectly plastic condition.

No. 2 A. On two cartridges nitro-glycerine had slightly exuded, and stood in drops on the inner fold of the paper, and at both ends. A piece of the paper exploded on being struck by a hammer. One cartridge did not exhibit any traces of exudation.

No. 2 B. No exudation on any of the cartridges, but paper inside looked stained. All cartridges felt hard.—See Appendix (C).

First warming pan test; 3 charges of each of the above, separately wrapped in linen, were placed in the pan at 7 a.m.; temperature of water 120°. Examined at 11.40 a.m.; temperature of water 81°, inside temperature 78°.

No. 1. Perfectly plastic; no exudation whatever.

Appendix, No. 18. No. 2 A. Slight exudation of two cartridges, at end in one case, alongside in other case; drop absorbed on blotting paper exploded.

No. 2 B. The paper was more saturated than in the case of No. 2 A, although no liquid had actually exuded to the outside.

Second warming pan test; temperature of water at 7 a.m. 95°; at 11.45 a.m. 70°; inside 66°.

No. 1. Perfectly plastic, no exudation whatever.

No. 2 A. Considerable exudation along inner fold of one cartridge, surface of paper smeared with nitro-glycerine, exploded readily on being absorbed on blotting paper and struck with a hammer. Other two cartridges slightly exuded.

No. 2 B. Two cartridges exhibited traces of exudation, and the paper appeared to be more saturated, but no actual drops of nitro-glycerine had exuded.

#### APPENDIX (B).

##### VI.—To Test the Effect of Concussion at various Heights.

6 May 1873.—SPECIMENS of No. 2 dynamite (A. and B.) were subjected to the following test with falling weight, at Woolwich Arsenal, under the superintendence of Captain Field; Colonel Milward was present during part of the trial.

The cartridges were cut into lengths of one inch. Each piece was placed between two gun-metal plates. The lower plate rested upon an iron anvil, and a 50 lb. gun-metal weight was allowed to drop on the upper plate. Three cartridges each, of A. and B., were taken from the oven (*see* Appendix A.), in which they had passed the previous night at a temperature of 90°. They were thoroughly thawed. Three cartridges of each were also taken thoroughly frozen from the ice box.

In the following remarks the oven cartridges are distinguished as "heated," the ice box cartridges as "frozen."

Explanatory Number.	Nature of Specimen.	Amount of Fall.	Result.
		<i>Feet.</i>	
1	A.—Heated - - -	2	No Explosion.
2	" - - -	Repeated 2	"
3	" - - -	3	"
4	" - - -	4	"
5	" - - -	5	"
6	" - - -	7	"
7	" - - -	9	"
8	" - - -	12	"
9	" - - -	20	Exploded partly.
10	" - - -	18	No explosion.
11	" - - -	20	"
12	B.—Heated - - -	10	"
13	" - - -	20	Exploded loudly.
14	" - - -	18	No explosion.
15	A.—Frozen - - -	20	"
16	" - - -	30	"
17	B.—Frozen - - -	30	Slight explosion.
18	" - - -	30	"
19	" - - -	20	Exploded.
20	" - - -	18	No explosion.

#### APPENDIX (C).

##### VII.—To Test Thawing Arrangement.

26 May 1873.—THE following additional warming pan experiments were carried out in presence of Captain Field, R.N., and Mr. Bauerman. At 11.40 a.m., three cartridges of ordinary

ordinary (No. 1) dynamite, wrapped in a linen cloth, and three cartridges of No. 2 A, dynamite, similarly wrapped, were placed in the warming pan surrounded by hot water. The inside temperature among the cartridges was 120°; at 2 p.m. the inside temperature had fallen to 100°, and the cartridges were in the following condition:—

#### No. 1 Dynamite.

One cartridge—slight exudation at end and inside fold of paper wrapper.  
 One cartridge—small trace of exudation inside paper fold.  
 One cartridge—no exudation. The linen wrapper exhibited a mark of exudation where the nitro-glycerine had escaped from the end of the cartridge.

#### No. 2 A. Dynamite.

One cartridge—considerable exudation from end and inside fold of paper wrapper.  
 One cartridge—considerable exudation from end and inside fold of paper wrapper (rather less).  
 One cartridge—no exudation. The linen wrapper much marked with exudation from the ends of the cartridges.

This brought the first series of experiments with No. 2 dynamite to a close, pending the submission of fresh samples by the British Dynamite Company.

The trials convinced the Committee that No. 2 dynamite was inferior in stability to No. 1, that is to say, nitro-glycerine more readily exuded from the former, but before finally reporting in this sense they determined to expose a certain number of cartridges to a damp atmosphere, such as would probably exist in a miners' magazine, with a view of noting the behaviour of the samples of the No. 2 dynamite, both of which contain deliquescent salts, under such conditions. (See Appendix D.)

### APPENDIX (D).

#### VIII.—Experiments with a Second Sample of No. 2 Dynamite submitted 6 June 1873. Test for Exudation in a Damp Atmosphere.

1.—6 June 1873.—Two warming pans, containing respectively about 5 lb. of No. 2 A. (nitrate of soda) and No. 2 B. (nitrate of ammonia), were left in the office of the Experimental Branch, Director of Artillery's Department. The ingredients of this sample were of similar proportions to that submitted 24th April 1873.

9 June 1873.—The pans were opened by Captain Noble. The centre compartment of a limber box was half filled with tow, well wetted, and six cartridges of each were placed on the shot trays at 2.15 p.m.

11 June 1873.—Examined at 11.30 a.m., in presence of Mr. Bauerman and Captain Noble. The A. cartridges were almost free from exudation, but the B. cartridges showed traces of exudation, particularly on the inside of the paper; a piece of blotting paper absorbed sufficient easily to explode with a loud detonation on being struck. More water was added to the tow, and the box closed.

12 June 1873.—Examined at 11.15 a.m., in presence of Mr. Bauerman and Captain Noble. Considerable exudation inside all the B. cartridges; slight exudation inside all the A. cartridges; thermometer stood at 70°.

13 June 1873.—Examined in presence of Colonel Milward and Captain Noble; Major Majendie and Captain Ford, R.A., were also present. Temperature in box, 75°. The B. cartridges exhibited a very considerable amount of exudation on the inside of the paper wrappers. In one case the nitro-glycerine dropped from the extremity of one of the cartridges on to a piece of blotting paper, which exploded violently on being struck with a hammer. The A. cartridges exhibited very slight traces of exudation on the inside of the wrappers.

16 June 1873.—Water was added to the tow.

17 June 1873.—Examined by Dr. Odling and Captain Noble at 12.30 p.m. The B. cartridges were in a very bad state; the nitro-glycerine had run out in a little pool under each. The A. cartridges were better, and only exhibited slight traces of exudation inside the wrappers.

18 June 1873.—Examined by Captain Field and Captain Noble. No alteration in the condition of the samples. A. cartridges getting worse.

19 June 1873.—Mr. Downie attended at 12.30 p.m., and the limber box and cartridges were examined in his presence by Colonel Milward, Dr. Odling, and Captain Noble.

Appendix, No. 18. There was no alteration in the samples. Mr. Downie was satisfied that the nitrate of ammonia (B.) having 18 per cent. of nitro-glycerine was inadmissible, and submitted fresh samples. See Appendix (E.)

20 June 1873.—Examined by Captain Noble; Major Majendie was also present. A. cartridges—considerable exudation inside the wrappers; nitro-glycerine would have dropped out if cartridges were held vertically. B. cartridges—each hollow in shot tray was half full of nitro-glycerine.

1 July 1873.—M. Noble and Mr. Downie attended the committee; the limber box was examined in their presence. All the cartridges exhibited exudation inside the wrappers and at the extremities, but no nitro-glycerine had actually run out into the trays. B. cartridges were in much the same state as when last examined. A considerable quantity of nitro-glycerine had run out of each cartridge into the trays. The samples stored in the small store in back yard, and packed in the usual india-rubber bags, inside the warming pans, were also examined. A. cartridges, all right; B. cartridges, slight traces of exudation inside wrappers.

2.—11 June 73.—To test the cartridges when exposed in the open, four cartridges of each were placed, 11.45 a.m., in a wooden box, under shelter, in the back yard of office of Experimental Branch. Box lined with blotting paper. The B. cartridges on being taken out of the warming pan exhibited slight traces of exudation on the outside of the wrappers. The warming pans with the remain of the cartridges (A. and B.) were stored in the little room in the back yard.

12 June 1873.—The A. cartridges in the box under shelter at 11.30 a.m. did not exhibit any trace of exudation, but there was more or less appearance of exudation inside the wrappers of all the B. cartridges.

13 June 1873.—There was considerable exudation inside the wrappers of the B. cartridges; very slight exudation inside those of the A. cartridges.

17 June 1873.—The B. cartridges exhibited considerable exudation; the A. cartridges very slight exudation.

1 July 1873.—No apparent difference.

3.—11 June 1873.—To test the amount of moisture absorbed, two A. cartridges and two B. cartridges were placed in earthenware dishes, and weighed in an accurate balance—

		<i>Grains.</i>
A.	Dish and contents weighed	- - - 3,238
B.	Ditto	- - - 3,294

The dishes were then exposed to the atmosphere in the back yard, under cover.

12 June 1873.—The weight of the dishes were as follows :

	<i>Grains.</i>		<i>Grains.</i>
A.	3,244	- - -	gain 6
B.	3,299	- - -	,, 5

17 June 1873.—

A.	3,250	- - -	,, 6
B.	3,307	- - -	,, 8

The exudation of the two B. cartridges in the dish was very slight. Two cartridges of each, placed on blotting paper in box, weighed as follows :—

	17 June 1873.*	19 June 1873.	2 July 1873.
	<i>Grains.</i>	<i>Grains.</i>	<i>Grains.</i>
A. - -	1,113	1,119	1,126
A. - -	1,082	1,087	1,096
B. - -	1,020	1,025	1,086
B. - -	1,095	1,101	1,113

\* By Dr. Odling.

APPENDIX (E.)

IX.—Experiments with a Third Sample of No. 2 Dynamite submitted 19th June 1873.

1. 19 June 1873.—Two more samples of dynamite ( $\frac{\text{No. 2}}{2}$ ), with less per-centage of nitro-glycerine, were brought by Mr. Downie. They were said to be of the following composition:—

$\frac{2 \text{ A.}}{2}$				$\frac{2 \text{ B.}}{2}$			
				<i>Per cent.</i>			
Nitrate of Soda	-	-	70	Nitrate of Ammonia	-	-	70
Paraffin	-	-	7	Paraffin	-	-	7
Charcoal	-	-	8	Charcoal	-	-	10
Nitro-glycerine	-	-	15	Nitro-glycerine	-	-	13

20 June 1873.—The fresh samples were opened by Captain Noble. A second limber box was fitted up with damp tow as before, and four cartridges of each were placed on the shot trays at 5.30 p.m.

23 June 1873.—Examined by Captain Noble.

$\frac{2 \text{ A.}}{2}$  slight exudation on inside of wrappers.

$\frac{2 \text{ B.}}{2}$  ditto - - - - ditto.

Up to this point no dangerous amount of exudation had taken place. The cartridges had been three days in the limber box.

27 June 1873.—Examined in presence of Colonel Younghusband and Captain Noble.  $\frac{2 \text{ B.}}{2}$  had commenced to exude into the trays of the limber box.  $\frac{2 \text{ A.}}{2}$  looked bad, but no actual exudation had taken place.

1 July 1873.—M. Noble and Mr. Downie attended, and the various samples under trial were examined by the committee in their presence.

$\frac{2 \text{ A.}}{2}$ . Exudation had commenced inside the wrappers, but no oil had actually run out of the cartridges, still the cartridges on the whole did not look as good as those in the first limber box (see Appendix D.), in which the per-centage of nitro-glycerine was greater.  $\frac{2 \text{ B.}}{2}$ . Considerable quantities of nitro-glycerine had run out of each cartridge into the trays.

2. 20 June 1873.—To test the cartridges when exposed in the open, four of each were exposed openly in dishes under shelter in the back yard.

23 June 1873.—The cartridges were as follows:—

$\frac{2 \text{ A.}}{2}$  dry and crumbling.

$\frac{2 \text{ B.}}{2}$  slight exudation.

1 July 1873.—The cartridges were as follows:—

$\frac{2 \text{ A.}}{2}$  traces of exudation inside paper.

$\frac{2 \text{ B.}}{2}$  each dish contained some liquid with globules of nitro-glycerine floating in it.

3. 1 July 1873.—The remain of the samples were also examined. These had been stored in the small store in back yard, packed in the usual india-rubber bags inside the warming pans.

$\frac{2 \text{ A.}}{2}$  all right.

$\frac{2 \text{ B.}}{2}$  slight exudation inside wrapper.

The whole experiments went to show that there was no dangerous amount of exudation, so long as the cartridges were kept in the waterproof bags inside the warming pans, but

Appendix, No. 18. that single cartridges exposed to a damp atmosphere parted with the nitro-glycerine; that is to say, if cartridges from a broken package were left lying about in a damp magazine, a dangerous amount of exudation would probably take place.

This closed the second series of experiments with No. 2 dynamite, pending the submission of a fresh sample.

### APPENDIX (F.)

#### X.—Experiments with a New Description of No. 2 Dynamite, submitted 1st July 1873. Test for Exudation in a Damp Atmosphere.

1. 1 July 1873.—A FRESH supply of No. 2 dynamite (C.), in which nitrate of potash was substituted for nitrate of soda, was left at the office of the Experimental Branch by Mr. Downie. The sample was packed in an india-rubber bag inserted in a warming pan.

2 July 1873.—The package was opened by Captain Noble, at 11.30 a.m., and six cartridges were placed on the shot trays of a limber box, fitted up, as before, with damp tow, &c. Six cartridges of the ordinary No. 1, or Kieselguhr dynamite, were placed at the same time in the same box.

4 July 1873.—Examined by Colonel Milward and Captain Noble. No appearance whatever of exudation in either.

5 July 1873.—Examined by Captain Noble; Major Majendie was also present; temperature, 63°. No appearance whatever of exudation.

12 July 1873.—Examined by Captain Noble. No exudation whatever.

6 August 1873.—Cartridges in limber box examined by Captain Noble; Major Majendie was also present. No exudation whatever.

2. 2 July 1873.—Four cartridges of each (No. 2 C. and No. 1) were weighed and exposed in an open box, under shelter in the back yard.

12 July 1873.—The cartridges weighed—

	2 July 1873.	12 July 1873.		2 July 1873.	12 July 1873.
	<i>Grains.</i>	<i>Grains.</i>		<i>Grains.</i>	<i>Grains.</i>
No. 1. {	1 974	974	No. 2 C. {	1 698	698
2 946	946	2 759		759	
3 806	806	3 723		722	
4 816	815	4 743		742	

#### To ascertain the Effect of Heat and Cold upon No. 2 C. Dynamite.

3. 16 July 1873.—Six cartridges of No. 2 C. were placed in a cardboard box in the water oven at 3 p.m.; temperature, 66°.

17 July 1873.—The oven was gradually heated, and the thermometer stood at maximum 95°, minimum at 89°, at 1.15 p.m., when the cartridges were examined by Captain Noble. There was no appearance of exudation. The cardboard box was then replaced in the oven.

16 July 1873.—Six cartridges of 2 C. were placed in a tin, in the ice box, at 4.30 p.m.

17 July 1873.—When examined by Captain Noble, at 1.20 p.m., they were found to be quite soft to the touch, although the thermometer stood at 25° in the ice box. The cartridges were then placed in the water oven.

18 July 1873.—Examined by Colonel Younghusband, Mr. Bauerman, and Captain Noble. No exudation whatever from cartridges in water oven; maximum thermometer stood at 90°; minimum at 88°. The six cartridges were again placed in the ice box.

19 July 1873.—Oven examined; temperature 93°–89°. No exudation whatever. The cartridges which had been in the ice box since 18th July 1873, were examined, 21st July 1873, and found to be not frozen.

This experiment proved that No. 2 C. dynamite, in which the nitrates of soda and ammonia were replaced by nitrate of potash, was free from the defects of Nos. 2 A. and 2 B., so far as exudation is concerned.

An analysis made in the chemical department, for the committee, of a sample of No. 2 C., Appendix, No. 18. furnished the following results:—

	<i>Per cent.</i>
Nitro-glycerine - - - - -	18.20
Paraffin - - - - -	0.47
Nitrate of Potash - - - - -	72.04
Charcoal - - - - -	9.29

An analysis of No. 2 A. and No. 2 B. gave the following results as the per-centages of nitro-glycerine and paraffin in the respective samples:—

A.		B.	
	<i>Per cent.</i>		<i>Per cent.</i>
Nitro-glycerine - - - - -	22.3	Nitro-glycerine - - - - -	21.2
Paraffin - - - - -	7.8	Paraffin - - - - -	3.6

The following list shows that even with the strictest precautions and the most scrupulous vigilance, there is no absolute security that all risks which attend the storage, manufacture and manipulation of powder can be invariably estimated. It is the strict requirement to require that those buildings which from their position are considered as dangerous machinery, are comparatively free from the most serious manufacturing risks, such as mixtures, and the packing rooms, dusting and sifting houses of rap powder factories are wholly free from the risk of explosion. To the following list may be added a case which occurred a few years ago, when a loader match was found (with some percussion powder) in a barrel of Government gunpowder at the Royal Cartridge Factory, Woolwich. This barrel of powder had come from a Government magazine.

In another case a detonating tube was found by Major Keates, R.A., in a barrel of gunpowder at the Government establishment at Ballinacorney, Co. Wick, Ireland, in 1871.

D. Maxwell, Major Royal Artillery,  
 Major Master's Inspector of Gunpowder Works.

List of Articles in the Cupboard.

1. Iron nut, 1 1/2 in. square by 1/2 in. thick.—Found in the charcoal mill while grinding bedwood. By it three cogs were broken out of the mill wheel.—23rd April 1857.
2. Piece of beech wood, 1 1/2 in. square by 1/2 in. thick.—Found on the surface of No. 2 granulating machine, after passing the top pair of rollers.—7th October 1859.
3. Stone, 1 1/2 in. by 1 1/2 in. thick.—Found on top plate while loading No. 1 press.—20th February 1860.
4. Stone, 1 1/2 in. square.—Found in press cake at No. 1 press when recharging.—March 1860.
5. Iron fragments.—Found on bed of steam mill D, when vertical shaft broke.—17th July 1860.
6. Iron Key of a Cupboard.—Found in the chucks from the granulating machine No. 1, while making Enfield rifle powder.—18th June 1861.
7. Knife blades, &c.—Found in charcoal mill while grinding.—23rd September 1861.
8. Iron Bolt, 1 1/2 in. at head, 1/2 in. long.—Found on the south end of No. 1 mill. The nut was found in the granulating machine next day.—12th May 1862.
9. Copper Neb Cover of Lubricator, 2 1/2 in. diameter.—Taken from No. 2 granulating machine, after having passed through the top pair of rollers.—January 1864.
10. Pieces of iron, 3/4 in. by 1 1/2 in. by 1 1/2 in. thick.—Found in the press plates of No. 2 press while loading the press.—8th August 1864.
11. Copper Bolt, 1 1/2 in. diameter head, 3/4 in. long.—Found on the bed at the north end of No. 4 mill. It had been brought there in a dust charge, as the washer and part of the nut were found in the granulating machine next day.—12th May 1862.
12. Copper Bolt, 1 1/2 in. at head, 3/4 in. long.—Found under the cap of No. 6 mill. The bolt belonged to a reel at No. 1 Josting House, and was seen there in a dust charge. Caused the explosion of the north end of the mill, and also the north end of No. 3 mill on the opposite side of Mill Head; both mills on that strike of N. E. G.—12th May 1862.

## Appendix, No. 19.

PAPER handed in by Major *Majendie*.Appendix, No. 19. LIST of ARTICLES found at various times in the GUNPOWDER WORKS at *Waltham Abbey*, or in Barrels of Gunpowder at the Government Establishments at *Purfleet* and *Woolwich*, and at present deposited at *Waltham Abbey*.

THE following list shows that, even with the strictest precautions and the most scrupulous vigilance, there is no absolute security that *all* risks which attend the storage, manufacture, and manipulation of powder can be invariably estimated. It is, therefore, imprudent to assume that even those buildings which, from their freedom from complicated or dangerous machinery, are comparatively free from the more serious manufacturing risks, such as magazines, and the packing rooms, dusting and glazing houses of gunpowder factories, are wholly free from the risk of explosion. To the following list may be added a case which occurred a few years ago, when a lucifer match was found (with some percussion caps) in a barrel of Government gunpowder, at the Royal Cartridge Factory, Woolwich. This barrel of powder had come from a Government magazine.

In another case a detonating tube was found by Major Keates, R.A., in a barrel of gunpowder, at the Government establishment at Bull Point.

*D. Majendie*, Major Royal Artillery,  
Her Majesty's Inspector of Gunpowder Works.

## LIST of ARTICLES in the Cupboard.

1. Iron nut,  $1\frac{1}{2}$  in. square by  $\frac{1}{2}$  in. thick.—Found in the charcoal mill while grinding dogwood. By it three cogs were broken out of the pit wheel.—23rd April 1857.
2. Piece of beech wood,  $5\frac{1}{2}$  in. long,  $2\frac{1}{2}$  in. wide,  $\frac{7}{8}$  in. thick.—Found on the screens of No. 2 granulating machine, after passing the top pair of rollers.—7th October 1859.
3. Stone,  $1\frac{1}{4}$  in. by  $1\frac{3}{4}$  in. thick.—Found on top plates while loading No. 1 press.—20th February 1860.
4. Stone,  $\frac{3}{8}$  in. square.—Found in press cake at No. 1 press when unloading.—March 1860.
5. Iron Fragments.—Found on bed of steam mill D., when vertical shaft broke.—17th July 1860.
6. Iron Key of a Cupboard.—Found in the chucks from the granulating machine No. 1, while making Enfield rifle powder.—18th June 1861.
7. Knife Blades, &c.—Found in charcoal mill while grinding.—20th September 1861.
8. Iron Bolt,  $1\frac{3}{4}$  in. at head,  $4\frac{1}{2}$  in. long.—Found on the south end of No. 11 mill, L. J.; the runners had passed over it.—7th November 1861.
9. Copper Nob Cover of Lubricator,  $2\frac{1}{4}$  in. diameter.—Taken from No. 1 granulating machine, after having passed through the top pair of rollers.—January 1864.
10. Pieces of Iron,  $3\frac{1}{8}$  in. by  $1\frac{1}{4}$  in.,  $\frac{1}{8}$  in. thick.—Found in the press plates of No. 2 press while loading the press.—8th August 1864.
11. Copper Bolt,  $1\frac{1}{4}$  in. diameter head,  $3\frac{1}{2}$  in. long.—Found on the bed at the north end of No. 4 mill. It had been brought there in a dust charge, as the washer and part of the nut were found in the granulating machine next day.—12th May 1865.
12. Copper Bolt,  $\frac{7}{8}$  in. at head,  $2\frac{1}{2}$  in. long.—Found under the curb of No. 6 mill. This bolt belonged to a reel at No. 1 Dusting House, and was sent from there in a dust charge. Caused the explosion of the north end of the mill, and also the north end of No. 3 mill, on the opposite side of Mill Head; both mills on dust charges of R. L. G.—13th June 1866.



13. Copper Bolt to fasten Screens to Frame,  $1\frac{1}{2}$  in. at top,  $2\frac{1}{2}$  in. long.—Shaken out of the lower screens of No. 2 granulating machine, having been taken up with the chucks and passed all through the machine.—13th December 1866. Appendix, No. 19.
14. Piece of Iron,  $2\frac{1}{2}$  in. long,  $\frac{5}{8}$  in. diameter.—Found in a bundle of dogwood at the Cylinder House.—19th May 1868.
15. Pieces of Iron, from 5 in. to 3 in. long,  $\frac{1}{2}$  in. diameter.—Found while picking dogwood charcoal at different times.—15th December 1868.
16. Grit.—Found in New Magazine, having fallen from joints of brickwork.—16th July 1869.
17. Copper Bolt to fasten Plough, 3 in. long.—Found on the bed of No. 12 mill, north end, while the millman was uncharging, the runners having passed over it several times without causing explosion.—31st August 1869.
18. Steel Needle.—Found in L. G. powder received from Upnor while examining at Purfleet.—22nd November 1869.
19. An Iron Rivet-head.—Found in charcoal mill while grinding common charcoal.—13th April 1870.
20. An Iron Rivet-head.—Found while picking charcoal.—April 1870.
21. Small Pieces of Iron.—Found in cotton waste supplied for cleaning machinery in powder and other houses.—September 1870.
22. Small Pieces of Iron and Iron Wire.—Found in cotton waste supplied for cleaning machinery in powder and other houses.—October 1870.
23. Bullets and Caps.—Found in R. F. G. powder, sent from Purfleet for redusting.—March 1871.
24. Copper Tack.—Found in a barrel of blank R. F. G. powder while being sifted in the Royal Laboratory, Woolwich.—15th August 1871.
25. Copper Nails and Piece of Copper Hoop.—Found in a barrel of returned service L. G. powder sent to Woolwich for S. A. ammunition.—1871.
26. Clay Pipe.—Found while picking dogwood charcoal; it had been enclosed in a bundle of dogwood, and was burnt with it.—5th July 1872.
27. Small Stones.—Found at Woolwich in a barrel of powder, marked 

{	Powder L. G.
	100.
	Redusted, July 1872.

—13th August 1872.
28. Copper Nail, 2 in. long.—Found in a piece of picric mill cake, on breaking it up for granulating.—19th December 1872.
29. Stones.—Found at No. 1 dusting house, while sifting F. G. powder for redusting.—20th December 1872.
30. Stones.—Found at No. 1 dusting house, while sifting F. G. powder for redusting.—24th December 1872.
31. Copper Nail and Caked Powder.—Found at Royal Laboratory in a barrel of L. G. powder, marked from examination 1872.—February 1873.
32. Bullets, Cartridges, Caps, &c.—Found in powder received from Purfleet for redusting.—February 1873.
33. Bullets.—Found in F. G. powder, received from Purfleet for redusting.—February 1873.
34. Iron Bolt,  $4\frac{3}{4}$  in. long,  $\frac{1}{2}$  in. diameter.—Found in a barrel of R. L. G. powder by Captain Majendie, R.A.—*Nil*.
35. Refuse, Hair, &c.—Found in powder at Purfleet returned for examination.
36. Copper Chisel, three Drams Measure, Iron, Stones, &c.—Found in powder sent to Waltham Abbey for redusting.
37. Pieces of Iron.—Found while grinding charcoal.
38. Copper Bolt,  $3\frac{1}{2}$  in. long, 1 in. diameter of head.—From the outside plough of No. 6 mill. Found in the bed after causing the explosion of south end of mine.—25th July 1873.

Appendix, No. 20.

PAPER handed in by Major *Majendie*.

Appendix, No. 20. ABSTRACT from REPORTS of MANCHESTER FIRE BRIGADE, furnished by Mr. *Tozer*,  
Superintendent of the Manchester Fire Brigade.

19 December 1864.—A FIRE occurred at A. Cadden's, Gunmaker's Workshop, No. 5, Brook-street.

Before a jet could be attached, three heavy explosions of gunpowder took place, scattering bricks and the contents of the shop in all directions; part of the front wall and sides was blown out, and the rest of the building was in a very dangerous state. Having been informed that a large quantity of gunpowder was stored on the first floor, the superintendent was convinced that if it exploded it would do serious damage to the neighbourhood. The fire was soon after sufficiently subdued to send one of the firemen into the first floor to search for the gunpowder.

Near the partition wall were five casks of loose gunpowder, which were brought into the street.

One of the casks had been broken by the explosion, and part of the contents was spread upon the first floor. Upon examining the *débris*, several cases of gunpowder and cartridges were found.

Before the arrival of the superintendent there were several explosions of a large quantity of fireworks.

4 November 1868.—A fire occurred at A. Shiers' Silk-trimming Warehouse, 13, Dyche-street, Rochdale-road.

The basement floor was occupied by Mr. Lancashire, Chemist, and contained a quantity of oil, saltpetre, resin, and eight extra large casks of loose gunpowder, which was only damaged by water, although the flooring, which was three inches thick, was burned through in four places. The fire was extinguished in about an hour.

18 March 1871.—A fire occurred at J. J. Salis', Painter's Workshop, No. 1, Spring Gardens. On his arrival the superintendent was informed that a quantity of gunpowder was stored between the roof and ceiling over the rooms on fire. The superintendent and chief engineer found about 1 cwt. in casks and cans, which were removed into the street, and afterwards to the detective office. The fire was extinguished in about one hour.

## Appendix No. 21.

PAPER handed in by Mr. *Arthur Vivian*.

I, JOHN HARRISON, of the City of London, Notary Public by Royal Authority duly admitted and sworn, do hereby certify and attest unto all persons to whom these presents shall come, That the hereto annexed sheet of paper contains true and faithful translations from the German into the English language, of two several announcements or notifications inserted, and now appearing, in the Central Journal for Railways and Steamers of the Austro-Hungarian Monarchy, published at Vienna, of the date of the 17th day of November 1869, No. 92. Therefore, full faith should be given thereto, in indicature and thereout. Whereof an Act being required, I have granted these presents, under my signature and official seal, to serve as need may require. Appendix, No. 21.

In London, this 15th day of June, in the year 1874.

(signed) *John Harrison*, Notary Public.

Seal:

(Translated from the German.)

## OFFICIAL REPORT.

DECREE of the Royal Imperial Ministry of Commerce, of the 30th October 1869, Z. 21,371—3,767, to the Collective Railway Directorates, which are in relation with it as to the privilege of the transport of Dynamite on Railways.

As the new experiments as to the liability of the material dynamite to explosion have greatly weakened the fears before entertained by the Ministry of Commerce, and which had induced it to exclude it as an easily explosive substance from transport, either by post or by railway, and have demonstrated rather that the transport of dynamite is much less dangerous than that of any other explosive material at present in use, the Ministry of Commerce is by consequence induced to allow the conveyance of the explosive material known as dynamite by railway under the following regulations and precautionary measures, and declares null the Decree against its transport of the 15th December 1868, Z. 15,956.

1. The conveyance by railway is only permitted by special trains, and under no circumstances by trains conveying passengers.
2. Consignments of dynamite must be indicated by specially coloured consignment notes.
3. Consignments of dynamite must not be allowed to be packed with such articles as are easily combustible, or which, by their ignition, form explosive gases (turpentine, petroleum), and particular care must be taken that no explosive preparation is loaded in the same truck, or in the neighbouring carriages.
4. Dynamite consignments must not be packed in packages that attract much heat; as, for instance, thin sheet iron, but the substance must be enclosed, first of all, in paper, and then in cases or barrels of wood, which must be secured only by wooden bands and wooden nails.
5. Trucks that contain dynamite which it is necessary to leave standing in the station, must only be left upon such rails as there can be no possibility of a collision with arriving trains, even could such be caused by defective shunting or pointing.
6. Consignments of dynamite must, immediately after their arrival at the place of destination, be removed by the consignee.

Vienna, the 30th October 1869.

Appendix, No. 21 DECREE of the Royal Imperial Board for the Inspection of Austrian Railways, of the 11th November 1869 (Z. 1687) to all the Austrian Railway Directors, in respect to the Regulation of the Ordinary Traffic.

The Royal Imperial Ministry of Commerce has, by Decree of the 26th October of this year (Z. 20466-3604), ordered, that from thenceforth no train may depart from a station before the regular time of departure, as given in the published Time Tables. This Decree is made known to the honored Directorates, with the addition that henceforth every departure of a train before the regular time, as given in the Tables, is most strictly prohibited, and that consequently the departure before time, which was permitted formerly by Decree, or the regulation of departures, is now declared no longer permissible.

Vienna, the 11th November 1869.



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