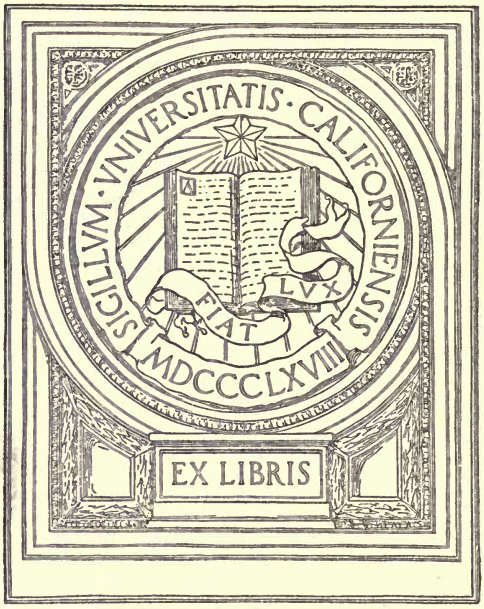
RUSSIAN MINING REGULATIONS.

BY

J. HARPER.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GENERAL REGULATIONS

FOR THE CARRYING ON OF

MINING WORK

WITH A VIEW TO SAFETY,
AS PROVIDED BY

RUSSIAN LAW

TRANSLATED FROM THE LATEST OFFICIAL SOURCES BY

J. HARPER

ALSO,

BRITISH-METRIC-RUSSIAN
CONVERSION TABLES

COMPILED BY

EDGAR RICKARD

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PREFACE

THE foreigner initiating operations in Russia is at first likely to be greatly confused and annoyed by being constantly told that he cannot do this or that thing according to his own designs, because it is against the Government Regulations. Upon investigation, he usually finds that the prohibition is a mere technicality, and can be easily avoided. It is difficult, however, to avoid a feeling of restraint imposed by these Regulations, particularly when one is not familiar with their provisions, and has to be continually reminded of some new instance of proposed violation of the law, with the possibility of a severe penalty.

Like a great many other things that we are prone to fear until we have seen them near at hand, these Regulations improve upon acquaintance, and become in reality a protection to the engineer rather than a hindrance to his operations, because, if observed, they

stand between him and almost any eventuality likely to arise from the carrying forward of work. In special cases not provided for in the Regulations, it is usually possible to get permission to proceed by simply furnishing the Mining Authorities with plans and descriptions of the proposed undertaking. This was done in the case of sinking inclined shafts (which are not provided for in the Regulations), the use of locked coil hoisting ropes, etc.

A few words on the subject of organisation, and the carrying forward of operations in Russia, from one who has been connected with the development of an enterprise involving various industries such as copper, iron and steel, lumber, etc., may be useful by way of preface. The first and most important study for a foreigner intending to conduct operations in Russia is the character and point of view of the Russians themselves, especially the Russian workmen. He will find vagaries of character which at first seem peculiar and mystifying, but which are easily understood after he has been able to adjust himself to the point of view. The most salient characteristic of the Russian workman is his constant suspicion that one is trying to drive the

hardest possible bargain with him, and, whatever may be done to better his position, his failing is to believe that there is some ulterior motive. Otherwise, I have found them willing, industrious, and capable of very efficient and satisfactory work in every department. I would compare them with foreign workmen in the following order :—Iron and steel workers, of the first class. Designers and draughtsmen, master mechanics, machinists, fitters, blacksmiths, etc., fully as good as ordinarily found in England or America. Carpentry and woodwork not so highly developed as a trade, but quite efficient as far as the type and style of building usually adopted in the country goes. Stone and brick work has to be designed fully 25 per cent. heavier than we are accustomed to, because the masons do not appreciate the importance of bonding. The cost of work is too large a subject to deal with here, but, with the exception of dwellings and structures, the material for which comes from abroad, the cost usually figures about 40 per cent. less than it would, say, in America. This also applies to industrial operations, such as mining, smelting, etc., into which labour enters as a prime factor. Staff organisation

is usually complicated and elaborate ; salaries are comparatively low, and the tendency is to have more departments and heads thereof than is customary in other countries. Good technical talent, as far as education goes, is plentiful, and they quickly adapt themselves to modern practice, showing the keenest enthusiasm and desire to excel. I believe it to be in the best interest of foreign companies to employ Russian foremen in all cases. When a new process or system of work is being introduced, experience has shown that this is best done by a Russian acting under the advice of the specialist from abroad, until the thing is successfully inaugurated. Administrative ability is quite another thing, and is just as hard to find in Russia as in other countries.

It is customary to quarter all employees at company's expense. This entails a large expenditure not generally required elsewhere, with attendant responsibilities for sanitation, etc. Terms of employment are regulated by law, which requires that workmen shall, if discharged (except for cause), be given two weeks' notice or two weeks' pay. On the Ural estates it is customary with salaried employees

who have been one or more years in the company's employ, to give two months' salary if discharged without cause. The foreigner will find the Russians always ready to meet him more than half-way with kindness and consideration. They are quick to recognise, and have the profoundest respect for, specialised ability, and are by no means backward in adopting ideas of practice which tend to elevate the standards of efficiency and economy. This spirit will, in time, enable the Russian engineer and artisan to take a place in the ranks of the world's industry commensurate with the vast resources of the country, the development of which has hardly yet commenced.

T. J. JONES.

PUBLISHER'S NOTE

As this translation was intended more particularly for metal mines, three sections, *i.e.* XI., XIII., XIV., dealing exclusively with coal mining regulations, have been omitted.

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REGULATIONS

FOR THE

CARRYING ON OF MINING WORK WITH VIEWS TO ITS SAFETY

I.—General Regulations

§ 1. The deaf, blind, dumb, and crippled in such a way as hinders working, and also those, on the decision of the Mine Doctor, generally unhealthy, must not be allowed to work in mines and mining industries.

Workmen having any kind of physical defects may be allowed to work not otherwise than by the decision of the Doctor, and to them may be assigned only such work the fulfilment of which may not, by reason of the physical defects of the workmen, cause danger to themselves or others.

§ 2. Intoxicated men must not be allowed to work in mines and mining industries. It is forbidden to take to work strong drink.

§ 3. Those under age, from fifteen to seventeen years of age, are allowed to work under ground only on Doctor's testimony that they can, by their physical and general condition of health, withstand the unfavourable influence of this work without special detriment.

Those of from fifteen to seventeen years of age may in no way be employed on the following more dangerous underground work, such as: shaft sinking, transport and use of explosives, extinguishing of fires, rescue work in connection with explosions of mine gases, and in the capacity of miner, raker at faces, sledgeman at faces, timberman, filler and shootman, brakesman and receiver. In like manner, such workers must not be employed at the mouths of shafts being deepened.

Workers under fifteen years of age must not be appointed to surface work: at hand winches, at brakes, and for tramming in wheelbarrows or trucks by inclined ways.

Those from fifteen to seventeen years of age may be employed in sorting and loading of mined materials, shifting and tramming of trucks, turning of the hand ventilator and other subsidiary occupations. Such workmen work-

ing on the turning of the ventilator must not work more than 8-hour shifts, and must have in the course of such shift at least half an hour's rest. In working for over eight hours at this work, there must be a double complement of workmen. During the half-hour's rest the workman at the ventilator must be relieved by another.

§ 4. Each workman noticing danger for people or for the mine must immediately inform the Management.

Before starting work the head, or most experienced, workman of the gang must testify as to whether all the appliances, etc., serving the gang in the course of work, and all the safety appliances in the region of his work, are in satisfactory condition. Defects noticed by him at this time, or arising during the course of work, he must immediately put right, and, when possible, report as to such to the immediate Management.

On change of shifts at the faces, the workmen knocking off work must call the attention of the following shift to possible unfirmness and dangers.

§ 5. For reclusive faces of underground work it is necessary to appoint experienced

miners. Novices may only be sent to work at faces together with experienced miners.

For dangerous faces it is necessary to assign only experienced workmen, and the members of the Technical Staff must immediately instruct and show them the means of working and timbering.

§ 6. For underground workings confined to a definite area it is indispensable to form not less than once a week a gang of from five to twenty workmen, which, in the company of the chief bosses or steigers or Superintendent, must descend by one shaft or drift-way and pass through all the workings, ascending by means of another shaft or drift-way. The Steiger or Superintendent going with the party is obliged each time to enter in the book instituted for that purpose (enumerating all the steigers accompanying the workmen) as to the fulfilment of the obligation put upon him, and testify that both surface and workings are in perfect good order, or indicate what is not in order.

In underground workings in reclusive places the bosses are obliged to acquaint all the workmen under them with the lay-out of the workings leading to the mine exit.

Note.—It is indispensable from time to time to change the position of the workmen, taking from other levels and other gangs, in order to introduce a large number of them with the lay-out and state of the workings.

§ 7. Between the sundry categories of employees engaged in looking after the safety of the work at the pit or mine, must be an exact and combined distribution of duties with a view to mutual assistance. As to such distribution, and also as to the number of persons included under each category, the Mine Owners, or Mines Management, is obliged to report to the District Engineer. In cases where the District Engineer suggests changing the distribution as submitted to him, and the Mines Management is not agreeable, the District Engineer reports as to same to the Mining Department, whose decision must be respected.

Each working face must be visited by Members of Inspection: by the Steiger not less than once every forty-eight hours, and by the boss twice per shift in coal pits and once per shift in other mines. The number of visits to faces of coal mines may be reduced by the

District Engineer to once per shift if the pit does not contain dangerous workings.

§ 8. In the case of any workman sustaining even slight injury, he must at once, and in any case before the end of the shift, inform the immediate Management, that he may be rendered prompt medical assistance.

§ 9. All workmen must be supplied with numbers, according to which there must be kept an accurate account of the number of workmen entering and leaving the mine ; and in the event of a difference in the number of workmen, the reason of same must be immediately made clear.

§ 10. For each working in the mine in which are engaged not less than twenty men, must be provided a stretcher, and for all workings in mines and open-cuts there must be at hand for the Technical Staff the necessary bandaging materials, and means indispensable for rendering first-aid in connection with accidents.

Further, all Members of the Inspection, and also some workmen, must be familiar with the rendering of first-aid, and in the mine office must be exhibited comprehensive instructions prepared by the Mine Doctor.

§ 11. Access to mine premises and stores, to shaft-head buildings, and to all departments underground or on the surface in which are engines, boilers, or other mechanical appliances, is allowed only to workmen appointed for work in these places, the Technical Staff, and to Members of the Administration in fulfilment of official obligations.

Other persons may be allowed into these buildings not otherwise than with permission of the Mine Management, and then always in the company of an experienced conductor.

At the entrance to such like premises must be exhibited notice boards with suitable inscriptions.

People bringing food to workmen must not be admitted to works premises or to the sites of mine workings.

All doors of mine or workmen's premises must open outwards.

§ 12. Ways, in which workmen move about, both in the mine and on the surface, must always be in good order, so that workmen using them are not exposed to any kind of danger.

Walking along the mine railway surface tracks, as also crossing the lines, is allowed

(excluding such persons as belong to the Railway Department) only to Superintendents, Overseers, or Inspectors, and men working on the track; other persons may cross the line only at the places specially intended for this purpose.

§ 13. It is forbidden to damage all such appliances as are arranged for the safe carrying on of work, and also for guarding the life and health of workmen, especially appliances for ventilation and for carrying off of water. In the event of damage to such becoming manifest, it is necessary to immediately inform the Mine Manager of same.

Those persons who, by the demands of the work, are obliged to open flood-gates (?) or temporarily remove safety constructions, are obliged, at the expiration of the necessity for the alterations, to put things back into their former order, having informed the Mine Inspector as to such.

Persons not familiar with such work are absolutely forbidden to temporarily open or remove flood-gates and safety appliances.

§ 14. The responsibility of boss or contractor overseeing separate jobs in mines and mine workings must only be assigned to

(on the responsibility of the Mine Manager) persons having worked in mines in the capacity of miner, timberman, or workman on the mechanical mining appliances (constructions) *not less than* three years.

Note 1.—On open-cuts such obligations may (with the permission of the District Engineer) be assigned to bosses and persons having worked for less than three years in the capacities shown in the above paragraph.

Note 2.—For those having finished special schools or courses of instruction, the period of study is considered as practice.

§ 15. At damp faces where there are heavy streams of water, workmen must be provided with waterproof clothing. The possibility must be afforded to the workmen, on leaving the shaft, of drying and changing their clothes in a warm building. Further, in the mine stores must be kept a sufficient stock of waterproof clothing for supply to the workmen.

§ 16. Workmen subjected to danger (injury to the eyes) from flying chips, etc., must be provided with glasses or goggles or nets gratis by the Management, who must see that in expedient cases such appliances are put into

practice. In boring, especially with perforators, it is necessary to moisten the holes with water, or adopt other means for nullifying the injurious influence of dust.

§ 17. For mines with a temperature of more than 25 deg. C. (20 deg. R.) exact thermometers are prescribed, and correct observations of the temperature must be made at suitable faces. At faces where the temperature exceeds 28 deg. C. (22½ deg. R.), observations must be carried out at least once a week and the results of same written up.

§ 18. In underground workings where the temperature exceeds 30 deg. C., workmen must not be engaged for more than six hours in twenty-four.

In places where the temperature is above 40 deg. C., work is allowed only in cases of extreme necessity, and the workmen must be changed as often as possible, and the general duration of a man's work, including interruptions, must not be more than six hours.

At faces with a temperature higher than 35 deg. C., independent of the 6-hours working, must be carried out a periodical renewal of shifts in such a way that no separate workman, even willingly, should be engaged in such

places for more than one month at a time, and that he should not again start such work earlier than after the lapse of at least one month. The shortening of this term is allowed only by permission of the District Engineer, who is guided by the Doctor's opinion.

At each mine, underground and on the surface, must be a supply, at all times accessible, of good drinking water for the workmen. The water must be kept in covered vessels in places fixed by the Mine Management. These vessels must, as often as possible, be submitted to careful cleaning with hot water. The soiling or dirtying of vessels is forbidden.

§ 20. Sleeping in the mine, and unnecessarily going to other drives, is forbidden. Workmen are not allowed to rest or sleep in dangerous places on the surface, as, for example, near to engines in operation, transmitting arrangements, on boiler and fireplace brickwork, etc.

§ 21. All underground workings which threaten danger must be covered in. Without permission entrance to such workings is forbidden.

Workings in which work is temporarily

stopped must be closed in by lattice-work fences. The entrance of workmen without the permission of the Mine Administration is forbidden. In like manner is forbidden the extraction of timbering from old workings.

§ 22. All littering or dirtying, by means of refuse, of places where mining work is being carried out is strictly forbidden.

Refuse and putrid matter must be completely removed from mine workings.

§ 23. In mines there must be arranged privies for workmen, to the disinfecting and due emptying and cleaning of which special attention must be paid. For each thirty men working in the mine at one time there must be at least one privy.

§ 24. For open workings and generally for workings under the open sky, must be arranged in the near vicinity roofed buildings under which workmen may, in bad weather, take cover.

§ 25. In populated places, and near roads and footpaths, excavations, as also other workings from the surface, presenting danger, must be carefully covered or fenced in.

§ 26. Hot slag and cinders from under steam boilers must be carted away to special

dumping places. These must not be scattered about the exits of coal and brown-coal workings or where hot gases could gain access to underground workings. Such dumps must be placed at a safe (in reference to heat) distance from neighbouring buildings and mine constructions and workings. Near these dumps must be exhibited caution boards.

§ 27. At each mine, in the underground workings, must be kept stocks of materials for timbering, and also candles, lamps, ropes, sticks which are driven into the earth to serve as ladders, etc., in readiness for the saving of people, and putting things right after chance landslides.

§ 28. Workings in all mines must be made so that the workmen are always assured of reliable and perfectly free access to the surface or to places of safety.

§ 29. The owners of mining properties, or those duly authorised by the owners, are obliged to prepare and hang in conspicuous positions on their property regulations referring to the order and safety of working; these rules are subject to the preliminary inspection and confirmation of the District Engineer. All paragraphs of these regula-

tions affecting the obligations of the workmen must be embodied in special notices exhibited in conspicuous places, and likewise must be embodied in the pay-books supplied to the workmen. Workmen unable to read must be made familiar with these regulations by verbal explanation of the Technical Staff.

II.—*Re* The Construction of Entrances to Workings

§ 30. Every mine in operation (excepting those workings dealt with in Part IV. of the present Regulations) must have at least two separate exits to the surface, fitted with all appliances for the movement of workmen in them, and standing one from the other at a distance of not less than 14 sagenes (29·87 metres); and in cases where the shaft-head buildings are constructed of fireproof materials, not less than 10 sagenes (21·34 metres). If the shafts serve as these two exits, then if their depth is up to 75 sagenes (160 metres), in each of them it is indispensable to construct stairways. If the depth is more than that mentioned, then in one of the shafts there may not be a stairway, if there are in the shaft two mechanical hoisting arrangements, whose

sources of energy are completely independent of each other. Exits must be so arranged that in the event of the inaccessibility of one of them, all workmen from all levels and from all parts of the mine can be delivered to the surface by means of the other.

For small mines the District Engineer may allow the setting aside of the regulations as to the distance between the two separate exits to the surface; however, for shafts, this is allowed only in cases where the shaft-head buildings are constructed of fireproof materials. In the opposite case, on the contrary, the distance between the exits must not be less than 14 sagenes (29·88 metres).

On deepening one of the shafts to a new level, it is necessary at the same time to take into consideration the joining up of same with the second exit to the surface.

The mouths of the two shafts serving as exits must not be in one and the same building. Exception is allowed when the head frames and buildings enclosing same are made of fireproof materials.

The mouths of small shafts and those excavations by means of which is carried out the lowering and raising of workmen, and also

of mined materials and other loads, must be covered by canopies.

In reference to mines already in operation, the setting aside of these regulations (excluding the number of exits) is allowed only at the time of prospecting or development work; in all other cases the permission of the Mining Department is essential. The regulation as to the minimum distance between the two exits to the surface applies also to newly opened-up mines.

> *Note.*—On the opening up of new mines, when the two projected exits are not yet connected up to each other, it is permitted to have only one exit, but the chief aim of the underground work at such time must be the connecting up of the projected exits.

For underground auriferous workings in a continually frozen state, the carrying out of development (or preparation) work is permitted with only one exit to the surface, but the working out of the deposit is allowed not otherwise than with two connected exits to the surface, exception being made for insignificant or small deposits which may, with the permission of the District Engineer, be

entirely worked out with only one exit to the surface.

§ 32. In the event of one exit becoming useless for the movement of workmen, and remaining so for more than three months, advice as to this must be supplied to the Mining Department, through the District Engineer.

III.—*Re* Strengthening (Timbering) of Workings

§ 33. All workings must be soundly timbered (strengthened) corresponding to their importance and length of service in all cases where the earth through which the workings pass does not possess the necessary stability and strength.

Note 1.—In earth of complete solidity and strength, working without timbering is allowed under condition that shaft-shaped workings shall be of cylindrical form, and that tunnel-shaped workings shall be made with arched roofs.

Note 2.—In continually frozen ground it is allowed to carry out work in the winter without timbering only in such cases where the walls and the roofs of the workings remain during work in a

frozen state, and also under condition that tunnel-shaped workings shall be made with arched roofs, and shaft-shaped workings in cylindrical form; shaft-shaped workings of right-angled section must be, in spring time, timbered for from 2 to 6 arshines (1·43–4·26 metres) from the mouths.

§ 34. In strengthening mine workings with timber, the thickness of the beams used must conform to the degree of pressure which it is anticipated will be put upon them.

§ 35. If in cracked and generally unsound earth are placed wooden beams at some distance apart, the open intervals of roof between them must be closed in with boards, or planks, etc.

§ 36. Separated, without accessory timbering, posts, cross-beams, door timbering, and props, and also posts and supports of several separate cross-beams, with their ends fixed into the walls of the workings, must be arranged corresponding to the pressure and nature of the earth, and also with the width of the working.

§ 37. In friable, sandy, and quickly disintegrating earth, shaft-shaped workings must of necessity be primarily strengthened by

drive-in stakes, or, generally, temporary timbering. On the completion of working out, or, if such proves to be indispensable on account of the extension of working, the temporary timbering must be replaced by close set timbering or another kind of strong timbering.

§ 38. Box timbering, supporting filling, in steeply-inclined workings, must be constructed in accordance with the nature of the working. In workings which are intended to serve a considerable time, as, for example, levels and tramming drives, timbering must be carried out, if the safety of the work demands it, by means of close-set timbering, and in workings with a less prolonged term, as, for example, intermediate and air drives, the filling may be supported by means of separate upright beams and cross-beams with boards between them covering the roof of the working. In wide levels, in the event of evidence of considerable pressure, the roof timbering must also be strengthened by supports or other reliable means, and there must be left at the roof a safety thickness of earth.

§ 39. In tramming drives, slopes, and shoots, not walled by columns, independently

of the fixing up of auxiliary sets in front of faces, when extracting continuously and transversally there must be formed walls of stone. Mine rubbish thrown against the walls must not contain materials capable of self-combustion. In the event of the absence of stones for the walls, the latter may be substituted by solid timbering.

§ 40. In downward-sloping deposits of coal or brown-coal, where is produced oxyhydrogen gas and coal capable of self-combustion, it is not allowed to leave posts in the earth when same are used for support. In the event of necessity, posts must be formed of extracted stone.

§ 41. Seams of coal declining at more than 30 deg., with a thickness of more than 3 sagenes (1·40 metres), must be worked out with filling of the spaces with wet sand. If, owing to local conditions, there are met serious economical obstacles to the use of wet filling, dry filling may be used instead, with the permission of the District Engineer.

The working out of the seams indicated above, with extracting of the roof, may be allowed only under condition that there exist specially favourable conditions; and then not otherwise

than with the approval in each separate case of the Learned Mining Committee.

§ 42. In flat-lying deposits of coal the cleaning out of workings in the low-lying seams before those lying above, can be allowed only under the following conditions :—

(*a*) When the veins lying above cannot, by economical or other reasons, be worked out at all.

(*b*) When the lower-lying seam is worked out with complete filling of the spaces made by means of waste earth, and

(*c*) When the distance between the low-lying seam (of small size) and the high-lying seam is sufficiently considerable that the working out of the lower seam can have no effect on the solidity of the upper seam.

> *Note.*—For the large coal seams of the Dombrovsky Basin, worked out with the system of extracting the roofs, the distance shown under letter "(*c*)" must be not less than thirty times the size of the seam worked out below.

§ 43. In pits working on large declining seams of coal, with extracting of the roof as part of the system, the use of side timbering is indispensable. The leaving, instead of

side timbering, of safety columns of coal, known as "legs," is forbidden; such columns must be entirely extracted. In the same way, it is not allowed to leave at the roof a layer of coal of more than $\frac{2}{3}$ sagene (0·314 metre) in thickness.

§ 44. In working with the extraction of the roof, the pulling out of timbering and pulling down of the roof must be carried out under the guidance of a Superintendent, who must be a completely reliable and experienced workman. The extraction of timber, with a view to using same again, from thin seams up to $1\frac{1}{2}$ arshines (1·067 metres) is allowed not otherwise than with permission of the District Engineer in each separate case.

§ 45. Working out by fires and such like means is allowed only for the mining of such products as iron ore, building stone, clay, sand, phosphorite, and so on; and then only with filling of spaces made with waste earth or with the leaving of posts—or columns—with suitable timbering.

§ 46. In friable, sandy, and quickly disintegrating earth, shaft-shaped workings must of necessity be primarily supported by drive-in stakes, or, generally, temporary timbering. On

the completion of working out, or, if such proves to be indispensable on account of the extension of working, the temporary timbering must be replaced by set timbering or another kind of strong timbering.

§ 47. In cracked and generally weak earth, it is necessary to strengthen each shaft-shaped working with suitable timbering, and leave at the side of same for greater stability safety pillars of earth. These latter are shown on the mine plans, and may be in part or in whole worked out only with permission of the District Engineer.

Note 1.—The timbering of excavations, small shafts, and well-shaped workings is carried out in accordance with the paragraph of rules *re* working out of deposits by means of well-shaped workings.

Note 2.—In gold and platinum mines, in the working out of veins at an insignificant depth (20–25 sagenes—46·67–53·34 metres), it is necessary to leave at the side of the shaft-shaped workings, for greater strength, safety pillars, which may be extracted under the indispensable conditions that they are replaced by pillars of stone, closely timbered on all four sides.

§ 48. All capital shafts serving for delivery, lowering, and hoisting of workmen, and for pumping, and also all other shafts by which is carried out hoisting and lowering, even though temporarily, must be minutely, at least every two weeks, inspected under the superintendence of the Manager of the shaft or mine, or person appointed by him. If any kind of danger is noticed, the work must be immediately ceased in these shafts, and, in the event of necessity, the timbering of same must be reinforced. Every such like inspection must be entered up in a book, indicating the defects noticed, the time of inspection, and the persons carrying out same, after which the book must be put before the Works Manager or his substitute.

As to shafts serving for the regular hoisting and lowering of men, then in such, apart from the above-mentioned inspections, under the direction of the Shaft Superintendent or person appointed by him, the Works Manager or his substitute must, by personal inspection not less than four times a year, check the condition of the timbering, and the results of the inspections must be entered up in the same book. If it is intended to reconstruct

a considerable portion of the shaft, in which it is proposed to replace the old timbering by new, then as to the commencement of the work, and the projected manner of carrying out same, it is indispensable to advise the District Engineer. Substantial retimbering and other important alterations in the timbering of the shaft must be entered on the plans, with indication of the manner and time of the carrying out of same.

§ 49. In development work on coal deposits, and also in worked-out deposits, in the event of the necessity of leaving safety columns, these must be of suitable dimensions for avoiding their being crushed and the breaking out of mine fires.

IV.—*Re* Movement of Workmen in Workings

1. *In Horizontal and Inclined Workings*

§ 50. In cases where the hauling of loads is carried out by single-line railways, between the trucks and walls of the working must be left a free space by which workmen may pass by. In narrow workings the walls must have niches, for the accommodation of workmen whilst the truck is passing. The number of

such niches must correspond to the amount of traffic and number of workmen.

§ 51. Ditches, or water-ways of considerable depth, in workings where workman move about, must have strong flooring (covering).

§ 52. In workings where there is not continual illumination, the movement of freight and workmen without lights is forbidden. Trammers must place themselves, with their trucks, not nearer than 5 sagenes (10·67 metres) one from the other on horizontal ways, and not nearer than 15 sagenes (32 metres) on inclined ways.

§ 53. The trammer's or carter's light must be visible to those approaching him. The driver is allowed to sit in the truck and guide the horse by means of reins only when the size of the working ensures that by so doing he will not be subjected to danger. Horse tramming in workings is allowed only at walking pace.

§ 54. In horizontal drifts with mechanical tramming (also serving for the movement of people) at a speed not exceeding 42 sagenes (89·610 metres) per minute, there must be left on one side of the track a free space not narrower than 18 vershoks (80 centimetres).

For speeds exceeding the above, the space along the side of the track must be fenced off.

§ 55. In workings where lights go out or burn with an abnormal flame, owing to the presence of injurious gases, and insufficiency of ventilation, locomotion is forbidden. In such events the steiger or boss at the time on duty must be informed.

Locomotion in workings (in the locality of which has been a mine fire) is allowed only after preliminary investigation by the Mine Manager.

Rising workings (winzes, etc.) before the starting of locomotion must be tested with a lamp, and in the event of the lamp going out locomotion by such workings is forbidden.

§ 56. In bad daylight surface tramming tracks, and also tracks for the movement of workmen, must be illuminated to a sufficient degree.

§ 57. Estocades or throw bridges in open workings on the surface must be floored with thick boards or joists for the whole of their length except the discharge holes. In heights of more than 1 sagene (2·134 metres) they must be provided with hand rails on both sides.

The absence of hand rails on estocades at places where at the present moment is being carried out the unloading of trucks by turning them on to their sides is permitted under condition:—(1) That the estocades have double tracks; (2) That they are well lighted at night time.

Note.—The requirements of the above paragraph do not refer to estocades with mechanical traction, and turning over of trucks, if the appliances serving this purpose do not demand the presence, or moving about, of people on the estocade.

§ 58. Slopes or inclined shafts, by means of which is carried out the movement of traffic, must not serve as ways for the movement of workmen, and only in exceptional cases where the leading through of a special drift-way is impossible or too expensive (which must be testified by the District Engineer) is allowed the making of a way in the same shoot or inclined shaft for the movement of workmen, separated from the railed track by strong sets and closed in with planks or boards.

§ 60. When a drift, inclined at more than 30 deg., serves for the regular movement of workmen, and in the absence of a ladder,

such drift must be provided with hand rails or barriers for support.

Moving about and passing through those inclined shafts, shoots, and slopes, by means of which is carried out hoisting, is allowed only to the Manager of the mine, steigers, and those persons who have to look after these workings.

When the hoisting machinery in inclined shafts and shoots is in operation, the entrance to the place where the coupling and uncoupling of wagons or trucks is carried out is forbidden to persons not engaged on this work.

The movement of wagons by steeply-inclined shafts may be allowed only in the presence of complete protection for those working below.

§ 59. Workmen are not allowed to take advantage, for the purpose of travelling, of platforms, counterweights, and trucks in vertical or inclined shafts and slopes, either on the surface or in the mine.

For transgression of this rule the brakesman and receiver are held responsible if such transgression takes place within their view.

Exception is allowed for the transport of those severely injured or suddenly taken ill.

Members of Inspection are allowed to take advantage of such means only for the purposes of inspection.

2. *In Vertical Workings and Workings inclined at more than 45 deg.*

§ 60. The lowering and raising of workmen in shafts may be carried out with cages or tubs of large dimensions (enclosing a man to the waist) and, in the case of development work, in nooses.

§ 61. In all shafts serving for the raising and lowering of workmen and freight, as also in shafts being deepened, must be arranged stairways from the mouths to the lowest levels. When such shafts attain a depth of 75 sagenes (160 metres), in each of them the construction of mechanical hoisting is indispensable—stairways are not essential for those shafts for which there are two mechanical hoists with entirely separate, one from the other, sources of energy. Under ordinary circumstances workmen are allowed to descend only by means of the shaft specially intended for this purpose—as to this a notice must be exhibited. In extreme cases, threatening the life of the workmen, the latter are permitted

to make use of all exits from the mines and of all hoisting appliances.

§ 62. In all shafts (with man-ways) inclined at more than 65 deg., must be constructed platforms for resting, at a distance not greater than 3·75 sagenes (8 metres) one from the other. In cases where this is impossible of fulfilment, as, for example, in temporary winzes, there must be at least seats alongside the steps at the above-mentioned distance apart.

§ 63. Shaft stairways must be constructed at an angle of not more than 80 degs., the steps must everywhere provide suitable foot support, and the point of support of string boards must be made as much as possible above the cross-bars of the platforms.

The trap-doors on the stairways must not be larger than the convenience of passing through demands. When stairways are being replaced, the openings on same must be closed up, or adequately guarded by rails.

Above the mouth of the shaft and above every shaft landing-place, the stairway must project at least 0·5 sagene (1·067 metres), or above the opening of the landing there must be fixed in the wall of the shaft strong iron bars.

The steps of wooden shaft-stairways must be securely fixed to the side-boards, and the stairways themselves must be sufficiently strong, firmly timbered, and so constructed that they are not above the openings in the landings, and the opening above the first flight of stairs must be closable.

When stairways cannot be at once fixed as is necessary, they must be at least suspended by means of stable hooks.

Wire ladders are permitted only for temporary use; they must be stretched out and fastened at both ends, and, when longer than 3·75 sagenes (8 metres), they must also be fastened in the middle.

The use of vertical ladders is forbidden except for deepening shafts, slopes, and winzes, with a depth of less than 5 sagenes, and in such cases they must be fixed in such a way that the steps stand out 6 in. from the wall of the working.

§ 64. Ladders must be kept in good condition, and the steps must be cleaned of dirt and ice.

§ 65. Stirrup-ladders (*i.e.* a beam with sticks fastened across same) are allowed only in exploration, or such like temporary workings:

they are always constructed at an angle, and must be so fixed that the ladder projects 0·5 sagenes (1·067 metres) above the opening of the working, or above the landing there must be fixed strong bars.

Stirrup-ladders longer than 3·75 sagenes (8 metres), or with worn-out steps, making movement by means of same difficult must not be allowed.

§ 66. The space between the ladders and the side of the working must be guarded by means of wooden rails or ropes.

§ 67. In vertical shafts and winzes not deeper than 7 sagenes (14·935 metres), and drifts which are not yet connected to the other shaft, serving for the movement of workmen, the lowering and raising of the latter by the stairways is allowed also in the hoisting compartment or beside it, without special partitioning, but only at such time as the lowering and raising of freight is not in operation.

§ 68. In cases when, during lowering and raising, workmen must have with them tools, the latter must be so tied together and secured to the workman that nobody may suffer through the accidental falling of any of such tools. In cases of workmen wearing boots

with wooden soles, such boots must be strongly fastened to the feet, so that on movement of the workmen the boots cannot fall from their feet.

§ 69. The descending of workmen by the cable is unconditionally forbidden, as also descending by means of one's own weight with the use of brakes.

§ 70. The lowering and raising of people in tubs is allowed only with the following conditions :—

(*a*) Tubs in inclined shafts must move along rails—and in vertical shafts be directed by guides or move in compartments closely lined with boards for the whole distance.

(*b*) In the use of tubs for the constant lowering and raising of workmen, hempen or aloe cables must be used. Metallic cables are allowed with observation of the rules laid out in pars. 116–132.

(*c*) It is forbidden to ascend standing on the edge of a tub, and also on loaded tubs.

(*c* 1) Lowering and raising in tubs automatically turning over, and with movable bottoms, is forbidden.

(*d*) Lowering and raising in tubs must be carried out at a speed not exceeding 7 feet

(2·13 metres) per second, and under the unremitted attention of the persons carrying out the lowering and raising, and of the superintendents of such work.

(*e*) Over the tubs must be fixed roofs for protecting the workmen against falling articles.

> *Note.*—In the deepening of prospecting shafts, winzes, and shoots of a depth of not greater than 10 sagenes (21·34 metres), the lowering and raising of workmen one by one in tubs and other hoisting appliances is allowed without roofs, guides, and lining of the shaft with boards.

§ 71. In tubs of small dimensions and in nooses, the transport of workmen is allowed only under condition that they are securely fastened to the cable by means of a strong belt passing under the arm-pits.

§ 72. In deepening shafts by means of one or two tubs (in the latter case with compartments in the shaft) and in arranging guides or in boarding the sides of the shaft, the lowering and raising of workmen is allowed on metallic cables.

§ 73. In the application of tubs to work in guides, measures must be taken that the tubs moving in the frames should not, during

hoisting and lowering, be caught anywhere.

§ 74. In the deepening of shafts, for the protection of workmen against accidents which might occur through the falling of heavy articles into the workings, it is indispensable to arrange over the mouths of shafts a platform moving on rails, or some other construction, for closing the mouth of the shaft: for the accommodation of blasters, to arrange safety landings (or platforms) if there are not higher side workings where they can take shelter, or in the absence of electrical firing from the surface, after the departure of the workmen. In arranging safety platforms it is indispensable to have from the lowest platform to the bottom of the shaft a light hanging ladder.

In the deepening of shafts and shoots, vessels for hoisting must not be loaded to the brim.

Materials and tools which are necessary at the time of deepening shafts and shoots, and which project over the edge of the vessel used for hoisting, must be tied to the cable.

§ 75. In carrying on work in shafts by means of hanging platforms made of thick boards,

and also in the renovation of old shafts or slopes, for the clearing away of excavated materials from them, and also, where the height and character of the work makes the men's position dangerous, the latter must be securely fastened to a reliable support to prevent their falling into the workings.

At the time of any working in hoisting compartments of shafts, winzes, and such like, or under them, hoisting and lowering by same must be stopped. In exceptional cases it may be allowed not otherwise than with the taking of suitable measures for protection of the workers.

§ 76. The suspended platforms mentioned in par. 75 must be suspended at least at four points; the cables or chains provided for this must be capable of holding five times the largest load to be put upon them, and the tension on other parts of the chains, hooks, bolts, etc., must not exceed the elasticity of same. The connection of supporting chains to the hanging platform, and also to the hoisting cable, must be such that accidental disconnecting cannot take place.

Note.—In strengthening circular shafts by means of concrete or stone, suspended

platforms are allowed to be hung on three chains, on condition that there are provided three long spare chains, and the definite fixing of same on pins which can be pulled out.

§ 77. Cages serving for the lowering and raising of workmen must have iron roofs: the long sides of such cages must be raised at least 2½ arshines above the floor by means of coarse wire-netting or perforated sheet-iron; and the short sides (or ends) must be made of similar height with the same materials and with movable or take-out frames. In these sides must be left an opening for access to the signal. All cages must have firm, tight floors. Also, cages serving for the hoisting and lowering of men must be fitted with parachutes.

§ 78. The number of men to be accommodated in the cage or tub at one time, and also the average speed of moving, must be fixed by the administration of the mine and confirmed by the District Engineer.

The number of men to be accommodated at one time in the cage must be fixed in the rules for inside order, and a notice as to this must be hung up in the hoisting building at the cages.

In the hoisting and lowering of workmen the speed of the cage must be half that fixed for the hoisting and lowering of freight.

The taking of open, burning lamps with one's self during lowering and raising is not allowed. Cages must be lighted by one or several closed safety lamps or lanterns.

Raising and lowering without illumination is forbidden.

Those being lowered or raised in cages must behave themselves quietly, not change the position they occupy, and not take with them heavy or cumbersome tools.

§ 79. The lowering and raising of workmen in fully-loaded cages is forbidden; but in empty floors of cages it is allowed under condition that the cable has a supporting power six times greater than the weight of the load, and that the cage moves at a speed not greater than that mentioned in the present regulations for the hoisting and lowering of men. For repairing or inspecting the body of the shaft by joiners and smiths, it is allowed to lower the latter standing on the roof of the cage, but not otherwise than with slow motion of the engine; and here, if the cage roofs do not possess barriers, those being

lowered or raised must be secured to the cable by strong belts.

§ 80. Landing-chairs on the level of the receiving platform on the surface are obligatory, and must be constructed in such manner that on movement of the cage from the bottom to the top it can, by its own pressure, automatically open them.

Landing-chairs on intermediate levels are not obligatory, but if they prove to be indispensable, then they must be so constructed that when hoisting and lowering from and to lower levels the cages may pass through these landing-chairs without danger.

Note.—With hoisting appliances of the Këpè system it is allowed to use landing-gates instead of landing-chairs.

§ 81. In the event of the hoisting of freight from sundry levels by means of tubs or boxes (cages) loaded in the shaft itself, then under the appliances for loading there must be fixed constructions for preventing the falling of lumps of earth or material to lower levels.

The sumps of mines must have appliances for preventing cages, tubs, and boxes sinking into the accumulated water.

§ 82. The connecting of cages with wire cables must be carried out with chains or shackles. The joining of cages to wire cables by means of couplings with soldering of the ends of the wires in the coupling with lead, tin, etc., is forbidden, as also is forbidden the direct joining of the cable to the cage. The chain connection of the cable to the cage must be of such dimensions that in the hoisting of the cage by way of open or closed cross-heads, bending of the cable will not be caused. The cross-section of the links of the chain must be suitable for bearing twenty times the weight of the heaviest load to be put upon them. Chains must be replaced not less than after every two years. The connecting of the cable to the cage by means of a welded-iron ring is forbidden: this must be done with a ring and bolt calculated to withstand twenty times the heaviest load to be put upon them. Chains must be so constructed that the links do not jam or stick.

§ 83. In the compartment of the shaft in which is carried out the hoisting and lowering of men, the directing or guiding joists, guiding sheaves and their axles, brakes, parachutes of the cages, the cable for the whole length

of the shaft, and the fastenings of same to the cages, must be minutely examined daily.

The spiral springs of the parachutes must be tested at least every six months, and flat springs at least once a year. The general term of service of springs must not exceed two years.

If, on inspection of the hoisting apparatus, faults prove to exist, then the hoisting and lowering of men must be stopped until the hoisting arrangements have been put into complete order, and particulars of such must be entered into a record book.

The hoisting machine and all its separate parts must be, at least once a year, examined by an experienced mechanic, and the results of such inspections must be entered in a record book, witnessed by the District Engineer, giving the date of inspection and test.

§ 84. Hoisting machines, on being started, must be let up to normal speed gradually when a stretched cable is in use.

The start or finish of a lowering must take place with the machine working slowly, and be completed with caution. In similar manner, movement must slow down in places where tubs meet, if the hoisting is

done without guides either in a lined shaft or compartment of same.

At a certain height above the mouth of the shaft the guides must be brought nearer together, and there fixed safety bars to stop the cage, in the event of an accident, flying under the sheave or falling into the shaft.

Instead of bringing the guides together, special uncoupling appliances may be used, or automatically-acting brakes on the hoisting engine.

§ 85. The hoisting engine must be fitted with two brakes working on the axle-tree of the drum, and placed in such a manner that the machinist, without moving from his position, may freely operate same. The stipulation as to two brakes does not embrace those machines erected before the issuing of the present regulation : on such machines there must be in any case one brake.

The hoisting machine must be fitted with an apparatus for showing the position of the cage in the shaft (an indicator), and an automatic bell, ringing on the approach of the cage to the mouth of the shaft.

The Mine Administration must establish a

system of signals to be given to the machinist (or engineer) for all necessary manœuvres.

The hoisting engine must also be fitted with a self-recording indicator of the speed of movement of the cage. The non-fulfilment of this regulation is allowed, but not otherwise than with permission of the Mining Department.

§ 86. In the event of breakage of the hoisting engine or sticking of the cage or tub, the Mine Administration must have such an appliance as will enable them to extract the passengers from the cage or tub.

§ 87. The Mine Administration must take steps to preserve order during the lowering and raising of men.

§ 88. The use of cast-iron for shafts, cranks, and connecting-rods of hoisting machines is not allowed.

§ 89. The Manager of the Works must appoint to the hoisting engines only experienced machinists. The working day of machinists engaged on the hoisting and lowering of men must not be of more than eight hours.

During the hours in which is carried out the lowering and hoisting of shifts of work-

men, on such engines there must be, besides the engineer on duty, another in reserve.

On the lowering and raising of men must be employed only such machinists as the Mine Administration admits to be experienced and knowing their business; and, further, the appointed persons must give written obligation (to be entered in a special record book) to conscientiously fulfil all the stipulations of these regulations.

The machinist has no right to start up hoisting appliances until he is convinced of the correctness of their condition.

The machinist is obliged to inform the Manager of the Works about all damage to the hoisting machine or steam transmitters noticed by him. In extreme cases, it rests on the Manager of the Works to authorise the use of a damaged machine for the hoisting and lowering of men, *i.e.* before repairs have been effected.

All noticed damage must be entered into the Journal of Hoisting and Lowering. In the entries it is necessary to show not only the time of discovery of the damage, but also when a stoppage of hoisting took place, and how long such stoppage lasted.

§ 90. For the lowering of pumps and other heavy articles into shafts, there must be arranged a winch with transmitters, which must be fitted with a brake and ratchet wheel, or a double transmitting apparatus (for one and the same transmission, two wheels and two chain wheels).

§ 91. The simultaneous hoisting and lowering of men from several levels is allowed only with a double signalling system, for example, light and sound signalling.

At the time of hoisting and lowering there must be at the head of the shaft, and in the mine yard, responsible landers.

Landers on the surface and Members of Inspection may use the hoisting appliances, in the absence of the above-mentioned landers in the mine yard, in cases when work in the mine is not in progress.

The landers must keep order in connection with the entrance and exit of men from the cages, see that men are lowered or raised in their proper turn, and supervise the shutting of the cage and the giving of signals.

Workmen being lowered or raised must absolutely comply with the requirements of the landers.

The number of men lowered and raised must be known to the chief of the lowering and raising, and must be entered with his signature in a special book.

As responsible landers it is necessary to appoint reliable and experienced persons, not less than twenty-one years of age, and who have worked in mines for at least two years.

§ 92. The Managers of Mines in which the hoisting and lowering of men is carried out by means of horse winches, are obliged to inform the District Engineer of this, except in cases shown in connection with par. 70 ; and, further, must indicate to the engineer the levels of hoisting, with drawings and descriptions of the hoisting appliances.

§ 93. The hoisting and lowering of workmen must take place under the guidance of a responsible person, as to the appointment of such the Management of the Mine is obliged to inform the Dictrict Engineer in writing.

§ 94. During progress of work access to the hoisting compartments of the shaft, and also passing through the same on a level with the mine yards, is strictly forbidden, and as to this there must be exhibited notices in all mine yards.

At all stopping-places in the shaft it is necessary to construct, for the safety of the workmen, mine yards (*i.e.* recesses in the side of the shaft), and workings for passing round from one side of the shaft to the other in the event of necessity. Free portions of the manways may substitute these workings.

§ 95. In the event of unsatisfactory natural lighting, mine yards and mouths of shafts must be well illuminated by special permanent lamps throughout the whole shift, even though work is stopped for a time.

§ 96. In hoisting shafts where the hoisting and lowering of workmen in cages is not permitted, such is allowed only to the Manager of the Works, and those instructed by him to repair or inspect the shaft.

§ 97. In mine yards, the mouths of shafts and winzes, in which is not allowed the use of mechanical appliances for hoisting, such prohibition must be plainly written on boards hanging in conspicuous places.

§ 98. Workings in which is carried out the lowering and raising of men or freight must have signalling arrangements from the surface to the bottom and back. In the event of the application of electric signalling, it is

indispensable to have also another system (wire or rope).

The signal rope must be easily accessible to people in the cage.

Those superintending the lowering and raising must know the meaning of the signals, and give and receive them with special attention. The persons appointed for such work must be experienced and reliable.

In the event of a considerable separation of the hoisting mechanism from the mouths of the shafts, as also between mouths and mine yards, there must be arranged speaking-tubes or telephones: exception to this regulation is allowed by special authorisation of the District Engineer.

The Manager of the Works is obliged to acquaint with the present regulations persons: (*a*) appointed by him for the inspection of hoisting gears and mechanism; (*b*) overseers of the hoisting and lowering; and (*c*) those giving signals. He is also obliged to see that near the shaft on the top receiving-place, and also in the surrounding buildings, are exhibited notices in which is stated—

(1) The surname and Christian name of the boss or overseer to whom is en-

trusted the supervision of the hoisting and lowering of workmen.

(2) The hours in which is carried out the regular hoisting and lowering of workmen.

(3) The signals used; and

(4) The number of persons that may simultaneously be hoisted or lowered in the cage.

§ 99. If at one time is carried out the seating and unseating of workmen from several floors of a many-floored cage, then at each reception platform must be a special lander giving signals for hoisting or lowering to the chief lander: in the mine by means of tubes, and on the surface by means of levers.

Having received the signals from the corresponding floors, the chief signaller signals the machinist. The lander must be on that side of the cage by which workmen enter or leave same.

Signals to the machinist are given only by the chief signaller at the mouth of the shaft, or, if the hoisting is between two levels, by the receiver on the upper level.

In the deepening of shafts signals may be given to the machinist by the workmen through the medium of the lander.

§ 100. At every shaft in which is carried out hoisting and lowering of men by means of hoisting mechanism, there must be special record books, authenticated by the District Engineer, in which the Mine Manager is obliged to enter all the requirements set forth in pars. 83, 89, 91, 109–111, and 123, and also that part referring to the testing of parachutes, signals, the names of responsible persons engaged on the testing of hoisting appliances, the names of receivers at the mouths of the shafts and at the different levels.

3. *The Lowering and Raising of Workmen in Excavations, Shallow Shafts, and Well-shaped Workings*

§ 101. Horse, and also hand, winches must indispensably be fitted with ratchet arrangements or strong brakes working automatically. Hand winches must be double-handled, that is, with two iron handles secured to the ends of the drum on to which the cable winds. In the raising and lowering of men, as also in the lowering of timber, there must be at the hand winches two workmen not under twenty-one years of age. In the lowering and raising of

workmen, with the assistance of a horse winch, it is necessary to lead the horse by reins. The lowering and raising of workmen must not be at a greater speed than 7 feet (2·13 metres) per second.

In lowering into shafts and excavations, timber and other articles must be secured to the cable sufficiently strongly to prevent their falling.

The construction of the winch above mouths of shallow shafts and excavations must be such that the taking off or raising of the vessel used for hoisting is without danger to the workmen doing this.

In excavations or well-shaped workings of not more than 15 sagenes (32 metres) in depth, signals from the top to the bottom, and the reverse, may be given by knocking, jerking of the cable, or verbally. In deep workings, the construction of a special signalling appliance is indispensable. During lowering and raising of freight, workmen are forbidden access to the lower level of the well-shaped working or excavation, and they are obliged to draw the lowered tubs on to the drive by means of a hooked stick, and also to place the tub on to the cable in

the drive. In those cases where it is indispensable for workmen to go out into the shaft, it is necessary to send a signal as to this, and await answer that corresponding measures have been taken, and that there are no obstacles to entering the shaft. Until such time as the workmen retreat to the drive, no kind of work at the mouths of the working or excavation, that is, pushing off and pulling on of tubs, etc., must be carried on.

§ 102. In deepening excavations by means of a winch with one tub, the end of the cable must be strongly fastened to an iron hook driven into the wooden drum of the winch, and on the drum must be not less than two unwindable turns of cable. Hempen cables of winches must satisfy the stipulations demanded in pars. 108 and 113, and, further, must be undamaged.

The Superintendent must see that the ends of the wooden drum of the winch are fitted with iron hoops, so that the handles of the winch are always strongly fastened to the drum and do not move about in same, and also that the hook is in order.

It is forbidden to fully load the tub (par. 74).

In cases of hoisting large lumps of strata from excavations without tubs, workmen are previously obliged to ascend by means of the stairway.

For the raising and lowering of workmen by means of exploration shafts deeper than 10 sagenes (21·34 metres), the stairways must be placed in separate ways, with platforms at a distance of from 2 to 4 sagenes (4·27–8·54 metres) apart.

V.—Referring to Cables used for the Hoisting and Lowering of Men

§ 103. The lowering and raising of men and freight in workings is carried out only on tested organic hempen, aloe, etc., and metallic cables.

> *Note.*—In the use of metallic cables for hoisting and lowering in workings in which there are acid waters, pumping must be done in such manner that this water does not get into contact with the cables.

§ 104. In each mining undertaking in which hoisting and lowering is carried out by vertical workings, there must be kept an exact record of all cases of injury to cables (see Appendix No. I.).

1. *As to Organic Cables*

§ 105. With test, the following cables are allowed :—(*a*) New, or those having been used ; (*b*) white or tarred, and (*c*) factory or hand-made.

§ 106. The lowering and raising of workmen is not allowed (*a*) on old cables with broken strands, and (*b*) on spliced cables, round or flat, even though new.

Note 1.—Several twisted strands form a cable.

Note 2.—The hoisting and lowering of men by means of spliced cables is allowed in extreme cases, when the men at the time in the workings are in obvious danger.

§ 107. Cables, subject to test, must undergo a preliminary outward inspection, the aim of which is to define the good quality of the cable.

§ 108. The hemp of which the cable is made must be without boon, and of even and long fibre. Old hemp is not allowed in cables. Aloe thread, serving for the preparation of the cable, must be of similar good quality. The absolute resistance of the hemp or aloe must be not less than 236 poods (600 kilogs. per square cent.) per square inch.

§ 109. Cables satisfying the demands of the external inspection must undergo the following test :—

(*a*) Cut off bottom ends of the cables for the preliminary test, and for the secondary test after four months, breaking by means of tension, when they must have a strength of not less than six times that which is necessary for their heaviest load in mechanical hoisting, and ten times when used with horse winches.

Note 1.—For testing, a length of from 3 to 4 arshines (2·13–2·85 metres) is cut off from the lower end of the cable. In the absence of a sufficiently strong testing machine, the strands of the cut-off piece may be broken separately.

Note 2.—With hand whims, and also, if the depth of the working does not exceed 25 sagenes (53·34 metres), with horse winches, the testing shown in the above paragraph is substituted by a monthly testing of the cable by loading it with double weight — such load being suspended to the cable itself. The cable is considered as having passed the test if broken strands do not appear.

(*b*) General daily inspection of the whole of the cable, with slow motion of the engine, winch or whim.

§ 110. The preliminary and secondary tests of the cut-off ends of the cables are carried out by an experienced person, as to whom the District Engineer must be informed.

Testing is allowed to be carried out not only at the mines, but also at the testing stations, confirmed by the Mining Department, that certify as to the test made over the signature of the responsible person carrying out the test.

§ 111. Results of tests are entered in a record book of the established form (Appendix No. II.), legalised by the signature of the District Engineer, kept at the mine. This book is written up by a responsible person, and is presented to the District Engineer, or his assistant, every time of their visiting the mines or works.

§ 112. The relation of the diameter of the sheave or drum to the diameter or thickness of an organic cable must be not less than—30 with mechanical and horse-winch hoisting, and 8 with hand whims.

§ 113. The least admissible diameter of organic cables for a depth of not more than 15 sagenes (32 metres) is $\frac{3}{4}$ inch (19 mm.), and for a depth of more than 15 sagenes (32 metres)

1 inch (25 mm.) for hand whims, and 1¼ inches (32 mm.) for horse winches.

§ 114. In lowering and raising of workmen on hand whims, there must be not less than three turns of cable on the drum, the diameter of the latter being not less than 8 inches (203 mm.), and towards the ends a little smaller.

§ 115. In temporary stoppages of work for more than one month, cables must be taken down and thoroughly dried.

2. *As to Metallic Cables*

§ 116. Metallic cables must be capable of supporting six times the largest load to be put upon them, including the weight of the cable itself.

It is only allowed to use cables of even thickness and of even strength. If the result of the test, carried out in accordance with par. 128, proves the strength of the cable to have decreased to less than six times the strength required for the heaviest load to be put upon it, it must be replaced by another. At every shaft there must always be in stock cables already tested and suitable for the

raising and lowering of men, for replacing spoilt ones.

§ 117. Cables must consist of steel wires, the thickness of which must not be less than $\frac{1}{32}$ inch (0·8 mm.), and not more than $\frac{1}{8}$ inch (3·2 mm.).

§ 118. The limit of tensile resistance is allowed from 4330–7090 poods per square inch (110–180 kilogs. per square metre) if the wires satisfy the bending test, in accordance with par. 128.

§ 119. The relation of the smallest diameter of the drum or sheave to the largest diameter of the wires forming the cable must not be less than 800.

§ 120. At the beginning of each shift the cable must be slowly let down with full load and inspected as far as possible, without wiping off the grease, by an experienced person, who, on the appearance of damage, not noticed on former inspections, must inform the Mine Manager.

Once a week must be carried out by a person indicated to the Mine Manager by the District Engineer, a minute inspection of the cable, by allowing it to pass through the hands (wrapped in cloth or tow).

§ 121. Every six months the cables must be examined, and the diameter measured at every 2–3 sagenes (4·27–6·40 metres), with a view to determining the parts which have become thinner, that is, the parts which have become weak. If the examination proves the cable to have very thin parts, it must be admitted as unsatisfactory and be replaced by a new one.

§ 122. If on examination the cable proves to be seriously damaged on the surface of the wires, *i.e.* if in 0·5 sagene (1·06 metres) in any part of the cable the number of broken wires equals, or exceeds, 10 per cent. of the full complement of wires in the cable, then the lowering and hoisting of men on such a cable is forbidden, and it must be replaced by a new one. As to the number of broken wires, notes must be made in a special journal.

The sheave must be constructed in such manner that the cable may not get jammed in the grooves.

§ 123. The results of daily, weekly, and also six-monthly examinations must be entered in the book established for this purpose. Regarding the results of six-monthly examinations of cables, there must further be prepared

each time a document with the signatures of the responsible person at the shaft, and of two assistants.

§ 124. In the event of excessive straining of the cable in consequence of the sudden catching of the cage in the guides during movement, sudden stoppage of the machine by brakes and such similar circumstances, the lowering and raising of people must be suspended for immediate inspection of the cable, and here, if it proves that the cable has (*a*) suffered damage as mentioned in par. 122, or (*b*) has been noticeably and permanently stretched, the cable must be considered as unsuitable for the lowering and raising of people, and replaced by another.

§ 125. In hanging the cable, the following regulations must be observed:—(*a*) In mechanical hoisting in vertical shafts, and also those inclined at more than 45 deg., a cable of round section on which is carried out the lowering and raising of people at a speed of more than 3 metres (9·80 feet) a second, must be rolled on to the drum in one layer, that is, in no case must one part of the cable be rolled on to another part. (*b*) Tendency of the cable to wind on only one side of the drum, in verti-

cal and inclined shafts, owing to incorrect adjustment of the machine, must be counteracted by fastening wedge-shaped joists on the face of the drum, or, with the help of an automatic appliance, entirely doing away with the side inclination of the cable.

§ 126. The height of the headframe above the mouth of the shaft in the case of mechanical hoisting, must not be less than two-thirds the circumference of the drum, and when conical drums or bobbins are used, not less than two-thirds the circumference of the drum or bobbin. In any case, the height of the headframe must not be less than 4 sagenes (8·53 metres), reckoning from the top loading platform to the axle of the sheave.

With cages of not more than four floors, the height of the headframe can be decreased, but must not be less than the circumference of the drum.

§ 127. The lowering and raising of people on spliced cables is unconditionally forbidden.

§ 128. Cables before being used for the hoisting and lowering of men must be tested in tensile strength and pliability. This test must take place in the following manner:—

(*a*) The resistance of the wires to tension

is measured by the amount of force required to break same.

(*b*) The strength of the cable is defined by the sum of the strength or force required to break each individual wire separately. Here, however, wires proving to be of 20 per cent. less than the average strength of all wires taken together, are not taken into account.

(*c*) Of a piece of cable 0·5 sagene long (1·06 metres), all the wires are tested for strength, and pliability, excluding wires of the cores, which are not taken into consideration.

(*d*) The pliability of wires is determined by the number of bendings of 180 degs. before breaking, within a radius of $\frac{1}{4}$ inch (6·3 mm.) at the place of bending. Bending at 180 degs. is considered to be the bending of a wire alternately to the right and to the left at 90 degs.

(*e*) The number of bends of the wire must comply with the table given below—

Diameter of wires, up to 2 mm., 8 bends.							
Diameter of wires, from 2	mm.	to 2·2	mm.,	7	bends.		
,,	,,	,, 2·2	,,	to 2·5	,,	6	,,
,,	,,	,, 2·5	,,	to 2·8	,,	5	,,
,,	,,	,, 2·8	,,			4	,,

§ 129. In the event of apparent unreli-

ability of cables, it is left to the District Engineer to carry out a test of same.

§ 130. Every six months the end of the cable fastened to the cage or tub must be cut off for a length of 3–4½ arshines (2·13–3·20 metres), and the cable newly bound. All wires of the cut-off end must be, not later than during the course of seven days from the date of cutting off, tested in the above-mentioned manner, and here the District Engineer must be advised of the proposed time of carrying out the test, at least 1½ weeks ahead.

§ 131. The non-arrival of the District Engineer at the appointed time must not delay the carrying out of the test. Tests, both of new cables and of cut-off ends of cables which have been used, must be made by an experienced person who is responsible for the proper carrying out of tests in accordance with the existing stipulations. As to the appointment of this person, the Management of the Mine is obliged to inform the District Engineer. In cases when the testing of a cable is not carried out at the mine, it is indispensable to inform the District Engineer as to the time of despatch of the cable for testing and the results of the test.

§ 132. In cases of the installation of hoisters of the Këpè system, the regulations in par. 130 are substituted by the following :—The term of service of the cable with Këpè hoisters is defined at 1½ years ; longer service of the cable (for a term of not more than one year) can be allowed only with permission of the Mining Department on the representation of the District Engineer.

VI.—*Re* Transport of Freight

1. *In Vertical and Inclined Shafts*

§ 133. In the hoisting of freight in cages, the average speed must not exceed for shafts—

250 feet (75 metres) deep	.	1/25th	the depth of	shaft.
350 „ (105 „) „	.	1/30th	„	„
500 „ (150 „) „	.	1/35th	„	„
750 „ (225 „) „	.	1/40th	„	„
1000 „ (300 „) „	.	1/45th	„	„
1500 „ (450 „) „	.	1/55th	„	„
3000 „ (900 „) „	.	1/85th	„	„

Note.—In special cases, by agreement of the Mine Management with the Mining Department, the average speed of cages may be increased by 25 per cent., and, under exceptionally good conditions, by 50 per cent.

§ 134. In hoisting and lowering freight in tubs along guides the average speed must not exceed three-fourths of that stipulated for cages. In the absence of guides, the movement of freight tubs must be carried out at an average speed of not more than 7 feet (2·13 metres) per second if the tubs move in a compartment divided off throughout the whole length by boards, and 3·5 feet (1·06 metres) in all other cases.

§ 135. Freight cables (that is, those serving exclusively for the hoisting and lowering of freight) must comply with part V. of the present Regulations, with the following differences :— (*a*) That the inspection and testing of the cables in accordance with pars. 121 and 130 must be carried out for the first time twelve months after hanging, and then after every six months of further service. (*b*) That cables proving, after test by breaking, to have a strength of less than five times that required for the weight of freight to be hoisted, or not satisfying the elasticity test by more than 20 per cent. of the requirements of par. 128 of the present Regulations, be substituted by new ones. (*c*) That the use of spliced cables (if, before splicing, the ends have been tested,

and satisfy the requirements of part (*b*) of the present paragraph) is allowed. Here, however, the number of splices must not be more than one if such is caused by breakage of the cable, and two in all other cases. (*d*) That it is allowed to wind the cable on to the drum in several layers if the average hoisting speed does not exceed 5 metres (16·4 feet) per second.

2. *By Horizontal and Inclined Drives*

§ 136. Ways, by means of which men and freight are transported in mines, must be spacious, so that the moving about of people and loads may be convenient.

Those portions of rail-tracks upon which trucks are continually stopping (such as at hoisting shafts where there is not automatic loading; shoots, spare ways, shuntings, etc.), must be perfectly horizontal. If the rail-track has a declivity, along which trucks move by gravity, there must be fitted well-constructed brakes. In storied drives, and also in intermediate drives serving as independent shoots, at the mouths of shoots must be arranged special workings for passing round same, or, in a widened place of the drive itself,

opposite the mouth of the shoot, must be arranged constructions assuring safe movement in the drives. In intermediate drives, serving one and the same shoots, in crossing with the shoots the drives must be fitted with barriers. Rail-tracks in underground workings, and on the surface, must be carefully laid with suitable raising of the outside rail on bends (curves). On approaching the crossing-points of drives, points, and stopping-places, the trammers must announce approach by shouting or by means of the established sound-signals.

§ 137. On those inclined drifts in which is carried out the movement of trucks by means of engines or whims, the trucks ascending must be fitted with appliances to prevent their running below in the event of breakage of cable. Such appliances may also be fitted to the trucks.

§ 138. Trucks and tramming sets must be loaded in such way that the articles in same cannot fall on the road in front of the following trucks, or catch with other articles.

§ 139. With one man tramming with several trucks, the latter must be coupled together.

§ 140. For simplifying the replacement of

a derailed loaded truck on to the rails, there must be suitable levers on the trucks or in appointed parts of the mine. In placing trucks on to the rails, measures must be taken that the trucks shall not mechanically start moving. The use of a machine or horse for pulling derailed trucks on to the rails is unconditionally forbidden, and at the time of placing the truck on the rails the horse must be unharnessed. In shoots and inclined shafts, the cable must be as tight as possible and the drum " braked."

§ 141. Trucks left on inclined ways must be so secured that they cannot be moved from their position by accidental causes.

§ 142. In drives with mechanical tramming, the construction of a signalling appliance is required for giving signals to the engineer from each stopping-place.

3. *In Slopes*

§ 143. All arrangements for lowering by means of slopes must be strongly constructed, and must be fitted with an automatically-acting braking appliance of such sort that the action of the brake is only ceased at the time of lowering and hoisting.

In slopes it is forbidden to fasten or suspend the brake-lifting lever. Without special permission from the Manager of the Works the load of the lever must not be altered.

Brakesmen in slopes must be accommodated in "pockets," arranged by the side of the braking appliance or in side drives, and the operating of the brakes must take place from appointed buildings or workings, by means of communicators leading from the braking appliances.

Before starting work on each shift, the brakesman must testify that the pressing cushions of the brake, and the whole mechanism serving for lowering, act correctly.

If delivery does not take place from the face itself, and if the braking is not done by workmen engaged at the face, then at the time of delivery there must always be on the lower platform of the slope a slopesman, and at the brake a brakesman.

Only persons having had mining experience for not less than one year can be employed as shootsmen or brakesmen. Members of the local Mining Inspection must acquaint these workmen with their obligations before setting them to work.

§ 144. If it is required that the workmen or

trammers themselves operate the brakes, the mechanism for hoisting must be so arranged that it can be operated from any loading point, and there should be no necessity for the workmen to go on to the shoot-way.

Workmen are forbidden to accompany trucks moving along slopes, drives, down-grades, and inclined shafts.

> *Note.*—The prohibition of accompanying trucks on inclined ways does not apply to unavoidable cases, on to turn-tables on crossing from inclined to horizontal ways, and the reverse.

§ 145. In cases where the mouths of shoots are not fitted with automatically-acting appliances for preventing uncoupled wagons running away down inclined planes, workmen on the platform are forbidden to place trucks on the rails, or place them in such a way that they can easily slip on to the rails before having coupled them to the cable.

§ 146. Receiving platforms of slopes and inclined shafts on which is carried out the coupling and uncoupling of trucks must be horizontal, and of such dimensions that coupled trucks may be freely accommodated on same; when in place of platforms there

are constructed rail-tracks, it is forbidden to place even a portion of a train of trucks, before lowering, on the incline of a slope, if there are not, in expedient places, retaining constructions specially intended for this purpose. Exception is allowed for mechanical tramming with an endless cable or chain.

§ 147. For the coupling of one truck to another, and also for fastening them to the cable, in slopes, inclined shafts, and inclined drives, the use of the usual hooks is not allowed, but for this purpose must be used hooks with springs or catches, etc. The rings on trucks by which they are fastened to the cable, or coupled one to the other, must be calculated on a weight of ten times the full load of the wagons.

§ 148. In the event of jumping of the rails by platforms, wagons, or counterweights, the changing of the load of these latter, or shortening or lengthening of the cable, is allowed only after the preliminary reliable securing of the platforms, trucks, or counterweights.

§ 149. In front of braking appliances there must be constructed a sufficiently strong barrier for preventing the hoisting of platforms, trucks, or counterweights right up to the guiding sheaves. This regulation need not

be observed for braking appliances only during progress of work on rises.

For preventing the running away of wagons or trucks on the top and intermediate receiving platforms of slopes, inclined shafts, and tramming drives sloping downwards, there must be arranged, excluding cases of mechanical tramming by means of endless chain or cable, strong barriers, which must open only after receipt of the signal from the lower platforms as to hoisting or lowering of trucks, and shut immediately on the ascending skip coming out on to the receiving platform. Besides barriers there may be used other appliances, but only such as will completely prevent the trucks running away and falling below.

§ 150. For correct and safe delivery, shoots must be fitted with reliable signalling appliances. Boards showing the signals fixed by the Works Manager must be exhibited at each shoot, both above, where there is a workman controlling the brake, and below at the receiving platform. Signalling arrangements at shoots must be such that the receiver and brakesman can give signals one to the other which are visible or audible at all platforms of the shoot.

The shootsman and brakesman before the

start and end of each delivery, excluding tramming by means of an endless chain or endless cable, must exchange signals by means of the signalling appliances. The signal as to the start of the delivery must be given at the start of a shift only when the shootsman, passing through the shoot, certifies that there are no people in same.

Stoppage of the skip at the platform every time must be done only when the brakesman has been given a signal as to stoppage and has replied to same.

4. *In Railway Trucks on the Surface*

§ 151. On railways and rope conveyors belonging to the mines, the requirements of Part XVII. of the " Rules for the Prevention of Accidents in Mining Works," confirmed by the Minister of Agriculture and Government Property, 30th September 1904, and published in No. 57 of Part II. of the Collection of Laws and Publications of the Government for the year 1904 (usual railway regulations), and also the following regulation, must be observed :—

§ 152. The engineer of a steam or electric movable platform (flat car) must always whistle before putting the platform into motion.

VII.—The Working out of Deposits by Means of Narrow Well-shaped (Systematic) Workings

§ 153. The carrying on of mining work by means of narrow well-shaped workings is allowed for the exploration of and working out of deposits lying not deeper than 25 sagenes (53·34 metres) from the surface, and not being, according to the definition of the District Engineer, veins or offsets of veins or masses.

The making of narrow well-shaped workings, of a diameter of not more than 3 feet (0·91 metre), without timbering is allowed only in stable and firm ground, and here the depth of such workings must not exceed 15 sagenes (32 metres). Around these workings must be left for safety columns of earth or ore not less than 1 sagene (2·134 metres) wide, reckoned from the wall of the working. Ore columns may be removed only just before the finish of work in the working, and, further, workings adjacent to the walls of the well-shaped workings must be strongly timbered.

§ 154. At a depth of more than 15 sagenes (32 metres), and also in deepening in alluvial, weak, friable, and generally unfirm ground,

round well-shaped workings must be replaced by square or rectangular ones, which it is necessary to strengthen by means of wooden stakes or compact box timbering, single or double, and, in watery earth, the intervals between such timbering must be filled with clay or wet earth.

§ 155. With more than ten miners, underground workings by means of small well-shaped workings must have two exits to the surface.

§ 156. Such workings when finished with must immediately be filled in with earth. Workings in use and also those finished with, but which the mine owner for some reason or other cannot possibly fill in as soon as work is finished, must be in a suitable manner fenced round for preventing the possibility of men or animals falling into same : with this aim the workings indicated must be covered with strong boards and fenced to a height of not less than 1½ arshines (1·067 metres).

§ 157. Drives leading directly from well-shaped workings to cleaned-out workings must be in extent at least 1 sagene (2·134 metres), not more than 2 arshines (1·42 metres) wide, and the width of exhausted

workings on the finish of work must not exceed 6 arshines (4·27 metres). When the roof is weak the District Engineer has the right to decrease this width. In reference to timbering, all these workings are subject to the regulations established generally for the timbering of underground horizontal workings, and here the extraction of timber is allowed only in frozen and solid ground, and then only by working backwards, that is, starting from the more distant workings, and gradually approaching the well-shaped workings.

§ 158. At the time of working, in the well-shaped workings and in workings leading from the latter, must be continually pure air, for which, in the event of necessity, it is obligatory to arrange suitable means of ventilation : ventilating fires are allowed to be placed only on the surface. In well-shaped workings not having two exits to the surface, the application of explosives is allowed only in such cases when, for the purpose of mining, there is employed only one shift of men ; and, further, exploding by means of drill-holes must take place not otherwise than at the end of the shift.

§ 159. For the movement of workmen and

hoisting of ore by means of well-shaped workings it is required to use a double-handled winch, consisting of a solid wooden frame with sets and supports and a cable-drum, fitted at the ends with two iron handles, or a so-called "whim," being in itself, fixed on sets and with supports, a drum on which are placed at a certain distance from the centre two wooden crosses, between which the ascending cable winds. In hoisting and lowering of people there must be two men at the handles of the winch. The hoisting cable must be of good hemp and of not less than $\frac{3}{4}$ inch (19 mm.) in diameter for a depth up to 15 sagenes (32 metres), and not less than 1 inch (25 mm.) for greater depths.

The handles and journals of the hoisting drum, and the handles of tubs, and also the ferrules with hooks on the cable, must be of sufficient thickness, and made of good soft iron. The shackle (or hook) must be so constructed that the jumping of the tub from same is impossible.

§ 160. The lowering and hoisting of men is allowed also in a noose of cable, or on a strong wooden board or joist, and, with a view to greater safety, the workmen must be secured

to the cable with a strong belt passing under the armpits.

§ 161. In connection with technical inspection, well-shaped workings, according to their position, are divided into groups, and for the guidance of work, and for seeing after their safety, must be appointed a boss for every ten such workings in order that the boss may daily inspect every working under his care. Further, the District Engineer has the right to demand that on every group of such workings on which there are employed over 100 men, a steiger be appointed for supervision of the work.

§ 162. In all other workings not mentioned in the present Regulations, must be observed the General Rules for the carrying on of mining work with views to its safety.

Note 1.—Above well-shaped workings and excavations, intended to serve for a more or less long period, must be constructed canopies protecting at the mouths from inclement weather.

Note 2.—Before the lowering of men after a more or less long interruption of work (for example, after Sundays and holidays), the boss, steiger, or in general the person superintending the work, must test the purity of the air by

lowering a lighted candle or lamp into the working.

Note 3.—For the workings dealt with in the present part, pars. 6, 7, 10, 11, 17, 18, 26, 48, 181, 182, 183, 184, 185, 186, 187, 192, 197, 198, 199, 328, and 329 (as also those pars. which by their sense do not apply) are not observed.

VIII.—*Re* the Working Out of Deposits of Useful Minerals, etc., by Means of Open Workings (Cuts, Coal Quarries, Clay Pits, and Similar Workings)

§ 163. The mining or quarrying of such materials by means of caves is forbidden.

§ 164. In open workings it is necessary to carry out the removal of the surface earth, and the mining of materials, by means of terraces or steps. The width of the terraces must be not less than 1 sagene (2·134 metres) in workings where horse labour is not employed, and not less than 1½ sagenes (3·201 metres) where such labour is employed. The vertical height of terraces, in general, must not exceed 1½ sagenes (3·201 metres), and greater heights can only be allowed under favourable conditions in the absence of objection on the part

of the District Engineer, to whom the Mine Owner or Lessee submits a drawing and description explaining the method of working. If, during the course of one month from the date of submitting the above drawing and description, no objection follows from the District Engineer, then the Mine Owner or Lessee has the right to proceed with the work in the method shown in the drawing and description, as though it were approved by the District Engineer. In friable and soft ground the slant of terraces (or steps) must not be greater than the natural angle of declension, and in firm ground and minerals, on the side of working, the angle must be in accordance with the nature of the ground or material. The foot wall of deposits, when the earth forming same is sufficiently strong (depending on the angle of declension), may be left in the working without steps (or terraces) if no objections are made to this by the District Engineer.

§ 165. All working faces and steps (or terraces) in front of which is carried out carting away, or in front of which people move, and also the walls surrounding the cut, every time before a new shift comes on, as also after the end of the dinner interval, must be in-

spected in order to avoid accidents from the falling of hanging lumps of earth, and, in winter time, from the falling of snow and ice. If such hanging lumps of earth, etc., are observed, then, before removal of same, no kind of work at these places is allowed. When there is a considerable amount of snow, digging-in work is forbidden, and mined minerals at the faces must be quickly and carefully removed.

§ 166. Faces being worked simultaneously on several terraces must in no case be directly one above the other.

§ 167. The width of the walls between workings must be equal to $\frac{1}{10}$ of the depth, but not less than 1 arshine (0·711 metre), and only in specially dangerous places the District Engineer may demand that this width be increased to 1 sagene (2·134 metres).

With the sanction of the District Engineer these walls may, by agreement of the Owners of the two adjoining workings, be worked out clean.

By "wall" it is necessary to understand the distance from the first level or terrace to the limit of the holding, and also the width of the terrace.

§ 168. Digging-in under soft, running, and unfirm earth is unconditionally forbidden. In sound, firm earth digging-in underneath is allowed, but not deeper than 1 arshine (0·711 metre). In such holes, there must be left for supporting the hanging wall small columns of earth, or must be fixed timber supports. Demolishing of the faces together with the holes is allowed not otherwise than from above, after workmen have been removed from the face.

§ 169. In open workings in front of faces, in the lower part of which mining is carried out, it is forbidden to load trucks. Near to such faces it is forbidden to place articles which, in the event of danger, may hinder the workmen in getting away.

§ 170. In places where, in consequence of the height or nature of the faces, workmen at the time of work are not in a sound position, for their support there must be fitted up safety ropes (or cables) or some other kind of appliance.

§ 171. Ascents and descents must be made as far as possible in the material that is being mined, and must be of sufficient width and of gradual inclination. Bridges must be strong.

In those cases when the width of ascents and descents, as also of bridges, is less than the above shown width for terraces, or if they are at a greater height than is allowed for terraces, then they must be guarded by rails.

§ 172. In open workings, the places where miners are working, as also adjacent places, must not be obstructed by any kind of articles that may hinder the free escape of men in the event of danger.

§ 173. Sleeping at the walls of workings is strictly forbidden.

§ 174. Open workings in populated places, and near to roads and footpaths, must be fenced in, in order to prevent the falling in of people, in such way that the height of the fence shall be not less than 1–1½ arshines (0·711–1·067 metres).

§ 175. After the completion of open workings there must be left slopes in accordance with the nature of the earth.

IX.—The Quarrying of Stone by Underground Workings

§ 176. The mouths of shafts and excavations serving for the quarrying of stone must be, on the surface, surrounded by fences (or brick-

work) closable by means of lattice-work doors. In localities where the earth may slide, the shafts and excavations mentioned must be strengthened inside by timber or stone. Winches, appliances, and other accessories must be strong and tested by persons of the local Mining Inspection Staff. During interruption of work, shafts and excavations must be shut under lock and key.

§ 177. The width of drifts and galleries, serving for the mining of stone, and connections with other workings, dependent upon the strength of the roof and conditions of transport, must not be more than 2 sagenes (4·267 metres), and individual pillars must have a foundation of not less than 4 square sagenes (18·209 square metres); drifts and galleries must be timbered conforming to the nature of the earth. In the event of extensive extraction of stone, filling of the empty spaces is compulsory.

§ 178. In workings it is compulsory to leave roofs, of a thickness of not less than 1 arshine (0·711 metre), of solid stone. If the stone is cracked, or consists of broken pieces, then for preventing the falling out of individual stones, the spaces of roof between the timbering must

be covered in by logs or boards. In clean mining, between the front faces and the filling is left only a space sufficient for movement, with temporary posts for supporting the roof.

§ 179. Underground workings in stone pits under living buildings and other constructions is not allowed ; in the same way it is forbidden to erect living buildings over underground workings of stone pits, until work in same has been finished. On the completion of work such buildings may be erected only with permission of the Management.

§ 180. In stone pits in which underground workings are admitted by the Mining Staff to be dangerous, the mining of stone may be carried out only by means of open workings.

X.—General Rules of Ventilation Obligatory for all Pits and Mines

§ 181. The ventilation of pits and mines throughout their whole extent (faces, drives, stables, and generally all workings in which people move, or where people live) must be carried out in as perfect a way as possible, and, further, all measures must be taken for the removing of stale air. Fresh air must be

delivered to the lowest part of the working, and have an ascending current.

Note.—Air must be considered as sufficiently pure if it contains not less than a 19 per cent. proportion of oxygen, and not more than a 11 per cent. proportion of carbonic acid gas.

§ 182. The ventilation of pits or mines may be natural or artificial, and the quantity of air entering the mine (pit) must be, at working faces, not less than 35 cubic feet (0·991 cubic metre) per minute per man working in the mine; and, where there are horses, above this 35 cubic feet, 140 cubic feet (3·964 cubic metres) per minute per horse.

Determination of the quantity of air is carried out on the ventilating current of the drive or other working near to the face.

Note.—Digression from the requirements of the above paragraph is allowed only in such cases when, owing to the conditions of working with natural ventilation, such requirements are impossible of fulfilment.

§ 183. For checking the amount (as stipulated in par. 182) of fresh air entering the mine, observations must be made at least

once a month, and the findings entered in the book kept at the mine for this purpose.

§ 184. At each mine (pit) there must be made at a definite time before start of work, and continually be added to, a ventilation plan with corresponding notes. On this plan must be shown all elements pertaining to the system of ventilation of the mine in question.

§ 185. All pits and mines in which is noticed, even though temporarily (spring or autumn), that the ventilation by natural means of workings shown in par. 181 does not comply with par. 182, must be fitted with artificial ventilation, either by the use of sufficiently strong, continuously operating, and completely safe mechanism, or with the help of ventilating stoves. The construction of ventilating stoves inside coal and brown-coal mines is forbidden.

Note 1.—Special attention must be given to the careful ventilation of workings, situated below the level of the foundation drive, directly communicating with the shaft.

Note 2.—The use of charcoal-pans in pits and mines is forbidden.

§ 186. Stoves, serving for the instigation of

air-currents, must be arranged in places safe from fire. The shafts by which the gases leave the stoves must be strengthened with non-inflammable materials in those places where strengthening is necessary. Smoke from these fires must in no way enter those parts of workings where there are, or may be, men.

§ 187. In workings in which lamps or candles do not freely burn, workmen must not be lowered.

§ 188. All coal mines although in them is not noticed oxyhydrogen gas, must at least once a month be tested by indicating lamps for the determination of the amount of oxy-hydrogen gas in the mine air, in compliance with par. 208, and once a year an analysis of the air must be made for the oxyhydrogen content. The results of these tests and analysis must be entered in a special record book. In the event of the discovery of the presence of oxyhydrogen gas, the District Engineer must be immediately informed, and steps taken towards the fulfilment of all regulations referring to working in mines with oxyhydrogen gas.

§ 189. During the whole time of working in

mines (especially in coal mines) the Manager of the Works is obliged to look after the condition of the ventilation and pureness of the mine air.

§ 190. In the working of sharply declining deposits, rises serving simultaneously for the lowering of mined minerals and for ventilating must be divided into two compartments, by means of one of which must be carried out ventilation, and by the other, lowering of materials.

§ 191. In the event of the discovery of gases dangerous for breathing, or of explosive gases in a quantity dangerous to the health and life of workmen, instructions must at once be given for the removal of workmen from such places, and suitable measures must be taken for more powerful ventilation of the mine, especially at faces.

§ 192. The ventilation of faces of workings, with the assistance of mechanism erected near such faces, must be carried out only by forcing.

In exceptional cases ventilation is allowed by extraction of air, but at such time the District Engineer must be informed of same.

§ 193. Any current of air spoilt by the

admixture of combustible or poisonous gases, presenting a certain danger to the health and life of workmen, must be carefully kept from the faces, and from works in which there are workers. The extent of faces must be limited in such a way that all workmen are in a sufficiently pure atmosphere.

§ 194. Filling, intended for the isolation or directing of ventilating currents, must be throughout its whole extent suitably solidified, and as far as possible air-proof.

§ 195. Such filling, according to the advance of the face, must be such a distance from the face that the current of air may be in a position to continually obstruct the accumulation of injurious gases at the faces. The speed of the air must not exceed 1 sagene (2·134 metres) per second.

§ 196. Obscure faces must not be separated from the adjacent ventilated workings receiving a fresh current of air at such a distance that the free burning of candle or lamp becomes difficult, or the presence of gases dangerous. If such conditions should exist, then the application of artificial ventilation at such faces is obligatory.

§ 197. Work should be carried on in such

a manner that for the direction or distribution of the air-current it is necessary to construct as few as possible ventilating doors. Each door should be so constructed that the full defined quantity of air may pass, and this quantity may, when indispensable, be regulated.

§ 198. Steigers and bosses must carefully see that the ventilation is in accordance with that instituted, and also that the doors, vaults, and other ventilating appliances are in good condition, and immediately inform the Manager of the Works as to any defect in the proper course of the air-current.

§ 199. Ventilating mechanisms must act uninterruptedly, excepting those short stoppages which are caused by attention to such mechanisms, as, for example, oiling or small repairs of the working mechanism, or the necessity of changing the direction of the current. More prolonged stoppages of the ventilating appliances are allowed only on days when work is not in progress. In the event of sudden stoppage of the mechanism, the local Mining Inspection must immediately take steps to put the workmen in the mine out of danger.

§ 200. On the day following a non-working day, and after any prolonged stoppage of the ventilating mechanism, before starting work all faces where mephitical gases may accumulate, and all the chief ventilating ways, must be preliminarily inspected by steigers or bosses.

Note.—In cases when the air in a mine is spoilt by the presence of metallic vapours and gases (for example, mercurial and arsenical vapours, sulphuretted hydrogen, etc.), the local Mining Inspection must, before the lowering of workmen, make special tests of the air to determine the quantities of the above-mentioned admixtures contained.

Note.—Section XI., pars. 201–287 omitted, deal exclusively with Regulations for Coal Mining.

XII.—General Lighting Regulations Obligatory for all Mines

§ 288. In underground workings it is forbidden to use lamps without glasses, when kerosene, naphtha, or a mixture of such materials with others is used. In such workings the use of shavings and torches is also forbidden.

Note 1.—The regulation of the above paragraph does not extend to lamps with pure vegetable oil.

Note 2.—In the event of the use of benzine lamps in coal pits not containing oxyhydrogen gas, and also in underground workings for other minerals, it is indispensable to observe the regulations of par. 282.

Note 3.—In coal pits not containing oxyhydrogen gas, it is allowed to use not only safety lamps, with double netting and of simplified constructions, but also open lamps that do not smoke.

§ 289. The place of loading and unloading in vertical and inclined shafts where tramming is carried out with the assistance of horses and machines, and also places of reloading and of junctions of the principal tramming drives,

must be illuminated at the time of delivery by special permanent lamps or lanterns.

§ 290. Moving about without lamps or candles in such workings as are not lighted either naturally or artificially is forbidden.

§ 291. All surface workings, and all not altogether shut in buildings, in which there are machines, transmitters, hoisting mechanisms, etc., must on night work be continually lighted by lamps or fires.

Note.—Sections XIII., XIV., pars. 292–302 omitted, deal exclusively with Regulations for Coal Mining.

XV.—In Reference to Steam Boilers and Machines

§ 303. The rules for safety, prescribed by law, for the erection, adjustment, upkeep, use, and examination of steam boilers, and also sections 2–6 of Rules for the Prevention of Accidents in Mining Works, are obligatory for steam boilers and every kind of machine erected at mines and mining works.

Note 1.—In connecting up several boilers in a group, each boiler must have a separate manometer (pressure gauge).

Note 2.—With the condition that the boilers are in one building, to one stoker there must be not more than the following number of boilers:—(*a*) In firing with coal or firewood—not more than two with two shifts, and not more than three with three shifts of work. (*b*) In firing with naphtha—not more than four. (*c*) In firing with gas—not more than five. And (*d*) in mechanical feeding with coal the number of stokers can be decreased, depending upon the system adopted; further, in every boiler-house in which are engaged more than five stokers there must be an experienced foreman (or Superintendent) obliged to look after the correctness of attention to the steam

boilers. As to separately situated boilers, each must have a separate stoker. Stokers when attending to boilers under steam must not be employed on the bringing up of fuel or the repairing of boilers. With small steam boilers, as an exception, stokers are allowed to bring up fuel to the boilers from a distance of not more than 5 sagenes (10·668 metres).

§ 304. Every kind of newly erected machine, intended for the lowering of people into mine workings, must not be started up until the District Engineer has been advised of same, and he, on his first visit to the mine after the starting up of such engine (or machine) carries out a detailed inspection of its parts, and, in the presence of the Manager of the Works, prepares a certificate in which must be explained to what degree the present Regulations, and those existing in the Law Stipulations as to the Safety of Machines and Steam Boilers, are fulfilled. The certificate prepared by the District Engineer must be preserved amongst the mine papers.

§ 305. Steam pipes in mines must be so arranged and protected that in the event of a breakage of pipe workmen may get away without danger.

For this object steam transmitters placed in the mine workings must be supplied with automatic valves, cutting off—in the event of breakage of pipe—the furthest stream of steam. The suitability of the appliances must be checked by tests, in the presence of a member of the Mining Inspection, not less than twice a year.

§ 306. Machines supplied for the lowering and raising of workmen must have two correctly constructed brakes, and also signals giving warning as to the approach of the cage to the surface, and an arrangement obstructing the hoisting of the cage under the sheave.

In a position conspicuous to the machinist must be exhibited from the steam pipes to the machine a manometer.

Note.—The regulation as to two brakes does not apply to machines erected before the publishing of the present Regulations.

§ 307. The machinist is imputed with the obligation, in the lowering of workmen into workings and the raising of them from the workings, of not exceeding the maximum speed defined by the Manager of the Works, and also of not leaving the machine. Stokers

are forbidden to leave operating boilers, except in the case of urgent calls from nature.

§ 308. Regulations applying directly to machinists and stokers must be known to them and exhibited in conspicuous positions in the engine-houses.

§ 309. With mine mechanisms having gear drives, the toothed wheels must be closed in to avoid careless contact with them.

XVI.—For Preventing Cases of People Falling into Workings

§ 310. The mouths of shafts, winzes, and slopes inclined at more than 20 degs. must be, during progress of work, continually fenced in on non-working sides, and on working sides have gates or doors automatically closing on cessation of work.

Suitable constructions must also be arranged on the different levels in order to prevent the workmen falling into the shaft. At the sumps of shafts must be an appliance for preventing the cage or tub with workmen sinking into the water which may accumulate at the bottom of the shaft (in the sump).

Note.—Trap-doors above stairways, and also landings (or platforms) on the latter, must be made in the form of trellis work, in order to decrease the bad influence on ventilation from shutting by means of solid trap-doors.

§ 311. The mouths of inclined shafts and drift-ways must have doors. When work is, for some reason or other, delayed, these doors must be closed.

§ 312. The mouths of mine workings coming out on to the surface and left for a long time must be strongly fenced in: vertical shafts must be immediately covered in with strong boarding.

Note.—The mouths of shafts, exclusively intended for the maintenance of ventilation in the mines, not in the shaft buildings, must be surrounded by strong walls at least 2 arshines (1·422 metres) high. Access to the shafts mentioned must be only by means of a side door, fitted with lock and key. Just in the same way, the doors arranged in the shaft itself at the meeting-places of horizontal workings with air shafts or excavations must be fitted with locks.

§ 313. All shafts with hand hoisting must be fitted on all sides with fencing and doors—

on the non-working sides, permanently, and on the working sides, shutting on cessation of work, *i.e.* hoisting. The floor and doorways at the mouths of shafts must be always cleaned of accumulating earth and ice. Earth hoisted to the surface must be placed at such distance from the mouths of the shaft or excavation, that there is no danger to persons in the shaft or excavation. In the raising of water in tubs, the earth clinging to the bottoms of same must be cleaned off down below.

§ 314. In populated places and near roads and paths, gaps on the surface, resulting from underground workings and working by means of layers, on those sides where there are declines of more than 30 degs. must be erected barriers or walls and ramparts not less than 2 arshines (1·422 metres) high.

§ 315. In populated places and near roads and paths, excavations and well-shaped workings must be, during cessation of work, closed in with beams, thick boards, or carefully fenced in, for the prevention of accidents. Excavations, well-shaped workings and holes, when finished with must be filled in or fenced round in accordance with par. 314.

§ 316. Each hoisting portion of a hoisting

shaft at each receiving platform must be fitted with an appliance for unconditionally eradicating the possibility of men or trucks falling into the workings.

§ 317. In front of mouths of shafts for the usual hoisting of earth by means of tubs, there must be erected a strong platform as a support for tubsmen: this must not obstruct the hoisting of the vessel. Tubsmen, to avoid their falling into the workings when receiving tubs, must be secured by the trunk of the body to a strong support, by a rope sufficiently long as not to hinder their movements, and strong enough to withstand the weight of the man's body.

§ 318. The mouths of hoisting shafts must be so constructed that the coupling and uncoupling of delivered vessels and materials is not attended with danger to the workmen engaged at the mouths of the shaft or in the mine yards.

§ 319. During the movement of people at the mouths of workings, and in all tramming, air- and road-tracks, must not lie any kind of articles hindering movement.

§ 320. All man-way shafts must be kept clean, and in winter be free of ice. The man-

way portions of underground shafts must be so arranged that access to same from the mine yard is not difficult. If the man-way portion consists of only a part of a shaft serving for other purposes, then they must be separated from other parts by a close board partition the whole length of the working. Doors and openings in such partitions must be securely closed at the time of delivery.

XVII.—For Preventing Danger and Injury from Water and Gas

§ 321. For preventing unexpected flooding or breaking through of gas, each mine, excluding open works, must have safety columns (walls) at the boundary with neighbouring mines. The smallest obligatory width of such walls is 5 sagenes (10·668 metres) for gradually descending deposits, and 8 sagenes (17·069 metres) for sharply descending deposits, reckoning half for each mine. These walls may be extracted on cleaning up, and ways made through them, only with the assent of the local Mine Inspection and when the owners of the neighbouring mines agree.

In cases where work is carried out lower than old flooded workings, safety walls must

be from 5–15 sagenes (10·668–32 metres) thick, according to the declension, which is fixed by the local Mine Inspection. Work lower than flooded workings is permitted with the condition of the due advising, through the District Engineer, of the Mining Department.

Note 1.—The requirements of the above paragraph apply to workings at a distance of not more than 1 verst (1·067 kilometres) from the capital shaft or cross-cut whence extraction is commenced ; in further development of work, for each 100 sagenes (213·361 metres) the thickness of the walls must be increased by 1 sagene (2·134 metres).

Note 2.—Digression on one side or the other of normal dimensions shown in the above paragraph is permitted by the Mining Department, on the representation of the District Engineer.

§ 322. In workings carried out under friable earth, there must be left at the roof a safety thickness of sufficient strength to prevent water breaking through.

§ 323. Shafts of all kinds, and boreholes passing in the direction of underground workings, must be so arranged that surface waters may not by passing through them

gain access to the mine, excepting cases where a borehole serves for the delivery of water.

§ 324. Under the beds of rivers, bottoms of ponds, etc., must be left safety walls, the thickness of which is fixed by the local Mine Inspection, or the worked-out space carefully filled in with waste. If the workings threaten the flooding of neighbouring workings owing to the formation of cracks through the abstraction of material, then such workings may be abandoned on the instructions of the Mining Department by preliminary consideration of this question with the mine owners interested.

§ 325. All mine workings which in advancing approach safety walls, or places where the breaking through of water or gases may be expected, must be carried on not otherwise than with a plan, and from the walls of these workings it is indispensable to make test drill-holes, not more than 1½ inches (33 mm.) in diameter, in sundry directions, which bore-holes it is necessary to enter up on the plan.

Owners of mines have the right to demand, through District Engineers, that the Surveyors give them for a consideration, in accordance with the rate paid for surveying work, copies

of plans of those parts of workings which are directly adjacent to their underground workings.

§ 326. Above places of workings it is necessary to turn away all considerable streams of water on the surface.

§ 327. If it proves to be indispensable to lead away the inflow of water or remove the inflow of gas from all the underground workings, or from large extracting places, the local Mine Inspection must be informed of same.

Under such circumstances it is necessary—

(*a*) To bring the cross-section of the working to the necessary minimum size. In the event of the use here of powder, there must be not more than one explosion.

(*b*) To make front boreholes of not more than 1½ inches (33 mm.) diameter, ensuring the safe outlet of water and preventing the sudden breaking through of same, or the breaking through of gases; here it is necessary to keep a stock of corks corresponding to the size of the boreholes.

(*c*) Construct a suitable dam or dyke for the event of a sudden break through of water or gas.

(*d*) One of the workings in the near locality it is necessary to keep well-lighted, and to have a cable leading to same (or guiding hand-rails), serving for the saving of workmen in the event of danger from the breaking through of water or gas.

(*e*) To see that workmen at the different mining works are in complete safety from the breaking through of the expected water or gas, and if same proves necessary to cease neighbouring work until the removal of the water or air has taken place.

Note 1.—Non-fulfilment of the above paragraph is allowed not otherwise than by permission of the local District Engineer.

Note 2.—Persons to whom is appointed the business of superintending the test drill-holes, give an account of the position of same to the Works Manager before the commencement of each shift.

XVIII.—*Re* Prevention and Extinction of Mine Fires

§ 328. Mouths of shafts by means of which fresh air enters the mine must be fitted with iron roofs, etc., easily shuttable in the event of fire breaking out on the surface, to prevent

flames and combustible gases entering the shaft. To the man-ways of such shafts must be arranged an underground way having a mouth inside the shaft-head building.

§ 329. Newly erected shaft-head buildings at shafts must be constructed of fireproof materials.

Note.—Digression of the requirements of the above paragraph is allowed for shallow shafts by the Mining Department, on representation of the District Engineer.

§ 330. The arrangement of air-stoves in mines, when such is not prohibited by the present Regulations (par. 185), is allowed only under condition that the air shaft is made through firm earth or strengthened by iron or stone, but not by timber.

§ 331. All workings of coal and brown-coal mines serving for delivery must be kept clean from small coal and rubbish.

§ 332. It is forbidden to use for filling, materials subject to spontaneous combustion, such as fine coal and rubbish, and also to fill workings with combustible or coal schists or pyritic mine products.

§ 333. In those mines where it is impossible to entirely prevent the greasing of wagons in

underground workings, on the floors of the latter must be kept a layer of sand or gravel, which must be changed as frequently as possible.

§ 334. Underground machine departments in which there are steam or electric movers must be entirely (not excluding floors) constructed of fireproof materials, and fitted with doors of similar material.

Chambers of mine yards serving for the entrance of air, as also parts of the latter adjacent to the mine yards, must be strengthened with fireproof materials: of such materials must also be made the floors of the buildings mentioned.

> *Note.*—Digression from the above paragraph is allowed, with the permission of the local Mining Inspection, for gold and platinum deposits, and for insignificant mines and temporary constructions.

§ 335. In underground machine chambers it is not advisable to keep a stock of oiling materials (tow, wicks, and mineral and other oils) in a quantity larger than is required for a twenty-four-hour period.

Oiling materials, tools, etc., must be kept in the machine departments in specially

intended tin boxes or in the stone recesses constructed for this purpose, shutting with iron doors. Rags and tow having been used for oiling or greasing, must be collected in a special iron box and daily removed from the mine.

It is necessary to have a supply of sand in engine chambers for use in the event of oiling and wiping materials catching fire, and also the most perfect fire extinguishers.

The keeping of hay in mines, in a quantity not exceeding the requirements for twenty-four hours, is allowed in a compressed or packed form. Quantities for more than twenty-four hours must be kept in a special place isolated from other workings by means of stone walls fitted with iron doors.

§ 336. All underground chambers and also stables must be lighted with electric lamps, fitted with thick glass cases and metallic nets : either safety lamps or continually-closed lamps.

The entrance to underground stables in gassy coal pits is allowed only with safety lamps, and in all other pits and mines with closed lamps.

§ 337. Underground workings serving as stables must be strengthened with fireproof materials.

§ 338. Anyone noticing an outbreak of fire must take all steps towards the extinguishing of same and the removal of men from the workings threatened by fire, and the informing of the Local Inspection as to the fire.

§ 339. Special attention must be paid to points near to which unexpectedly, and without visible reasons, the temperature of the air increases, or where the smell of burning is noticed, which may indicate the start of combustion of coal in its mass or between fillings, or the burning of timbering owing to the decomposition of pyrites—happening, for example, in wet and badly ventilated workings or ore deposits.

§ 340. In workings strengthened by timber, by no means is it allowed to erect for the increasing of ventilation, or for any other purposes, any kind of inflammable constructions. Exception is allowed for exploration work, with the condition that all highly inflammable parts of the ventilating appliances are suitably isolated from timbering.

§ 341. As in shaft-head buildings, so in mine yards and stables of each level, there must always be in perfect condition portable fire extinguishers, and also an adaptation for

the immediate delivery, in the event of necessity, to the place of the fire of wet hay or straw, boards, and clayey earth for extinguishing and for the preliminary protecting of neighbouring workings from fire.

§ 342. All workings connecting underground workings with the shafts must be in perfect condition, in order that access by them to the shafts may be perfectly free. Such workings must be daily inspected by Members of Inspection.

§ 343. The method of working out by means of workings slanting downwards from the level of the shaft is allowed with observation of the stipulations of par. 244.

§ 344. If a fire takes place in air-outlet shaft, then it is necessary to instruct that the working gang without delay come to the surface by the shaft by which air enters the mine, and also that all steps for locating the fire are taken.

If a similar fire takes place in the air-inlet shaft, and combustible gases and smoke, penetrating the mine with the air current, fill all workings, here lowering in cages by the shaft frequently proves impossible even with respirators, and if there is not a special

arrangement for altering the direction of the ventilation, then in such cases it is necessary to stop the latter in order that the burning shaft may be turned into an inlet shaft. For this purpose an impelling ventilator may also be placed at the burning shaft, or the latter may be connected to the smoke channels. Here workmen must be removed to the surface by the shaft serving at the time for the egress of air, and if there are several shafts by which fresh air enters the mine, then it is necessary to take advantage of the most convenient shafts. If air enters by several shafts, then there ought to be arranged on all levels of shafts which may be subject to danger from fire, doors made of fireproof materials, which, usually left open, are closed in the event of fire; and, further, there must be prepared and kept near the mine yards the indispensable materials for isolating the fire by means of party walls.

§ 345. When suppression of the fire is unsuccessful, then the area of the fire must be enclosed by means of thick clay or brick walls, and in case of necessity by longitudinal party walls.

§ 346. On considerable development of the

fire, and with the condition that no workmen remain in the mine, the ventilation may be ceased, all air doors shut, and the mouths of shafts and galleries made air-tight.

§ 347. When after a fire or explosion of mine gases smoke or suffocating gases remain in the shaft by which men move, then, preliminary to the lowering of men into such, it is indispensable to restore the ventilation and freshen the air in the workings.

§ 348. Men engaged on the extinguishing of underground fires must be supplied, in the event of necessity, with respirators. Changing of the men must be carried out as frequently as possible.

§ 349. None of the persons of the Mine Administration have the right to cause men, for whatever purpose, to penetrate into workings where there are suffocating gases.

XIX.—As to Measures in the Event of Explosion of Mine Gases, Coal-Dust, or Break-out of Fire

§ 350. At each coal mine there must be organised a rescue gang of workmen, trained to rescue work in suffocating gases. Here

the number of men and the quantity of rescuing appliances must conform with the following regulations :—

(*a*) At pits entering into the central organisation of the rescue parties and their instruction, the number of men included in these parties must be 4 per cent. of the largest number engaged in the pit at one shift, and for each four men in the rescue party there must be at least one respirator and one electric lamp, with movable source of light ; further must be observed the condition that there be at each separate pit not less than three complete sets of rescuing appliances.

(*b*) At pits not included in the above-mentioned organisation the number of workmen forming the gangs for each pit is defined generally at the same rate as for mines of the first category, but in any case there must not be less than six men ; and, further, for every three men in these gangs there must be two respirators and two electric lamps, with movable sources of light. If the number of men of the rescue party is not divisible by three without fractions—that is, for example, if there are thirteen men, lamps and respirators will be required as for fifteen men.

At pits where the number of men is less than fifty, the number forming the rescue party may be decreased, by permission and on the responsibility of the District Engineer, to three men, with two respirators and two electric lamps (with movable sources of light), if these pits are near (not more than 1½ versts, if there is telephonic communication between the two pits, and not more than 1 verst in the absence of the latter) to a large pit having a rescue party of the normal (shown above) size.

§ 351. At each gold mine where fires are used, and at all mines, excepting those producing incombustible materials (and without the use of timber), there must be organised a rescue gang of workmen, trained to rescue work in suffocating gases.

The number of such workmen, the number of apparatuses, portable electric lamps, and other rescue means must be defined by the local Mining Inspection; with the co-operation of the mine owners having interest in such definition. These gangs must be trained to render first-aid in accidents.

Note.—At gold mines to which the requirements of the above paragraph refer, the rescue party must consist of not less

than three men, under condition that each man in same is supplied with the necessary rescuing appliances, etc.

§ 352. The selection of types of respirators and lamps is left to the mine owners, in agreement with the local Mining Inspection, but under condition that the selected types have been practically tested and proved to be satisfactory for demands of safety, and, as far as possible, of perfect construction. For settling the question as to the constructions indicated, and also of other questions connected with the organisation of the rescue gangs, it is left to the local Mining Inspection to convene a meeting of the managers of the local pits and mines, or persons appointed by the latter belonging to the mining-technical portion in the working of pits and mines.

§ 353. In the fulfilment of the regulations set forth in pars. 350–352, it is necessary to be guided by the attached instructions as to the organisation of rescue gangs in the event of an explosion of oxyhydrogen gas and coal-dust, or the breaking out of fire.

Appendix No. I. to Par. 104

SCHEME

Other Damage.	Reason.	
	Date.	
Breakages of Cable.	Reason.	
	Date.	
Hoisting Load.	Dead.	
	Live.	
Length of Service of Cable.	When taken down.	
	When hung.	
Diameter of Guiding Sheaves.		
Diameter of Drums.		
Diameter of Cable.		
Diameter of Wires.		
Number of Wires.		
Cables.	Metallic.	
	Organic.	
Yearly Production of Shaft.		
Depth of Shaft.		
Name of Mine.		

Appendix No. II. to Par. 111

BOOK FOR THE ENTERING OF TESTS OF MINE CABLES

1. Name of Mine.....
2. Name of Owner or Lessee.....
3. Mining District.....

YEAR AND MONTH

Consecutive No.	Name of Mine. Nature of Cable: Organic or Metallic. Name of Makers of Cable. Date of hanging Cable.	Depth of Shaft. Sagenes (metres).	Size of Cable: Length.	Size of Cable: Diameter.[1] mm.	Size of Cable: Number of Separate Cables in Complete Cable.	Number: Of Wires.	Number: Of Strands.	Diameter of Wires and Strands. mm.	Weight: Working of the Cable.	Weight: Of Dead Load.	Weight: Of Load. Poods (kilogs.).	General Weight hoisted.	Length of Service of the Cable from the Date of Hanging.	Date of Testing the Cable.	Length of Cut-off Pieces of Cable. Sgns. (mtrs.)	Breaking Strain.[2]: Of Strands.	Breaking Strain.[2]: Of Wires.	Breaking Strain.[2]: Of Cable. Poods (kilogs.).	Number of Bendings of the Wire before Breaking at an Angle of 180 deg. in a Radius of 6 mm.	Absolute Resistance of the Wires.[3] Kilos. by Sq. mm.	Time and Results of the Weekly Inspecting and Testing of the Cable.	Remarks.[4]

[1] Diameter of the cable = $\frac{1}{\pi}$ of its circumference.
[2] If impossible to break the cable, the breaking strain is defined by the sum of the force required for breaking the strands or wires separately.
[3] F, or organic cables: Kilograms by square metres of the section of the strands or of the cable.
[4] Results of tests of the cable must each time be signed by the person carrying out the test, and those present at the test.

INSTRUCTIONS AS TO THE ORGANISATION OF RESCUE WORK IN THE EVENT OF EXPLOSION OF OXY-HYDROGEN GAS OR COAL-DUST, OR BREAKING OUT OF FIRE

§ 1. At each rescue station there must be electric lamps with movable sources of light, and glasses for protecting eyes from smoke, corresponding to the number of respirators.

For the quickest possible construction of air dams, there must be ready prepared tarred-linen or sail-cloth.

It is indispensable to have not less than two hand ventilators and a sufficient quantity of sail-cloth ventilating pipes.

Electric lamps must be enclosed in hermetically-sealed globes of thick glass, over which there must be metallic nets.

§ 2. In all places where it is admitted by the local Mining Inspection as indispensable, there must be placed at the service of em-

ployees sufficiently sensitive and accurate oxyhydrogen gas gauges.

§ 3. The Manager of the Works must appoint a special Inspector responsible for the intact and unimpaired condition of the whole stock at rescue stations. This Inspector must keep a registrating book in which he makes notes as to the tests of the apparatus, lamps, etc. The inventory must be kept at the station.

§ 4. In accordance with pars. 350 and 351, at each mine there must be a suitable number of workmen who must be able to use the apparatuses, lamps, etc. At the time of rescue work it is necessary to divide the working of the rescue gangs into three shifts, and with each shift there must be a guide-inspector.

The names of men forming the rescue gangs must be kept in a special statement by the Inspector of the rescue station, and if such station serves several mines, then in this statement the workmen of the rescue gangs must be entered according to the mines. Every alteration it is necessary to note in the statement mentioned. In this statement it is also necessary to note when, and by whom, each man was appointed to the rescue party.

§ 5. In order that the workmen may easily find their bearings, the Manager of the Mine must in good time acquaint them with such steps as it is indispensable for them to take in the event of accident in the mine.

§ 6. Independently of the rescue gangs, it is advantageous to acquaint a certain number of workmen in both shifts with the application of respirators, and also of rendering of first-aid to the injured, in order to have in reserve at any time a well-trained party.

§ 7. The rescue party must be equipped at the station with all necessary appliances: also this is fulfilled by neighbouring mines in sending rescue parties in assistance.

§ 8. On an explosion or break-out of fire, the Manager of the Works must take steps that his subordinates, employees, and inspectors of all categories, appear for the fulfilment of their obligations without special summons: those off duty or absent must immediately return to their places, not having the right to leave the latter without permission from the Manager of the Works.

§ 9. At the same time must be organised in a sufficient degree medical assistance, and there must be put at the disposal of the

doctors attending all medicaments, bandaging materials, etc., and also a sufficient number of persons acquainted with the rendering of first-aid.

§ 10. Before starting work it is necessary to fix a plan of working.

§ 11. The Manager of the Works, having acquainted himself with the position and extent of the explosion or fire, gives instructions as to the definite exit of workmen by the shaft ; if such has not already been done, and if the explosion proves to be insignificant, then, having explained to the workmen the dangerless position of the matter, the Manager takes measures for returning them to the place of work.

§ 12. The taking of active measures for the rescue of workmen and renewal of work lies upon the Manager of the Works, with the steigers, bosses, and workmen put under his instructions for this purpose. On the Manager of the Works receiving information of an explosion or fire, he, firstly, assures himself of the satisfactory condition of the ventilator and all ventilating appliances, and, if necessary, adjusts them so as to restore correct ventilation in the mine. Thereupon, in accordance

with the information he has received, he immediately starts on the active rescuing of workmen.

§ 13. Increasing the number of revolutions of the ventilator may be allowed only in the way of an exception. Whilst rescue work is going on, the ventilator must be all the time under the observation of an experienced person, and under the observation of the latter must be carried on the regular motion of the ventilator, in accordance with the indications of the Manager of the Works.

§ 14. In general, the director of the rescue work must make clear whether or not there are signs which, owing to the explosion that has taken place, may lead to the breaking out of a mine fire ; this may easily be known—at least, if the explosion takes place during the day—by the smoke leaving the ventilating shafts becoming denser.

§ 15. If a mine fire has not broken out, then the matter of saving men and cleaning the workings, with certain caution, may be completed without danger ; it is necessary only to follow the current of air, clearing the field of the explosion from the very start, gradually restoring the ventilating appliances damaged

by the explosion, and advancing with the current of fresh air to the site of the explosion and to the faces.

In order, as far as possible, to quicken the advance of the rescue party to the scene of the catastrophe, it is necessary to divide the party into two, of which one, not paying attention to the restoration of the ventilating appliances, must go ahead as far as the action of the respirators allows in order to render aid to the injured and as quickly as possible carry them out to places ventilated by a current of fresh air; at this time the second party quickly restores the destroyed ventilating appliances.

In many cases may be recommended the increasing of the ventilation of the parts affected at the expense of other parts of the mine, having assured oneself in good time that the workmen remaining in these workings are not subjected by this to any kind of danger.

If here it is necessary to go to faces short distances away, where there are injured men demanding immediate aid, then this may be done with the help of especially strong and circumspect people, who, being supplied with safety appliances, and forming themselves

into a chain, can reach the faces and save the sufferers. If in such work the lamp goes out, or any one of the rescue party loses consciousness, then movement ahead in this manner is useless, and it is necessary to look to the quickest possible ventilating of the faces.

§ 16. Summoning volunteers for the rescue of the injured, it is necessary to approach the scene of the explosion or fire, conducting thence fresh air.

For the active rescuing of sufferers it is necessary to take specially strong, experienced, and circumspect people. Special attention should be given to the means of lighting for the party : for this purpose is recommended—

(*a*) To have in stock at each mine several portable electric lamps with accumulators, and other appliances with movable sources of light.

(*b*) The way by which the rescue party passes from the shaft to the scene of the explosion of fire must be lighted by safety lamps hung at a distance of 7–9 sagenes (14·94–19·20 metres) apart, and in such way assure the unobstructed retreat of the party.

§ 17. If a large explosion has taken place, as to which there are no exact particulars

which would make it possible to take all the necessary measures for rescuing, the Manager of the Work, having prepared on the surface (in accordance with the above) everything necessary for rescuing, must, first of all, convince himself as to the perfect condition of the hoisting and shaft-way constructions, and also that there are not suffocating gases in the shaft (this may be known by slowly lowering into the shaft cages with lighted lamps).

Thereupon the Manager instructs as to the lowering of the rescue party with respirators, electric and safety lamps (indicators), under the guidance of a steiger or boss. When the site of the catastrophe is discovered, it is necessary to fix the apparatuses or hold them ready.

§ 18. The duties of the rescue party after being lowered into the mine are the following:—

(*a*) To investigate as to whether there are short connections between an air-inlet and air-outlet shaft, which connections, without loss of time, must be at once done away with : or the Manager of the Works must be informed—who himself takes the necessary steps.

(*b*) To arrange signalling on the chief

levels, appointing signallers or other persons specially intended for this.

(*c*) To quickly send injured men to the surface.

(*d*) To inform workmen of other parts of the mine, and instruct as to their leaving for the surface.

(*e*) Together with the last equipped party sent by the Manager of the Works to penetrate—or endeavour to penetrate—to the place of the catastrophe, and, having reached same, inform the Manager of the Works as to the results.

§ 19. The Manager of the Works organises the despatch of new parties with apparatuses and electric lamps for the reinforcement of the first sent party.

§ 20. The construction of arched vaults at the time of a mine fire, or the opening up of a way to the site of the fire, is allowed only with the taking of measures ensuring a sufficient current of fresh air and the readiness of the rescue party supplied with the necessary outfits (especially respirators and portable electric lamps).

§ 21. The Manager of the Works must see to the delivery of all necessary materials, such as boards, sail-cloth, nails, planks, spare doors,

etc., according to requirements and in a sufficient quantity.

§ 22. It is necessary to take measures that there should not be strangers in the mine yard.

§ 23. The number of workmen ascending to the surface from underground workings, immediately after the catastrophe and at the time of rescue work, must be checked by the person specially appointed for this purpose at the mouth of the shaft in the shaft-head building. The overseers coming to the surface with their parties, in the event of special instructions on this head, must report to the Manager of the Works.

§ 24. The Works Manager hears the reports of the bosses coming to the surface with their parties, and instructs that at the places of crossing of tramming drives there be placed men acquainted with the place to show those escaping the way, and also that the mine doors to the exit are lighted by a sufficient number of electric or safety lamps.

§ 25. If it is indispensable for the Works Manager to himself descend into the mine for direction of the workmen, then he leaves at the mouth of the shaft in place of himself a substitute.

§ 26. If, after the explosion, suffocating gases remain in the workings, then he instructs as to removal, by way of the chief drives to the man-way shaft, of all workmen engaged in places affected by the stream of air coming out.

It is necessary to select a way in the direction opposite to the current of fresh air. When the above has been fulfilled by the boss, and the Works Manager informed of same, then the latter must endeavour to extract from the drives suffocating gases and renew, as far as possible, the destroyed ventilating constructions.

§ 27. Temporary renewals of the ventilating constructions must always be carried out from the side of the outgoing current of air. Special attention ought to be paid as to whether the chief ventilating doors, arched vaults, and partitions between the incoming and outgoing currents of air are destroyed, and as to the possibility of leading up to the place of the explosion the necessary quantity of air.

§ 28. If the place where the explosion took place is not destroyed altogether, and there is the remotest possibility of rendering aid to injured workmen, then to such a place it is necessary to send not one man, but a party of

men, whom, following one after the other at a distance of from 3 to 6 paces, may render each other mutual assistance if at the face there is suffocating gas.

§ 29. Workmen being sent to the site of the explosion must be supplied with ammonia for smelling in the event of dizziness.

§ 30. After an explosion has taken place it is necessary to immediately summon carpenters with tools and nails, and deliver to the scene of the explosion, or neighbourhood of same, boards, materials for cementing, ventilating pipes, and hand ventilators.

§ 31. The Mine Inspection must see to the exact fulfilment by the workmen of these instructions, with the contents of which they must be quite familiar ; further, workmen and bosses must be taught the following directions in the event of an explosion of oxyhydrogen gas.

§ 32. As soon as a workman notices that the mine gas breaks into flame, he must quickly lay himself on the floor of the working, endeavouring to hold on to the timbering or walls. In such a position he must wait and see whether the flame returns, which generally occurs in large explosions. Only when the

flame goes out must he endeavour to reach the nearest air-drift.

If the flame of the lamp is not out then it is necessary to hold the latter as low as possible. If it is out, then it must be lighted only in a current of fresh air, if such lamp has a safety lighter.

It is necessary to inform the Inspection and Works Manager as to the taking place of an explosion in order that by increased forced ventilation either of a separate ventilating current or by isolation of the scene of the explosion, the accumulation of combustible gases may be obstructed, and, in the event of a mine fire, endeavour to extinguish same.

§ 33. At working faces in which the workmen notice signs of an explosion having taken place in the mine, the boss is obliged to get his gang together and, by the shortest way, if the place of the explosion is not certain to him, lead them to the air-inlet shaft.

If there are several available roads to safety, then the workmen must select a road to meet the current of fresh air. If on the way they encounter suffocating gas, which is easily known by the smell and dim burning of lamps, they must endeavour by the shortest possible

way to get into another air current. If this cannot quickly be done, then they must turn back and hasten to find another air current, which, in the majority of cases, according to the nearness of the air shaft, when the air branches off into different directions, is easily reached.

If the place of the explosion is known, then it is necessary to avoid the road by which the air passes from the explosion.

§ 34. Bosses in the mine are obliged first of all to look to the saving of the men of the gang. They must explain to the workmen what has taken place. Until the arrival of the Works Manager the Chief Boss gives all instructions. The latter first convinces himself as to the intensity and extent of the explosion, and if it proves to be insignificant and limited, then he first of all informs the whole gang as to what has taken place, and sees that escaping workmen are accompanied by bosses or old-experienced workmen acquainted with the mine.

§ 35. Workmen informed as to an explosion having taken place, must, without delay, and not considering clothing and other articles left by them, leave the mine.

If the escaping workmen are ordered to ascend to the surface, then this must be carried out in complete order and without confusion, and those ascending to the surface must give their lamps in to the store, stating their names and numbers in the collecting room.

§ 36. In small explosions of gas or coal-dust, it is sometimes possible to put oneself out of danger by observing the following conditions:— (1) It is always necessary to be clothed, even though lightly, in order to preserve oneself from serious burns. (2) It is necessary to lie down with the face to the earth in the event of an explosion. (3) If escape is yet possible, then a way should be selected against the current of fresh air.

CONVERSION TABLES AND HOW TO USE THEM.

The following tables afford a very accurate and rapid means of converting Russian into British, Russian into Metric measurements and *vice versa.*

The number to be converted is subdivided into its multiples of 1, 10, 100, etc.

On the extreme left of each table is a column of "multiples" from 1 to 9.

If the original number is Russian the equivalent value in English measurement will be found in the English column opposite the required multiple. The actual values given are for multiples of "unity"; for multiples of "ten" use the same figures with the decimal point moved one place to the right, etc.

LENGTH or Lineal Measure.

BRITISH—RUSSIAN—METRIC

	Inch	Vershok (Chetvert)	Foot	Vershok (Chetvert)	Foot	Arshine	Foot	Sajene	Yard	Arshine
1	1.750	0.5714	0.1458	6.8571	2.333	0.429	7.00	0.143	0.778	1.2857
2	3.500	1.1429	0.2917	13.7143	4.667	0.857	14.00	0.286	1.556	2.5714
3	5.250	1.7143	0.4375	20.5714	7.000	1.286	21.00	0.429	2.333	3.8571
4	7.000	2.2857	0.5833	27.4286	9.333	1.714	28.00	0.571	3.111	5.1429
5	8.750	2.8571	0.7292	34.2857	11.667	2.143	35.00	0.714	3.889	6.4286
6	10.500	3.4286	0.8750	41.1429	14.000	2.571	42.00	0.857	4.667	7.7143
7	12.250	4.0000	1.0208	48.0000	16.333	3.000	49.00	1.000	5.444	9.0000
8	14.000	4.5714	1.1667	54.8571	18.667	3.429	56.00	1.143	6.222	10.2857
9	15.750	5.1429	1.3125	61.7143	21.000	3.857	63.00	1.286	7.000	11.5714

	Mile	Verst	Metre	Arshine	Metre	Sajene	Kilometre	Verst
1	0.663	1.509	0.7112	1.4061	2.1336	0.4687	1.0668	0.9374
2	1.326	3.017	1.4224	2.8121	4.2673	0.9374	2.1336	1.8747
3	1.989	4.525	2.1336	4.2182	6.4009	1.4061	3.2004	2.8121
4	2.651	6.034	2.8448	5.6242	8.5345	1.8747	4.2673	3.7495
5	3.314	7.543	3.5560	7.0303	10.6681	2.3434	5.3341	4.6869
6	3.977	9.052	4.2673	8.4363	12.8018	2.8121	6.4009	5.6242
7	4.640	10.560	4.9785	9.8424	14.9354	3.2808	7.4677	6.5616
8	5.303	12.069	5.6897	11.2485	17.0690	3.7495	8.5345	7.4990
9	5.966	13.577	6.4009	12.6545	19.2026	4.2182	9.6013	8.4363

AREA or Square Measure.

BRITISH—RUSSIAN—METRIC

	Sq. Foot	Square Arshine	Sq. Yard	Square Arshine	Acre	Desiatine	Sq. Mile	Sq. Verst
1	5.444	0.1837	0.6049	1.6530	2.700	0.370	0.439	2.276
2	10.889	0.3673	1.2099	3.3061	5.399	0.741	0.879	4.552
3	16.333	0.5510	1.8148	4.9592	8.099	1.111	1.318	6.827
4	21.778	0.7347	2.4198	6.6122	10.799	1.482	1.758	9.103
5	27.222	0.9184	3.0247	8.2653	13.499	1.852	2.197	11.379
6	32.667	1.1020	3.6297	9.9184	16.198	2.222	2.636	13.655
7	38.111	1.2857	4.2346	11.5714	18.898	2.593	3.076	15.931
8	43.555	1.4694	4.8396	13.2245	21.598	2,963	3.515	18.206
9	49.000	1.6531	5.4445	14.8776	24.298	3.334	3.955	20.482

	Square Metre	Square Arshine	Square Metre	Square Sajene	Hectare	Desiatine	Sq. Kilometre	Sq. Verst
1	0.5058	1.9770	4.5522	0.2197	1.0925	0.9153	1.138	0.879
2	1.0116	3.9541	9.1045	0.4393	2.1851	1.8306	2.276	1.757
3	1,5174	5.9311	13.6567	0.6590	3.2776	2.7459	3.414	2.636
4	2.0232	7.9082	18.2090	0.8787	4.3702	3.6612	4.552	3.515
5	2.5290	9.8852	22.7612	1,0984	5.4627	4.5765	5.690	4.393
6	3.0348	11.8623	27.3135	1.3180	6.5552	5.4918	6.828	5.272
7	3.5406	13.8393	31 8657	1.5377	7.6478	6.4071	7.966	6.151
8	4.0464	15.8164	36.4180	1 7574	8.7403	7.3224	9.104	7.029
9	4.5522	17.7934	40.9702	1.9770	9.8329	8.2377	10.243	7.908

VOLUME or Cubic Measure.

BRITISH—RUSSIAN—METRIC

	Cub. Yd.	Cubic Sajene	Cord 128 Ft.	Cubic Sajene	Cubic Metre	Cubic Sajene	Pint	Krujka (Schtoff)	Gallon	Vedro	Litre	Vedro
1	12.7037	0.07873	2.6797	0.3732	9.7127	0.10296	2.164	0.462	2.7056	0.3696	12.299	0.0813
2	25.4074	0.15743	5.3594	0.7464	19.4254	0.20592	4 329	0.924	5 4111	0.7392	24.599	0.1626
3	38.1111	0.23615	8.0391	1.1195	29.1380	0.30887	6.493	1.386	8.1167	1.1088	36.898	0.2439
4	50.8148	0 31487	10.7187	1 4927	38.8507	0.41183	8.658	1.848	10.8222	1.4784	49.197	0.3252
5	63.5185	0.39359	13.3984	1 8659	48.5634	0.51479	10 822	2.310	13.5278	1.8481	61.497	0.4065
6	76.2222	0 47230	16.0781	2.2391	58.2761	0.61775	12.987	2.772	16.2333	2.2177	73.796	0.4878
7	88.9259	0.55102	18.7578	2.6122	67.9887	0.72071	15.151	3.234	18.9389	2.5873	86.095	0.5691
8	101.6296	0.62974	21.4375	2.9854	77.7014	0.82366	17.316	3 696	21.6444	2.9569	98.395	0.6504
9	114.3333	0.70845	24.1172	3 3586	87.4141	0.92662	19.480	4.158	24.3500	3.3265	110.694	0.7317

WEIGHT

BRITISH—RUSSIAN—METRIC

	Grain	Doli	Dwt.	Zolotnik	Oz. Troy	Zolotnik	Lb Avoir	Funt	Lb.Avoir	Pood	Cwt.	Pood
1	0.6857	1.4583	2.7429	0.3646	0.1371	7.2914	0.903	1.108	36.11	.02769	.32243	3.101
2	1.3715	2.9166	5.4859	0.7291	0.2743	14.5829	1.806	2.215	72.23	.05538	.64486	6.203
3	2.0572	4.3749	8.2288	1.0937	0.4114	21.8743	2.708	3.323	108.34	.08307	.96729	9.304
4	2.7429	5.8331	10.9718	1.5483	0.5486	29.1657	3.611	4.431	144.45	.11076	1.28972	12.406
5	3.4287	7.2914	13.7147	1.8229	0.6857	36.4572	4.514	5.538	180.56	.13846	1.61215	15.507
6	4.1144	8.7497	16.4577	2.1874	0.8229	43.7486	5.417	6.646	216.68	.16615	1.93458	18.608
7	4.8001	10.2080	19.2006	2.5520	0.9600	51.0401	6.320	7.753	252.79	.19384	2.25701	21.710
8	5.4859	11.6662	21.9435	2.9166	1.0972	58.3315	7.223	8.861	288.90	.22153	2.57944	24.811
9	6.1716	13.1246	24.6865	3.2811	1.2343	65.6229	8.125	9.969	325.02	.24923	2.90187	27.913

WEIGHT (continued)

British—Russian—Metric

	Ton 2000 lb.	Pood	Ton 2240 lb.	Pood	Milli-gram	Doli	Gramme	Zolotnik	Kilo-gram	Pood
1	0.01806	55 382	0.01612	62.028	44.435	0.0225	4.266	0.2344	16.3805	0.06105
2	0.03611	110.764	0 03224	124.056	88.870	0.0450	8 532	0.4689	32.7610	0.12210
3	0.05417	166.146	0.04837	186 084	133.305	0.0675	12.797	0.7033	49.1415	0.18314
4	0 07223	221.528	0.06449	248.111	177.740	0.0900	17.063	0.9377	65 5220	0.24419
5	0 09028	276.910	0.08061	310.139	222.175	0.1125	21.329	1.1721	81 9025	0.30524
6	0 10834	332 292	0.09673	372.167	266.610	0.1350	25.595	1.4066	98.2830	0.36620
7	0 12639	387.674	0.11285	434.195	311.045	0.1575	29.860	1.6410	114.6635	0.42734
8	0.14445	443 056	0.12897	496.223	355.480	0.1800	34.126	1.8754	131.0440	0.48839
9	0.16250	498.438	0.14510	558.251	399.914	0.2025	38.393	2.1098	147.4246	0.54943

PRICE OF COPPER

British-American-Russian

Pounds Sterling Per ton 2240 lb.	U.S.A. Cents Per lb. Avoir.	Roubles Per Pood
£1	0.21725	0.15250
2	0.43451	0.30500
3	0.65176	0.45749
4	0.86902	0.60998
5	1.08627	0.76248
6	1.30353	0.91498
7	1.52078	1.06747
8	1.73804	1.21997
9	1.95528	1.37246

GRAVEL MEASURE

Estimating
1 Cub. Sajene = 1200 Poods
1 Cub. Yd. = 3411 lbs.

Dolis per 100 Poods	Dolis Per Cu. Yd.	Grains Per Cu. Yd.	Grams Per ton 2000 lb.
1	0.945	0.6477	0.0246
2	1.889	1.2953	0.0492
3	2.834	1.9431	0.0738
4	3.778	2.5908	0.0984
5	4.723	3.2385	0.1230
6	5.667	3.8862	0.1477
7	6.612	4.5339	0.1723
8	7.556	5.1816	0.1969
9	8.501	5.8293	0.2215

Based on 1 British Pound Sterling = $4.8665 = Rs.9.459

VALUE OF PURE GOLD.

British—American—Russian.

Weight			£	s.	d.	Sterling	U.S.A. Dollars	Roubles
1 Grain	= 1.46 Dolis	= 64.8 Milligrams =			2.124	£0.00885	$0.04306	Ro.0837
1 oz. Troy	**= 7.29 Zolotniks**	**= 31.10 Grammes =**	**£4**	**4**	**11 4545**	**£4.24773**	**$20.6716**	**R40 179**
1 lb. Avoir.	= 1.11 Funts	= 453.6 Grammes =	£61	18	11	£61.946	$301.46	R585.95
1 Doli	= 0.69 Grains	= 44.4 Milligrams =			1.4564	£0.00607	$0.0295	Ro.0574
1 Zolotnik	= 2.74 Dwt.	= 4.27 Grammes =		11	7.82	£0.5826	$2.8350	R5.5105
1 Funt	= 0.90 Lb. Av.	= 0.41 Kilograms =	£55	18	6.27	£55.926	$272.16	R529.00
1 Pood	= 36.11 Lb. Av.	= 16.4 Kilograms =	£2237	0	10.7	£2237.04	$10,886.58	R21,160.20
1 Gramme	= 15.4 Grains	= 0 23 Zolotnik =		2	8.776	£0.1366	$0.6646	R1.2918

	Shillings	Pounds Sterling £ s. d.	U.S.A. Dollars $ c.	Roubles R. k.
1 Gramme	2.73	2 8.78	.66	1.29
2 ,,	5.46	5 5.55	1.33	2.58
3 ,,	8.19	8 2.33	1.99	3.88
4 ,,	10.93	10 11.10	2.66	5.17
5 ,,	13.66	13 7.88	3.32	6.46
6 ,,	16.39	16 4.66	3.99	7.75
7 ,,	19.12	19 1.43	4.65	9.04
8 ,,	21.85	1 1 10.21	5.32	10.33
9 ,,	24.58	1 4 6.99	5.98	11.63
10 ,,	27.31	1 7 3.76	6.65	12.92
11 ,,	30.04	1 10 0.54	7.31	14.21
12 ,,	32.77	1 12 9.31	7.98	15.50
13 ,,	35.51	1 15 6.09	8.64	16.79
14 ,,	38.24	1 18 2.87	9.30	18.09
15 ,,	40.97	2 0 11.64	9.97	19.38
16 ,,	43.70	2 3 8.42	10.63	20.67
17 ,,	46.43	2 6 5.19	11.30	21.96
18 ,,	49.16	2 9 1.97	11.96	23.26
19 ,,	51.89	2 11 10.75	12.63	24.55
20 ,,	54.62	2 14 7.52	13.29	25.84
21 ,,	57.36	2 17 4.30	13.96	27.13
22 ,,	60.09	3 0 1.07	14.62	28.42
23 ,,	62.82	3 2 9.85	15.29	29.72
24 ,,	65.55	3 5 6.62	15.95	31.01
25 ,,	68.28	3 8 3.40	16.62	32.30
26 ,,	71.01	3 11 0.18	17.28	33.59
27 ,,	73.74	3 13 8.95	17.94	34.88
28 ,,	76.47	3 16 5.73	18.61	36.18
29 ,,	79.21	3 19 2.50	19.27	37.47
30 ,,	81.94	4 1 11.28	19.94	38.76
31 ,,	84.67	4 4 8.06	20.60	40.05
31.1035 = 1 oz	84.95	4 4 11.45	20.67	40.18

Based on 1 British Pound Sterling=$4.8665=R9.459

	Shillings	s. d.	U.S.A. Dollars $ c.	Roubles R. k.
1 Grain	0.177	2.124	.04	.08
2 ,,	0.35	4.248	.09	.17
3 ,,	0.53	6.371	.13	.25
4 ,,	0.71	8.495	.17	.33
5 ,,	0.88	10.619	.22	.42
6 ,,	1.06	1 0.743	.26	.50
7 ,,	1.24	1 2.867	.30	.59
8 ,,	1.42	1 4.990	.34	.67
9 ,,	1.59	1 7.114	.39	.75
10 ,,	1.77	1 9.238	.43	.84
11 ,,	1.95	1 11.362	.47	.92
12 ,,	2.12	2 1.486	.52	1.00
13 ,,	2.30	2 3.609	.56	1.09
14 ,,	2.48	2 5.733	.60	1.17
15 ,,	2.65	2 7.857	.65	1.26
16 ,,	2.83	2 9.981	.69	1.34
17 ,,	3.01	3 0.105	.73	1.42
18 ,,	3.19	3 2.228	.78	1.51
19 ,,	3.36	3 4.352	.82	1.59
20 ,,	3.54	3 6.476	.86	1.67
21 ,,	3.72	3 8.600	.91	1.76
22 ,,	3.89	3 10.724	.95	1.84
23 ,,	4.07	4 0.847	.99	1 93
1 Dwt.	4.25	4 2.971	1.03	2.01

	Shillings	Pounds Sterling £ s. d.	U.S.A. Dollars $ c.	Roubles R. k.
1 Dwt.	4.25	4 3	1.03	2.01
2 ,,	8.50	8 6	2.07	4.02
3 ,,	12.75	12 9	3.10	6.03
4 ,,	17.00	17 0	4.13	8.04
5 ,,	21.25	1 1 3	5.17	10.04
6 ,,	25.50	1 5 6	6.20	12.05
7 ,,	29.75	1 9 9	7.23	14.06
8 ,,	34.00	1 14 0	8.27	16.07
9 ,,	38.25	1 18 3	9.30	18.08
10 ,,	42.50	2 2 6	10.33	20.09
11 ,,	46.75	2 6 9	11.37	22.10
12 ,,	51.00	2 11 0	12.40	24.11
13 ,,	55.25	2 15 3	13.43	26.11
14 ,,	59.50	2 19 6	14.47	28.12
15 ,,	63.75	3 3 9	15.50	30.13
16 ,,	68.00	3 8 0	16.53	32.14
17 ,,	72.25	3 12 3	17.57	34.15
18 ,,	76.50	3 16 6	18.60	36.16
19 ,,	80.75	4 0 9	19.63	38.17
1 oz.	85.00	4 5 0	20.67	40.18

Russia. Laws, statutes, etc.		R9A3
General regulations for the carrying on of mining work with a view to safety		