SHOOTING NOTES *and* COMMENTS

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A BOOK CONTAINING MATTERS *of* INTEREST TO SPORTSMEN.

Printed & Published by
KYNOCH LTD.
BIRMINGHAM

The object of this publication is, in the first place, to inform cartridge buyers on the merits and advantages that we claim for Kynoch Ammunition, a comprehensive term that includes such varied products as

Shot-gun Cases, *Wads*, *Caps*,
Black & Smokeless Powders,
Shot-gun Factory-loaded Cartridges,
Rifle Ammunition.

Secondly, we have collected a number of articles, some reprinted from the "Kynoch Journal," and some written specially for this publication by gentlemen well qualified to write on the subjects, concerning matters which are constantly discussed by shooting men. We hope that authoritative notes on these points, collected in a form which can be conveniently kept for reference, will be appreciated.

July, 1910. KYNOCH LTD.

KYNOCH LIMITED were the first ammunition manufacturers to advocate the use of factory loaded cartridges. Like all innovators and innovations, the Company and their proprietary cartridges were subjected to much criticism, but the immediate and immense success of the cartridges placed on the market was the best answer to these criticisms; followed, as they have been, by the adoption, more or less completely, of the Company's methods by all the other case and powder manufacturers.

It is necessary to say "more or less completely" because none have carried the policy to its logical conclusion as the Kynoch Company have done, and consequently none have produced such satisfactory cartridges, nor met with the success that has attended the innovators' departure.

The following articles have been written to show what were the advantages to shooting men that Kynoch Limited expected would follow from their policy of pressing factory loaded ammunition, and the nature of the tests that led them to form these conclusions.

The features of Kynoch factory-loaded "K.S.G." cartridges are :—

1. General evenness of pattern, velocity and pressure.
2. Freedom from blowback.
3. Less recoil than that given by any other fully loaded standard ammunition.

It only remains, in this article, to mention that the cartridges referred to are known by the names of :

(1st quality). The only perfectly designed cartridge in the world. The metal extends beyond the turn-over, and it is therefore absolutely water and damp proof under all conditions.

(2nd quality). The "Kynoid" is a similar case to, and gives the same shooting results as, the "Primax" ; but the paper tube has been treated with a waterproofing process which renders the cartridge rain and damp-proof.

(3rd quality). A highly polished green paper cartridge with a deep brass head to ensure perfect ejection, and an inner iron head to give strength. A good looking cartridge giving excellent shooting results.

(4th quality). A paper cartridge with a brass head $\frac{5}{16}$" deep, and an inner iron head. This cartridge has the largest sale of any individual cartridge in Great Britain, a fact that need surprise no one when its price and excellent shooting qualities are taken into consideration.

(5th quality). This cartridge is loaded with just under an ounce of shot, and was introduced to meet the competition of the cheap foreign rubbish that has been sold in this country. The shooter who buys a cartridge at a lower price than this does so at the risk of losing his fingers or his eyesight.

IN the days of black gunpowder, the production of a sporting cartridge was entrusted to many hands. There was the case manufacturer, who made the case and the cap; there was the wad manufacturer, who produced the various qualities of wads required; there was the powder manufacturer, who made the black gunpowder; and, finally, there was the gunmaker, who bought these components from their various manufacturers, and then either assembled them himself, or set his assistants to do so under his supervision. The subsequent sale to the shooter, doubtless, brought satisfaction both to himself and the sportsman, for the regularity of black shot gun cartridges has never been excelled, if indeed it has been equalled, by the newer smokeless powders; although the other advantages to be derived from smokeless powder are such as to many times outweigh this slight failing in regularity.

Black gunpowder is not a chemical compound, but is a mixture of three materials, which, however well mixed, never combine or change their original properties. Consequently the manufacture, though dangerous, is simple, as is shown many times in history; the Chinese, the Spaniards in Peru, the Arabs in Morocco to-day, all

having manufactured it when pressed by need. The finished powder is absurdly simple to load. The only essential thing is to see that all the cartridges have an exactly similar charge of powder and the results, speaking broadly, will be identical.

How different is the case with smokeless powder. What Spaniard in Peru could have aspired to perform even the earliest processes in the manipulation of materials that are made to go through a number of complicated chemical changes and processes before appearing as a finished powder ?

Moreover, just as the powder maker has had to instal a far more expensive plant to produce smokeless powder than black, so has the case maker had to redouble the strength of his case to withstand the vagaries of this new propellent ; and the cap which in black powder days would fire anything, however it was made, now calls for a trained staff of chemists to produce from it a flame of just the right size and heat and force to ignite a particular powder, or combination of all three to best suit a group of powders, all having the same general characteristics, but differing in detail in many points.

Now the task of loading is no longer a sinecure. The loader, to do justice to his components, should have not only a practical technical knowledge of the general principles of manufacture of each class of component, but a detailed knowledge of the manufacturing history of every batch of cases, wads and powder that passes through his hands ; he must also have the necessary testing plant in the shape of chronographs, pressure guns, recoil apparatus, pattern plates, and penetration tests, to check the results

that the history of the several batches leads him to expect.

Such a plant costs little less than £1,000, and it is for this reason that Kynoch Limited considered it absolutely necessary that the manufacturers of the components should also load them ; and the more complete the range of manufactures that the loader controls, the more complete will be the success attendant on the loading.

Kynochs were the first firm in Great Britain who loaded cartridges, the cases, caps, wads and powder in which had all been made by them in their various works, the history of every batch of each component being handed on from department to department till it reaches the hands of the manager of the loading field, who studies the results so put before him, and then marries the components so as to produce an uniform excellence in the finished cartridges.

When, in 1902, Kynoch's Directors decided that, for these reasons, hand-loaded cartridges could not give such satisfactory results as factory-loaded, the components of which were all made under one management, they ordered a number of experiments to be made to determine what were the most common faults of hand-loaded cartridges that factory loading ought to obviate, and what was the best system of factory loading to turn out a cartridge that should give regular results in all guns and in all climates.

It may surprise shooters to learn that almost every fault found in a cartridge may be caused or obviated by the loading.

Missfires, hangfires, high pressures, scattered patterns, balled shots and poor penetration can all be caused by

loading good components imperfectly. Further, it was proved that many of these faults could be, and were, caused by the liability to human error in the use of the various hand apparatus in general use.

The first desideratum, therefore, was an automatic loading machine that would eliminate the human error. This they were unable to find already invented. Accordingly the Company's engineers designed an automatic loading machine which throws powder and shot charges, with unfailing regularity, within a margin of less than half a grain toleration. At the same time the wads are accurately placed in the cartridge and pressed, not to a set level as in hand machines, but to a set pressure.

Next, it was found that although the recommended loads for the different powders in different cases gave a satisfactory average of results over a season, yet different batches of powder or cases, if loaded according to these set rules, gave very different individual results.

It was therefore determined that loading should be controlled, not by regulating the charges according to recommendations of the various manufacturers, but according to the actual results obtained from each batch of the various components bought. In other words, the rule of loading from results instead of formula was adopted.

Thus, in a box of Kynoch loaded cartridges, it is possible to find different weights of powder charges, whereas in another make of ammunition the powder charges will all be uniform, yet the velocities of Kynoch cartridges will be regular and the velocities of the other ammunition up and down. This is one of the great

features of Kynoch cartridges. The firing results are the all important object, and to get regular firing results much care and skill must be shown in humouring the components.

The next result of the experiments undertaken was the clear proof that nearly all English cartridges were overloaded as regards the amount of shot put into a cartridge.

These experiments are given in full, so interesting do we deem them to be, on pages 54—56 of this book. It is enough to say here that it was clearly proved that with practically every gun bored to take a $2\frac{1}{2}$" ordinary game cartridge loaded with soft shot (say, 90% of the cartridges used in this country) it was a mistake to put in more than $1\frac{1}{16}$ oz. shot. That $1\frac{1}{16}$ oz. actually gave better patterns than the old accepted charge of $1\frac{1}{8}$ oz. Indeed, for a short range, such as for driven birds, 1 oz. should be ample. The patterns thus obtained are beautifully regular, and yet not so thick as to render the game unfit for the table.

Every batch of powder, cases and wads, therefore, that comes into the Kynoch loading factory, is tested, and from the result obtained a charge is settled that the manager knows will give our regular velocity, pattern, pressure and recoil; and while they are being loaded, samples are constantly being drawn and fired, to see if the actual results are those that were arranged for. All these records are kept, and when the cartridges are packed up a reference number is placed in the box, so that should any customer have anything to say about the cartridges later on, we can turn up the records and see exactly

what was the history of all the components and their loading.

It may readily be supposed that such a system was not evolved in a few days, nor is it kept up without a large and highly trained staff, which, again, renders it impossible for any but a large factory to produce the most regular cartridges.

This being the system, what of the components?

The powder is perhaps the most interesting to the shooting man, and a description of "K.S.G."—Kynoch's latest smokeless powder—will not be out of place here.

Nowadays the choice of a smokeless powder is large, and there are many brands that can claim regularity in manufacture, not only from day to day, but from month to month and year to year. Good velocities and moderate pressures are also common to a number of powders. In fact, the only points where a shooter may look for any great improvements are in blowback and recoil.

The 42 grain group of powders contain about 23% of their total weight of mineral matter, which, after firing, is left in the form of solid particles known as blowback.

The 33 grain group similarly contains about 13% of such minerals. The general idea of shooters, therefore, that 33 grain powders are less objectionable from the blowback point of view than 42 grain ones is fully justified by facts, although probably very few shooters know it for

a fact, but only supposed it to be so from accumulated experience.

"K.S.G.," although a 33 grain powder, contains only 6% of solid matter, which places it as much in front of the 33 grain explosives in general use as they are in front of 42 grain powders.

No component of a cartridge is more difficult to make satisfactorily, or has more bearing on the firing results to be obtained, than the powder.

The most important component of a powder is the nitro cotton. On the purity, and consequently stability, of the nitro cotton depends the regularity, the good shooting, the freedom from changes due to climatic differences, and the good keeping qualities of the powder.

Kynoch Limited make their own nitro cotton, and thus are ensured against trying to make a good powder out of a bad cotton.

Every batch of nitro cotton when made is tested—

(*a*) To ascertain if it has the correct degree of solubility in the solvent employed.

(*b*) To ascertain if it is properly nitrated, a test known as the "nitrogen" test.

(*c*) The heat test to ascertain its stability or permanency.

(*d*) To prove the absence of unnitrated cotton.

(*e*) To find the degree of vicosity.

The process of manufacture consists in :—

1. Weighing and mixing	The Ingredients
2. Milling and incorporating	
3. Granulating	The Grain
4. Drying	
5. Sifting and sizing	
6. Hardening and waterproofing	
7. Final sifting and sizing	
8. 1st Blending	The Finished Powder
9. 2nd Blending	

Every final blend results in a batch of powder of two tons weight, to which a batch number is allotted, which enables it to be traced at any future time.

Samples of powder are taken haphazard from the preliminary blends, and some of the tests afterwards described applied to them, but it is not until it has become a final and two ton batch that all the tests are made in rotation and the results recorded.

The batch tests are as follows :—

(*a*) Under normal conditions.

1. Velocity
2. Pressure
3. Recoil
4. Ignition
5. Penetration
6. Pattern

(*b*) For damp test.

Velocity.—After being placed in a vapour bath for 24 to 36 hours in an atmosphere saturated with moisture.

(*c*) For heat test.

Pressure.—After being placed in a heated oven for several hours until the whole of the moisture in the powder has been extracted.

The powder is proved to a specification and tested with a standard known to give certain ballistics and accuracy.

A satisfactory standard of ballistics is thus ensured under normal conditions, and in addition the possibility of the deterioration of the powder in damp or moist atmospheres, and high recoil and pressure in warm climates, is obviated.

When a batch has been so passed, it is placed in our magazines for from three to six months and kept under observation.

From time to time, as the stock of powder at Witton, where all our loading is done, runs low, a requisition for further supplies is sent to Kynochtown, who send on the powder accompanied by the history of the manufacture of the particular batch forwarded, for the information of the manager of the loading field, as mentioned before.

Whatever may have been the fact 15 or 20 years ago, it is now acknowledged by everyone who has experience of all makes, that Kynoch sporting cases are superior to those of any other manufacturer.

The paper tubes are so strong that it is no longer necessary to put iron linings in cases (N.B.—Iron linings must not be confused with iron heads); and the brass for

the heads is made in the Kynoch works, and is such that split heads or burst rims are practically unknown.

The gauging and inspection of the work, both in process of manufacture and when completed, are carried out by men brought up to government cartridge inspection, and insure us against any carelessness in the works.

Finally, the cases are all examined again by the loading department before they are issued to the automatic loading machine minders.

As long ago as 1897 the "Field" said of Kynoch caps:—

"In our issue of September 12th, 1896, we published the results of a long series of trials of percussion caps of British, American and Continental manufacture. These trials brought to light what was suspected but not actually known, viz., the excessive variations in the strength of the cap. We think we may fairly congratulate ourselves upon the fact that the trials above alluded to had the effect, amongst others, of placing Messrs. Kynoch on their metal, with the result that their caps, as now sent to us, we have found more regular in their action than any other we have hitherto tried. We think Messrs. Kynoch deserve great credit for having successfully tackled this most difficult problem."

Kynoch Limited are a progressive firm, and whatever may have been the state of their manufactures in 1897 it is safe to say that it has much improved since then.

Wads are dealt with similarly; and shot is bought from the best and most conscientious English shot manufacturers.

It will not surprise shooters who have read thus far to know that we have very few complaints of ammunition to deal with, but it may interest them to know that, so far as we are able, we are determined that every user of Kynoch ammunition shall be satisfied with it in every way. Should there be anything, therefore, with which the shooter is not pleased, we hope he will communicate with us and send us the identifying label out of the box complained of and, if possible, a few cartridges. We are always most pleased to make every enquiry into a complaint and, if we find that we are to blame, we always replace the cartridges.

A few years ago the mention of the term "factory-loaded" was sufficient to deter most shooting men from the purchase of ammunition so described. The sportsman was not aware of what specific faults he might expect to find in such cartridges, but the term was used to imply every sort of reproach that could be brought against a cartridge, and the shooter felt that he had only himself to blame when he was not entirely satisfied with his purchase if he had completed it after hearing that the "stuff" was "factory-loaded."

That sportsmen should have accepted this implication has been a very fortunate thing for the hand loader; but for this universal dread of the factory-loaded product, it must have long ago completely ousted its hand-loaded rival.

As a matter of fact the term "factory-loaded" is, or should be, a guarantee of perfection. Probably half the cartridges fired in Great Britain to-day are "factory-loaded," and the proportion increases each year. To-day the hand loader is no longer able to put sportsmen off by the old shibboleth "factory-loaded," but he has to indicate in what particular "factory-loaded" cartridges will fail to give satisfaction.

Practically the only arguments that he feels will now appeal to his customers are :

1. That factory-loaded cartridges are not, by the time the shooter uses them, "freshly" loaded, and
2. That his hand-loaded cartridges are specially loaded to suit the particular gun they are intended for.

Neither argument is worth the time it takes to state it.

Let us look at argument No. 1. In the first place, how many millions of cartridges are ordered months before the shoot they are intended for, or are not all used at such a shoot, but are finished later in the season? Is any difference noticed in the firing of these "stale" cartridges? Of course not. Some shooters we know often give to their keepers any cartridges that are left over at the end of the season, but many keep them, and how often you hear shooters, in a surprised tone, saying that they are shooting last year's cartridges and that they are perfectly good. Of course they are.

The fact of the matter is that if a cartridge is properly stored it is as good certainly three years after loading as three days or three weeks.

The hand loader says an old cartridge is not likely to be so good as a freshly loaded one. We say that it is more likely to be good, because, apart from all the advantages that we have shown a wealthy factory can supply, there is this further advantage in an old loaded cartridge. The powder in a cartridge is very largely protected from atmospheric influences. Now the hand loader, who supplies the loading fresh, has to do it with powder that has been in his shop for some time lying loose in a tin. It is therefore much more likely to have deteriorated than the powder lying secure in the "factory-loaded" cartridge during that time.

In short, there is no advantage to be gained by the use of freshly loaded cartridges, and there are possible drawbacks attendant on their use.

As to No. 2. With some very few exceptions, we can only say that there is less justification in this statement than in the preceding one. We have made some thousands of tests and found that about 90% of the guns used by English shooters give the best patterns with $1\frac{1}{16}$ or 1 oz. of shot, and though, of course, the 1 oz. pattern is not so dense as the $1\frac{1}{16}$ oz., there is nothing to choose between the regularity or evenness of the two charges.

There is no universal definition of "game" throughout the United Kingdom.

In England "game" is usually understood to mean what is so defined in the Game Act, 1831, viz., "hares, pheasants, partridges, grouse, heath or moor game, black game and bustards."

In Scotland the same list, with the addition of ptarmigan, comprises what is meant by the word in the statutes relating to the unlawful killing and taking of game.

In Ireland "game" also for most purposes includes land-rail, woodcock, snipe, quail, wild duck, widgeon and teal.

As far as licences for dealing in game are concerned the English definition given above applies to all three countries.

In the English Poaching Prevention Act, 1862, "game" means "hares, pheasants, partridges, eggs of pheasants and partridges, woodcocks, snipes, rabbits, grouse, black or moor game, and the eggs of grouse, black or moor game."

It must be understood, however, that in the following notes "game," unless otherwise stated, has the meaning given to it in the first of the above definitions, and that the law applies only to England unless otherwise stated.

"Ground game" means, of course, hares and rabbits.

If a man shoots game on his own land, or land on which he has the right of shooting, and it falls dead on, or runs and dies on his neighbour's land, the game shot belongs to the shooter and he is entitled to demand the delivery of it from the neighbour. Even if the game in the case supposed was not actually shot till it crossed the neighbour's boundary, the game belongs to the shooter, though in this case he was technically guilty of a common law trespass (not a "trespass in pursuit of game") in firing over the other's land. If a trespasser puts up game and shoots it on the same land, the game shot belongs to the person having the right of shooting on the land, and may be demanded and taken by force if necessary from the trespasser. But it has been laid down that if a trespasser puts up game on one man's land and follows it on to another's land and there shoots it, it belongs to the trespasser, although he may be prosecuted for a trespass in pursuit of game by either of the two parties. Of course, what is stated as to the ownership of game applies to other birds and wild animals not falling within the definition of game.

Any unauthorized entry by a person on to or over the land of another is a trespass at common law, for which an action for damages may be brought. Only the actual, that is usually nominal, damages can be recovered unless the trespass is repeated frequently or after warning, when possibly a jury would be justified in giving heavier or

what are called "vindictive" damages. The proper remedy in such a case, however, would be an action for an injunction to restrain repetition of the trespass.

If actual damage, to the extent of only 6d. or 1/-, to fences, grass, crops or cultivated plants, can be proved, the offender may be prosecuted before the local bench of magistrates for malicious damage.

It is a trespass to shoot over another's land or send a dog on to the same without the consent of the occupier, or save in pursuance of some legal right.

A landowner has no more right to go on to or shoot over his tenant's land than he has to go on to a stranger's, unless he reserved a right to do so at the time of letting. Of course the reservation of a right of shooting or sporting implies the right to go on the land to shoot for sport or for any purpose incidental to shooting or sporting.

The soil of a public road is deemed, until the contrary is proved, to be vested in the owners of the adjoining land on either side, each owning to the centre of the road, though for many purposes the upper crust of main roads and roads in urban districts belongs to the County or Urban District Council. The general public have a right to use any highway, whether a metalled road, a bridle-way or a footpath across a field, for the purpose for which it is dedicated, but for no other. Any other use, such as loitering about with a gun or dog for the purpose of killing or taking game, or other birds, or rabbits coming from the adjoining land, is a common law trespass—or trespass in pursuit of game, as the case may be.

In addition to the remedy by legal action, the law allows the occupier of the land trespassed upon to take the more

primitive but quicker and usually more effective remedy of requesting the trespasser to leave, and in case of neglect on the latter's part to immediately comply with the request, ejecting him with force. He may be pushed or, if necessary on account of his resistance, carried off. No more force must be used than is reasonably necessary otherwise the trespasser himself may take legal proceedings against his ejectors.

The occupier of land next a public road or through whose land a footpath runs may treat in this way any one who thus loiters for the purpose of taking game, etc., or interfering with the shooting, provided that in the case of the ordinary roadway bounding the land the loiterer is on that half of the roadway next the land.

It is only the occupier of the land who has this summary remedy and not the landlord to whom the shooting is reserved (unless he has expressly reserved the soil of the roadway when letting the land) nor the sporting tenant to whom the rights have been let. Either of these can only so act if he has the authority of the actual occupier of the land.

"Daytime" means from commencement of the first hour before sunrise to end of the first hour after sunset, by local or astronomical, not Greenwich, time.

In the daytime anyone who is found or is proved to have entered or been on land in search or pursuit of game or woodcocks, snipe, quails, landrails, or rabbits, to which

he is not entitled, commits an offence for which the penalty is not exceeding £2 and costs, unless there are five or more persons together, when the maximum penalty is £5.

To pick up wounded game, etc., is a trespass in pursuit, but to pick up dead game which was not killed by the person picking it up, or by someone acting in concert with him, is not such a trespass, though it may be and usually is larceny.

Though shooting over another's land is a common law trespass it is not an "entry" in pursuit. The entry must be of the body or some part of the body of the trespasser. So a man who, standing on his own land, or on land where he has a right by consent of the owner to be, shoots game, etc., on another's land, cannot be prosecuted for trespass in pursuit even if he sends his dog on to the other's land to retrieve the dead game. If, however, he subsequently enters on the other's land and fetches it himself, having had at the time of shooting the intention of taking it, he may be convicted, although the game, etc., was dead at the time he picked it up. To constitute the offence the shooting and picking up must both be in the daytime. If the shooting is in the daytime and the picking up at night no criminal offence is committed.

The mere putting of the arm through a fence or one leg over the boundary is a sufficient entry of the body to justify a conviction.

A man on a highway in search of game, etc., on or coming from the adjoining land to which he has no right, may be prosecuted for a trespass in pursuit, the land on which he has "entered" and is trespassing being the

highway itself as before explained. If, however, a shooting estate is bounded by a public road a man may, with the consent of the occupier of the land on the opposite side of the road, stand on that side of the road and shoot the game as it comes over without being guilty of a trespass in pursuit.

It is an offence, however, for anyone to fire a gun within 50 feet of the centre of a carriage road in such manner as to endanger or interrupt a passenger.

As a ditch presumably and usually belongs to the owner of the land on the far side of the hedge, if a man stands or sits in a ditch with a view of shooting game coming over or through the hedge from someone else's land on the other side, he will be guilty of trespass in pursuit if his intention was to shoot before the game actually crossed the ditch. If his intention was to shoot after it had crossed so as to be over or on his own land, he probably could not be convicted.

A tenant of land where the shooting is reserved cannot be guilty of a trespass in pursuit on the land; but if he takes or pursues game other than hares he is liable to a similar penalty and in addition to not exceeding £1 a head of the game actually killed. This does not apply to birds not game (woodcock, snipe, etc.), and in respect of these he is only liable to a common law action.

It is a good defence to an action for common law trespass that the alleged trespasser had the authority of the occupier, but on a prosecution for trespass in pursuit where the shooting is reserved or let away from the land, the leave of the occupier is no defence except in the case of a written authority to take ground game.

"Night" is after the close and before the beginning of "day" as above defined.

Night poaching only extends to game or rabbits. The offence is committed by anyone who unlawfully by night (*a*) takes or destroys game or rabbits on any land open or enclosed (unless it is waste land) or on any highway; (*b*) enters or is on any open or enclosed land (not being a highway) with a gun, net, engine or instrument for the purpose of taking game (not rabbits).

The offence is punishable summarily by imprisonment, but a third offence is a misdemeanour triable at Quarter Sessions.

If three or more are together committing offence (*b*) and any one is armed with an offensive weapon it becomes a misdemeanour triable at Quarter Sessions. In this instance, too, rabbits are included as well as game.

It is no offence to be on a highway at night even with a gun, dog, and net for the purpose of taking game or rabbits unless any such are taken.

It is no offence to be on land at night even with a dog for the purpose of taking game or rabbits unless any such are taken. If, however, the trespasser in this case has a gun, net or stick, it will depend whether the place and circumstances justify the assumption that he was in search of game whether he can be convicted; if he was in search of rabbits only and did not take any he cannot be convicted.

A tenant where the game is reserved may be prosecuted for night poaching as well as a stranger, except that he is entitled to take hares or rabbits otherwise than by

the use of firearms, but on moorlands or unenclosed lands only from 1st September to 31st March inclusive.

There are special penalties for unlawfully taking hares or rabbits or setting snares or traps for the same in warrens or places set apart for the breeding of hares or rabbits.

The Night Poaching Acts apply equally to Scotland and Ireland.

By "Foreshore" is meant not what is commonly included in the term beach, but only the land between the average line of ordinary high tides and the average line of ordinary low tides, *i.e.*, not the springs and neaps but the tides at periods between these two. The sands, shingle or rocks which are above the average line of ordinary tides, and are sometimes covered by the sea at spring tides are presumed to belong to the owner of the adjoining inland.

Below the average line of ordinary low tides the soil is the property of the Crown, and the soil of the foreshore itself is presumed to belong to the Crown until the contrary is proved. This rule applies to all inlets of the sea, estuaries and navigable rivers as far as ordinary high tides flow. The greater part of the foreshores of this country, however, have at different times been granted to private persons, usually the Lords of the Manors of the adjoining lands. The original grants in many cases are not in existence, but the private ownership can be proved by long usage.

Where the soil of any part of the foreshore is vested in

a private person the public have no right to shoot on or over such foreshore, or, speaking generally, even to walk thereon. In such cases it is not even possible to prove a custom for the inhabitants of a particular parish to shoot there, and however long they may have been allowed by the owner of the foreshore in question to do so, such owner may at any time revoke the permission.

A "trespass in pursuit" may be committed on a private foreshore as well as on inland soil, and if it is proved that any rabbits, hares or other game, or any woodcocks, snipe, quails or landrails are ever found there, it is a question of fact for the magistrates to find whether the person prosecuted was in fact in pursuit of any such. If he was not, he can only be treated as an ordinary trespasser and either turned off or proceeded against by civil action.

The occupier of land, whether he be a tenant or an owner who has let the shooting, has the right of which he cannot by any means deprive himself to take ground game on land in his occupation. He may take or kill them in any way, except by poisons, and save that spring traps may only be employed in rabbit holes, nor must firearms be used at night.

The right is a personal one which cannot be assigned, but he may depute the right of taking the ground game to all or any of the persons in his ordinary service on the land and the members of his household resident on the land, and to one outsider, if the latter is bona fide employed for reward to kill and take the ground game. Only one of the above persons at a time can be authorised

to use firearms for the purpose. Each person authorised must have a written authority from the occupier, which must be produced on demand by the person having the right of shooting over the land, or anyone authorised in writing by the latter. Otherwise, the person taking ground game, other than the occupier himself, will be guilty of a trespass in pursuit.

The rights can be exercised all the year round, except on moorlands or unenclosed lands (not being arable lands) which either do not adjoin arable land, or if they do, are not less than 25 acres in extent. On these the occupier's right is exercisable only from the 1st December to the 31st March both inclusive, and as to the period from 1st September to 10th December inclusive firearms may not be used. In respect of this last mentioned period, too, the occupier and person having the sporting rights may make an agreement as to the joint exercise of the right of killing ground game. This is the only case in which an agreement can have any legal effect.

An owner occupying his land and not letting the shooting can kill ground game how and when he likes, but if he lets the shooting he is in the same position as an occupying tenant where the shooting is reserved.

A tenant of land who has the shooting as well may not set spring traps, except in rabbit holes, use poison, or kill ground game by firearms at night.

A shooting tenant who does not hire the land may shoot ground game at night or set spring traps elsewhere than in rabbit holes, unless, of course, he has contracted not to do so.

The law as to ground game applies to the whole of the United Kingdom.

All game licences are now under the jurisdiction of the County Councils, but by arrangement with the Postmaster-General are issued from Post Offices. Some County Councils also appoint special officials to issue them from the Council Offices.

A yearly licence to kill game costs £3 and expires on the 31st July following the date of issue. If taken out after the 1st November the cost is £2.

A 14-day licence may be taken out at any time and costs £1.

A yearly licence for a gamekeeper costs £2 only. But it only authorises him to kill game, etc., on the sporting estate of his employer, and if he leaves the employer's service, the latter may get the licence transferred to another gamekeeper.

A tax of 15/- for a male servant must also be paid for a gamekeeper.

The game licence is required for taking game (as to hares see below), woodcocks, snipe, quail, or landrail, or for using any dog, gun, net or engine for the purpose of taking any such, except that woodcock and snipe may be taken with nets or springs without a licence.

A trespasser requires a game licence if he kills or uses a dog, gun, net or engine for the purpose of taking rabbits.

The owner or occupier of land does not require a game licence to kill hares, nor does any person duly authorised by the occupier when exercising his rights under the Ground Game Act. A 10/- gun licence is, however, required.

No licence is required to course hares.

A person convicted of trespass in pursuit of game forfeits his game or gun licence, if he has either.

Any person in pursuit of game, or other birds for which a licence is necessary, may be required to produce his licence for inspection by an Inland Revenue officer, a police constable, or other person authorised by a County Council, or by the owner or occupier of the land on which the person is, or any person having himself a game licence; failing production of the licence the person's name and address may be demanded. If this be refused, or a false name or address given, the defaulter is liable to a penalty not exceeding £20. The demand may be made on the road or elsewhere than on the land on which the game, woodcock, etc., is being shot or pursued, providing it be made immediately after the person whose licence is demanded has left the land where he was shooting or pursuing game. It is not likely that Inland Revenue officers will in future concern themselves with the matter. No authority is given by statute to the officer or licensed person wishing to demand inspection of another person's licence to enter upon any land for the purpose of making the demand. If the person whose licence is to be demanded is shooting on land in his own occupation, it is believed that such entry would be justified. If otherwise, it is thought the occupier of the land might treat the person coming to make the demand as a trespasser.

A sportsman having game to sell may only sell to a licensed dealer in game; if he sells to anyone else, he is liable to a penalty not exceeding £2 a head of the game sold. This only applies to game proper.

The licences above treated of apply to the whole of the United Kingdom.

These are outside the scope of this article, save so far as concerns game farmers, whose position as dealers in live game is a somewhat difficult one to legally define. There are no direct dicisions of the Courts to guide us, but the general opinion of those who have studied the Game Laws is that a game farmer who sells live game, whether British or foreign (and not merely the eggs of game), requires a licence to deal in game, whilst if he has such a licence he is undeniably liable to a penalty if he keeps pheasants in a pen at any time from the 12th February to the 30th September, both inclusive.

It is likely, now that County Councils have taken over the licences, we shall soon see the question before the Courts.

Broadly speaking, every person who carries a gun, except on behalf of another duly licensed person, must have a gun licence if he has not a game licence, but the occupier of land, himself using a gun for the purpose of scaring birds or killing vermin on such land, is exempt. If he authorises any other person to do so for him, one of them, it doesn't matter which, must have a licence.

A farmer scaring pigeons off his peas does not require a licence, but if he kills a pigeon he does, though it has not hitherto been the custom to prosecute in such a case.

If a dog causes injury to the sheep, cattle, horses, asses, mules, goats, or pigs of another person, its owner

is liable to pay for the damage done. If it kills poultry he is not liable, unless it had to his knowledge previously shewn a mischievous propensity.

The shooting of a strange dog or cat seen in a wood chasing game or rabbits cannot be justified, unless there was absolutely no other way of saving the life of the object chased. It is not clear that even such an excuse is sufficient to exonerate from liability to pay damages to the owner of the dog or cat.

If a dog sent by train is killed, injured or lost, the owner can recover from the railway company the full value of the dog or amount of damage sustained, provided the death, injury or loss was due to the negligence or default of one of the company's servants, and no contract limiting the company's liability has been signed.

Most railway companies have a condition that they will not be responsible for any dog (even though caused by negligence) beyond the amount of £2 unless the higher value of the animal is declared at the time of consignment, and 1¼% additional freight or carriage is paid on such excess of value. That condition is perfectly valid and binding on the owner of the dog, providing that he or someone on his behalf (*e.g.*, the person who takes the dog to the station for him) signs a consignment note with the clause printed on it. If it is signed and no extra percentage is paid, £2 is all that can be recovered for loss of the dog even though it was worth £100. If the extra money is paid the amount on which the percentage is paid is the limit which can be recovered.

If the consignment note or some other paper is not signed the condition limiting the liability of the company to £2 is inoperative.

The law appears to be the same with regard to dogs accompanying their owners in a passenger compartment, but in this case the owner is, of course, bound to keep his dog out of harm's way as far as possible, so that the railway company in such cases runs little risk.

The various subjects which have been shortly dealt with in the above article can be found treated at greater length, with authorities cited for the propositions laid down, in the Author's "Shots from a Lawyer's Gun," 5th Edition, 1910.

The fortunate possessors of really good partridge ground in a country where there is no hunting, and consequently where foxes are not encouraged, should have comparatively little difficulty in keeping up a fair stock of partridges without resorting to the many systems and dodges which are practised by less fortunate owners.

In deciding whether the ground is the most suitable for partridges or the reverse, there are two things, before all others, which should ever be borne in mind. These are (1) the necessity for killing down vermin; (2) for leaving a sufficient, and above all a healthy, breeding stock.

Many theories have been advanced in the Press of late to account for a decrease of partridges in some parts of England, but none of them seem to be at all convincing. In places where the badness of past breeding seasons does not sufficiently account for the present decrease of partridges, it is probable that the chief reason for the shortage of birds complained of is constitutional weakness. Consequently the birds in the affected localities are less able to withstand climatic changes than they used to be. This may be attributable to three possible causes: hand rearing; Hungarians turned down in the wrong way; and refraining from shooting entirely in bad seasons. Hand rearing of partridges is likely to produce weakly birds from the fact that many which live to maturity under

a hen-coop, and when fed by man, would, and ought to, die under natural conditions. Nor can there be much doubt that hand-reared birds make very indifferent parents. Having been fed and housed by man themselves they are incapable of finding proper food and shelter for their young.

During recent years a large number of Hungarian partridges have been turned down in England and most of them have been liberated in the wrong way. That is to say they have been turned out on the night of their arrival, when even the strongest of them must have been in a more or less weak condition after their long journey. While in this state they are not only obliged to find food and shelter in a strange country, but also to withstand the attacks of the native birds, who treat them as interlopers. Most of these birds are not even examined before being let out of their baskets. There may be a large preponderance of cocks among them, and some may even be afflicted by a catching form of disease. Under these circumstances many are driven away, some die, and the remainder never sufficiently recover strength to enable them to bring up strong constitutioned families.

Hungarians should be penned for three weeks or a month before being let out. Every bird which is not in good condition and thoroughly healthy at the end of this time should be killed, and the number of cocks and hens noted, care being taken that more cocks are not liberated than hens.

Twenty-five brace is sufficient for each pen, which can be made of wire netting $1\frac{1}{2}$" mesh, 3 ft. high, 25 ft. long and 15 ft. broad. Wooden shelters should be placed

in each of the four corners and fir boughs in the centre. The birds will then be able to see out at the sides and make the acquaintance of their future neighbours. Hungarians will stay best if they have been bought in January and turned out on ground which has been heavily shot. When let out in February, or about the middle of the pairing season, their thoughts are turned more towards love-making than to exploring fresh country, and it will be found that the higher price charged for the birds at this time of the year will be more than counterbalanced by the number which remain to nest.

Refraining from shooting during a succession of bad seasons, was given as the last reason for a possible weakness of constitution among partridges in some districts at the present time. There are some owners of partridge shooting who make the mistake of leaving as large a breeding stock after a bad season as after a good one.

If the limit of stock which will nest on the ground has been reached after a good season, the same number of birds will be too many to leave on it after a bad one. Young birds are scarce in a bad season, consequently the stock will consist for the most part of old ones, which require an ever increasing area to themselves for their nests. The young birds are driven off the ground, and the number of nests is by no means proportionate to the stock left. After several bad seasons, if the ground is not shot, the nesting stock consists of the very oldest birds only. Many of these will die from old age, some are barren and spend their time fighting the remainder, of which the majority are too old to produce strong constitutioned families. It is true that few estates suffer in

the way just described, but there are some at the present time on which few, if any, young birds are allowed to remain to nest.

The question of breeding stock is the most important and one of the most difficult ones that the partridge preserver has to deal with. If he knows, and he should insist on knowing, what birds he has before he begins to shoot, it will be his own fault if he does not leave a proper breeding stock at the end of the season.

Many things have to be taken into consideration when estimating the number of birds to be left on a given area. The amount of nesting ground on it, and the number of birds usually left on the neighbouring properties, are two of the factors to be reckoned with. But as space does not permit of going into the whole question thoroughly, suffice it to say that one bird to every four acres is the minimum which should be left in any year, and that one bird to every two acres is probably the maximum from which any good will be derived; and the latter number should only be left after a good year.

When there are not sufficient birds to supply the minimum stock just mentioned, it is better to increase the stock gradually by shooting lightly and leaving a few more each year, than to refrain from shooting entirely in the hope of raising the stock to the required dimensions at once.

Of late years, many dodges have been introduced, under various names, with the idea of increasing partridges by their means. It may be said, at once, that none of them will work miracles, and that all are useless without hard work in other directions as well.

Isolated and transitory successes only can be claimed

for the French system, or the unattached cock system; so that they may be left out of our calculations here.

The Euston system—so called because it was invented by the Duke of Grafton's keeper at Euston—for the hatching of wild pheasants, has never been adopted on that estate for partridges. Nevertheless, it can be applied to these birds with great success, and modifications of it will be found useful on any estate.

As is now fairly well known, the main principle of this system lies in incubating the eggs artificially, or under hens, and returning them to the partridges on the eve of hatching. The partridges are meanwhile given boiled or dummy eggs to sit on. In this connection it may be said that since the improvement which has been effected in manufacture of imitation eggs, some kinds are taken to quite satisfactorily by the birds, which will sit on them as if they were their own.

No eggs should be taken from a nest until there are at least four in it, and no chipped eggs should be given to a bird until she has been sitting ten days, unless a miscalculation in time has been made, and it is impossible to place the eggs elsewhere. It will be readily understood that in a country where foxes abound numbers of eggs may be saved if treated in this way.

Again, by this method the hatching of eggs laid round clover fields may often be retarded till after the crop is cut by allowing the partridge to sit for a month on dummy eggs instead of for the usual three weeks.

The lives of many young birds may, however, be saved by starting the mowing machine in the centre of the clover and grass fields and cutting outwards instead

of from the outside inwards. The writer is indebted to a friend for this plan, which is as helpful in practice as it is sound in theory.

In order to make the most of the Euston system, the eggs should be put under hens at intervals, which will ensure a setting of eggs, partially incubated, being ready, in case of emergency, at any time during the hatching season. It often happens during very wet weather that birds will desert their eggs for a time and return when the young birds inside them are dead. If the keeper has some eggs under hens at this time he can distribute them very profitably to those birds which would otherwise sit without effect.

The hatching of late second nests should always, when possible, be accelerated by ten or twelve days.

Very late birds, even if they live, seldom grow properly, and invariably lay very late the following season. Their eggs also being small and few in number, the probability is that the offspring is none too strong. The fact that these birds can be hatched by artificial means ten or twelve days earlier than would be the case under ordinary circumstances, makes a considerable difference to their growth and laying power.

The Euston system will be found useful in other cases which crop up during every nesting season.

Keepers should be encouraged to keep statistics of all the nests they find, and if maps of their beats, showing the fences, are provided for them, the nests can be marked down and none should be forgotten.

The date on which each bird begins to sit should be carefully noted, as it may become of the utmost importance later on.

After all is said and done, the two most important factors in partridge preservation are the breeding stock and the keeper. The latter should be one who works hard, and who works with intelligence.

[For further particulars of the above system for improving a partridge manor, the Editor recommends a study of Mr. Alington's book on "Partridge Shooting," printed by John Murray, 50a Albemarle Street.]

The subject of the striking velocity of shot has for some time past been receiving considerable attention, and rightly so, since this is the most satisfactory method of determining what is generally spoken of as the penetration of the shot at a given range.

Whilst the maker of powder or cartridges is most interested in the velocity at which the shot leaves the muzzle, to the sportsman this is only a matter of secondary importance; the real point to him is—with what velocity does the shot strike the mark? There is, of course, a certain connection between the two, but there are so many influences which may cause an abnormal loss of velocity, that it is not safe to state positively that a high muzzle velocity will give a correspondingly high striking velocity at 30 or 40 yards. It is therefore necessary to consider the most suitable means for measuring striking velocities.

We think that one of the most careful and complete series of experiments on record is that made by Mr. R. W. S. Griffiths, at the Schultze Co.'s works, nearly twenty years ago. In these experiments, by means of a rotating disc 12 feet in diameter, the times taken by all the different parts of the pattern to reach the plate were recorded. This method of experiment, since it enabled the velocity of the main body of the charge to be measured, obviated one of the causes of irregular records of velocity, which with other methods are liable to occur,

owing to a few shots having a higher velocity than the bulk of the charge. This is a point we shall refer to later on.

The magnitude of Mr. Griffiths' work is shown by the fact that he fired with 10 sizes of shot at 12 different ranges with 6 different charges, three shots being fired under each of these 720 different conditions, or a total of over 2,000 shots. The results of these experiments were published in the "Field," December 4th, 1886.

In order to calculate from the results of Mr. Griffiths' experiments the striking velocity at any range, such as, say, 40 yards, it is necessary to take the times of flight over ranges respectively greater and less, say, 45 and 35 yards; the difference between the two times representing the time of flight between 45 and 35 yards. From this the mean velocity between these two ranges can be calculated, and this can be taken as approximately equal to the striking velocity at 40 yards. The objection to this is that the conditions may vary between the firing at 35 yards and at 45 yards, so that the difference of the two times may not truly represent the time of flight between the two distances. Any errors due to this cause may be largely diminished by judicious averaging or by graphical methods, such as are commonly employed in all physical experiments.

Whilst Mr. Griffiths' method of measuring the interval of time between the shot leaving the muzzle and arriving at the target is, owing to the spread of the shot, not as accurate as measurements obtained by the breaking of electric circuits in the ordinary way, yet the uncertainty in the latter case as to whether the second circuit is broken by the front, middle, or even the rear of the cluster of

shot, is sufficient to counterbalance this advantage; so that whilst the source of error in Mr. Griffiths' experiments is the width of the cluster, by the other method uncertainty is caused by the length of the group of shot.

In our own experiments we have found it preferable to substitute a rigid steel plate, with a light spring contact at the back, for the wire screen. The spring may either be made so light as to break the circuit on the impact of a single pellet, or by a certain amount of stiffening three or four shots arriving in rapid succession may be required to interrupt the current. In any case, the spring is made sufficiently stiff and the plate sufficiently heavy to prevent the sound wave from breaking the circuit.

If two of these plates are arranged at different distances, so that each receives adjacent patches at the centre of the pattern, the time taken for the shot to pass from one plate to another may be measured with considerable accuracy up to 40 yards; serious error could only be caused by one side of the pattern travelling faster than the other, which is most unlikely to occur, unless there is balling or clustering, which is easily detected. By this arrangement striking velocities at any required distance may be taken simultaneously with the velocity from the muzzle to ranges of five or ten yards, at one of which points a few fine wires are cut by the shot, whilst the latter is still in a compact mass.

It is possible thus to study the loss of velocity by various sizes of shot under different conditions.

In some recent experiments published by the "Field," an attempt is made to imitate the well known experiments of Bashforth, in which a single heavy projectile

broke a number of screens in succession. The method does not seem very satisfactory when a group of small shot of divers shapes, moving with various velocities, is substituted for a single bullet. It is impossible to insure that all the screens shall be broken by the fastest, or even by average shots, so that irregularities are introduced which require a good deal of smoothing over.

Apart, however, from any question of accuracy of results, there is a fundamental difference between the latest "Field" experiments and those obtained by Mr. Griffiths, which latter are in close agreement with a series of preliminary experiments made by the "Field" and published in their issue of October 24th, 1903.

For example, in Mr. Griffiths' experiments the velocity with 42 grains Schultze and 1⅛ oz. shot, measured over 20 yards, is, for No. 7 shot, 1,008 ft. per second; for No. 3 shot, 1,064 ft. per second; a difference of 56 ft. in favour of the larger shot.

In the preliminary "Field" experiments similar charges, under similar conditions, give 1,008 ft. per second for No. 7 shot, and 1,058 ft. per second for No. 3 shot, the figures with intermediate sizes of shot being also consistent.

The "Field" final conclusion, arrived at from later experiments, is that the velocity measured over 20 yards is the same for all sizes of shot, whether fired in choke or cylinder barrels. This conclusion, based on 20 shots selected out of 40 shots fired in one gun, cannot, unfortunately, be accepted as generally true. We have hitherto been of opinion that the muzzle velocities were higher with the larger sizes of shot, and our own recent experiments, in a variety of guns, tend to confirm the

general truth of this conclusion. Exceptions are, however, occasionally met with.

We have known cases in which, owing to large chambers, loose loading, or sluggishly burning powder, the velocity with $1\frac{1}{8}$ oz. shot was higher than with 1 oz., although the powder charge and turnover, etc., were the same in both cases. On this point, also, it is not safe to establish a rule on a single exceptional case. Stated generally, we find that in cylinder barrels, the smaller sizes of shot give rather lower velocities measured over 10 yards, rather higher pressures and, curiously enough, rather higher recoil than the larger sizes.

In the choke barrel the difference between large and small shot, although appreciable, is less than in cylinder barrels, but in nearly every case the choke velocities are higher than the cylinders when measured over a range of 10 yards. This, we think, is quite in agreement with theory.

We consider that the action of the choke on the charge of shot is as follows:

The length of a charge of shot in passing from the diameter of the barrel ·729" to the diameter of the choke, say ·700", is increased about 8%, so that if the wad behind the shot is kept moving with the same velocity, the front of the charge is accelerated so that its velocity is increased approximately 8% in passing from the larger to the smaller diameter, whilst intermediate portions of the charge increase their velocity in proportion to their distance from the wad behind them. In actual practice the wad behind the shot probably does not maintain its velocity. It is more reasonable to assume that the average velocity of the shot charge remains

nearly constant, or, being only slightly retarded, unless there is a great deformation of the shot in passing into the choke, so that the front portion of the charge is accelerated whilst the rear portion is retarded as compared with the mean velocity of the charge, the extremes being ± about 4% ; thus the charge of shot on leaving the muzzle is no longer in a compact mass, the front portion tending by virtue of its higher velocity to get further and further in front of the rest of the charge, whilst the rear portion tends to lag more and more behind, and the shot is no longer pressed tightly together nor against the sides of the barrel. The tendency of the front pellets to separate from those behind them is, however, kept in check by the wad in front, which is greatly retarded by the pressure of air on its front surface. In the majority of cases the front wad is soon displaced laterally, so that the charge can proceed unimpeded. In the same way the rear wad is forced up against the rear pellets, which have been retarded by the action of the choke, so that they regain some of the velocity which they have lost ; but in the meantime the bulk of the pellets have escaped from the barrel free from the disturbing influences of the front and rear wads. The action may therefore be summarised as follows :

On passing through the choke an advance guard is thrown forward, which takes charge of the front wad and deflects it out of the line of march of the main body, whilst a rear guard is left behind which wards off the attacks of the felt and over powder wads, the result being that better order is kept and there are fewer stragglers.

The occasional lower velocity in the choke barrel may be due to the jamming of the shot in the choke when they

are packed together in regular layers, as is liable to occur with certain sizes of shot. It is certain that there is sometimes a tendency for the choke barrel to give lower striking velocities at, say, 30 yards from the cylinder, this being probably due to the deformation of the shot in passing the choke, so that they experience greater resistance in their flight through the air.

It seems reasonable to suppose that the striking velocities at various ranges will depend a good deal on the distribution of velocity amongst the pellets as they leave the muzzle. In a choke bore, for instance, a certain number of shot start with a higher velocity than the main body, and are still in front at 10 yards, although, being unsheltered they have lost velocity more rapidly and are actually travelling slower than those behind; at 20 yards the main body has probably overtaken those which started first; whilst at 30 yards the shots that were in front at 20 yards are probably not the first to strike. We are thus not dealing with the loss of velocity of a single projectile, so that the Bashforth tables do not apply to the velocity of the front of the charge, nor, owing to the deformation from the spherical form, to any single pellet.

As an example of this it is found that in certain guns the shot from the choke barrels lose velocity more rapidly than those from the cylinder, whilst in other guns the contrary is the case. It therefore seems hopeless to lay down any hard and fast relation between the striking velocities at various distances.

The following are the records of some of the (Kynoch) experiments which have been made on this subject. Three different guns were used.

No. 1 was a Birmingham gun with chambers and barrels correct to standard dimensions. The right hand barrel was nominal cylinder, and the left not quite full choke, the nominal patterns being 140 and 190 with "Bonax" cartridges, No. 6 shot.

Nos. 2 and 3 were London guns, right barrel nominal cylinder, left barrel full choke.

In the experiments 1 and 2 with No. 1 gun, two different charges were used with the intention of getting velocities over 10 yards of 1,120 and 1,200 ft. respectively. The cartridges were loaded with $1\frac{1}{16}$ oz. No. 7 and No. 3 soft shot, but were otherwise identical, and were fired alternately, shot for shot, so that the conditions were as nearly as possible the same. In experiments 3, 4, and 5, $1\frac{1}{16}$ oz. of chilled shot was used instead of soft shot.

No. 1 GUN

Experiment No. 1

	Velocity over 10 yards	Striking Velocity at 30 yds
Cylinder No. 7	1119 ...	677
Choke No. 7	1131 ...	677
Cylinder No. 3	1118 ...	774
Choke No. 3	1105 ...	742

Experiment No. 2

Cylinder No. 7	1196 ...	705
Choke No. 7	1212 ...	691
Cylinder No. 3	1199 ...	818
Choke No. 3	1223 ...	791

Experiment No. 3

Cylinder No. 7	1242 ...	766
Choke No. 7	1268 ...	768
Cylinder No. 3	1238 ...	836
Choke No. 3	1253 ...	873

Experiment No. 4

	Velocity over 10 yards	Striking Velocity at 30 yds
Cylinder No. 7	1129 ...	754
Choke No. 7	1141 ...	743
Cylinder No. 3	1156 ...	809
Choke No. 3	1143 ...	787

This shows a slightly increased loss of velocity at 30 yards with choke barrel.

Experiment No. 5

Cylinder No. 7	1143 ..	745
Choke No. 7	1145 ...	749
Cylinder No. 3	1159 ...	828
Choke No. 3	1161 ...	839

This shows a slightly reduced loss of velocity at 30 yards in choke barrel.

It will be seen that with soft shot the choke velocities

at 30 yards were less than the cylinder, whilst the contrary is generally the case with chilled shot.

No. 2 GUN. $1\frac{1}{16}$ *oz. Chilled Shot.*

		Velocity over 10 yards		Striking Velocity at 30 yds			Velocity over 10 yards		Striking Velocity at 30 yds
Cylinder	No. 7	1199	...	749	Cylinder	No. 3	1189	...	859
Choke	No. 7	1207	...	758	Choke	No. 3	1223	...	847

No. 3 GUN. $1\frac{1}{16}$ *oz. Chilled Shot.*

		Velocity over 10 yards		Striking Velocity at 30 yds			Velocity over 10 yards		Striking Velocity at 30 yds
Cylinder	No. 7	1170	...	756	Cylinder	No. 3	1197	...	839
Choke	No. 7	1205	...	723	Choke	No. 3	1212	...	831

These results tend to show that although no hard and fast rule can be laid down, the velocity over 10 yards is in general higher with No. 3 than with No. 7 shot, which agrees with Mr. Griffiths' results of twenty years ago. They also show that whilst the velocity with the choke barrel is generally higher at the short range, it is sometimes lower at 30 yards than with the cylinder. This latter result is clearly due to the deformation of shot by the choke. With a view to examining into this, a number of charges were fired from a distance of 20 yards into water, the pellets being collected and examined. It was found that a very large proportion of the shot had been dented by the pressure of adjacent pellets, so that they were covered with facets, whilst those which had been in contact with the barrel were more nearly hemi-spherical than spherical. This deformation was still present with chilled shot, though less marked. Experiment shows that the deformation is much more marked with $1\frac{1}{8}$ oz. than with 1 oz. charges, and the proportion of badly deformed shot is much greater in the choke than in the cylinder barrel.

The following experiment shows the effect of deformation on striking velocities with different charges of shot. The powder charge was adjusted to give practically the same velocity over 10 yards in each case.

	1 oz. No. 6 Soft Shot	1 1/16 oz. No. 6 Soft	1 1/8 oz. No. 6 Soft
Velocity over 10 yards	1155	1177	1151
Striking velocity at 30 yards	786	783	762

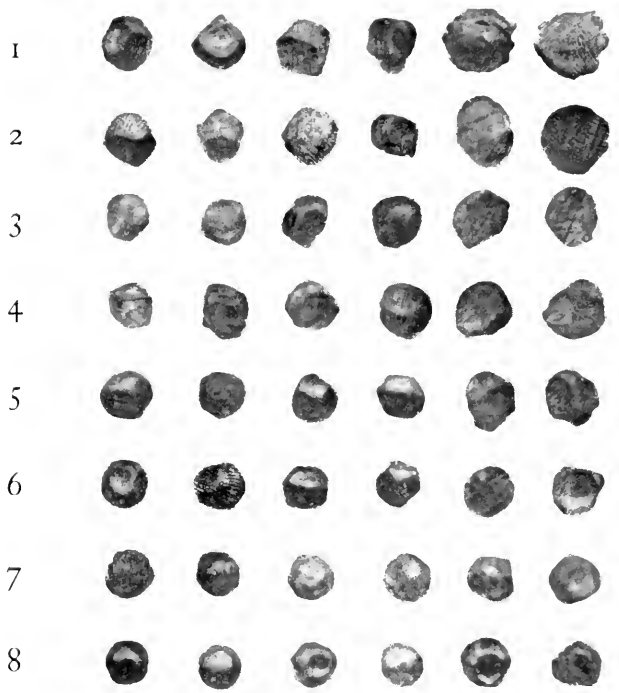
A further experiment, with cartridges giving higher initial velocities still shows the same result, although in this instance chilled shot was used.

	1 oz. No. 5 Chilled	1 1/8 oz. No. 5 Chilled
Velocity over 10 yards	1259	1235
Striking velocity at 30 yards	855	828

It will be noticed that whilst the velocity over 10 yards was 24 feet higher with the 1 oz. charge, the striking velocity at 30 yards was 27 feet higher, instead of the 7 or 8 feet which we should have expected.

The illustration shows selected pellets from various charges of shot, magnified so as to show the nature of the deformation. There is no doubt that the deformation of the shot throws light on the otherwise puzzling differences in the striking velocities of various guns, and shows that there is some foundation for the reputation of some guns as specially hard hitters with certain charges, quite apart from the now recognised effects of chamber dimensions on muzzle velocity, which, we may mention, were first pointed out in these columns some two years ago.

The pellets were carefully chosen so as to be thoroughly representative. Each row consists of two of the most perfect pellets, two moderately damaged, and two badly crushed pellets.



Shot pellets recovered after firing.

Row 1.—	1 $\frac{1}{8}$	oz.	No. 6	Soft	shot in	Choke Barrel
,, 2.—	1 $\frac{1}{8}$	,,	,,	,,	,,	Cylinder ,,
,, 3.—	1 $\frac{1}{16}$	,,	,,	,,	,,	Choke ,,
,, 4.—	1 $\frac{1}{16}$	,,	,,	,,	,,	Cylinder ,,
,, 5.—	1	,,	,,	,,	,,	Choke ,,
,, 6.—	1	,,	,,	,,	,,	Cylinder ,,
,, 7.—	1	,,	,,	Chilled	,,	Choke ,,
,, 8.—	1	,,	,,	,,	,,	Cylinder ,,

The foregoing experiment also accounts for the superiority which the Kynoch Company found in the 1 $\frac{1}{16}$ oz. charge, as compared with the then universal 1 $\frac{1}{8}$ oz., and serves to justify its adoption by them for their factory-loaded cartridges.

The general conclusions arrived at may be summarised as follows :—

1. The velocity at short ranges, cæteris paribus, is higher the larger the shot, the striking velocities at longer ranges being, of course, relatively still higher with the larger shot.
2. With choke barrels the velocity at short range is generally, but not invariably, higher than with cylinder barrels, but the striking velocity at longer ranges is often less.
3. The striking velocity at long ranges (30 yards and upwards) depends very largely on the shot retaining its approximately spherical shape, which condition is most nearly arrived at by the use of 1 oz.—1 $\frac{1}{16}$ oz. charges in cylinder barrels, whilst chilled shot will also help.

THE majority of owners and lessees of shootings at the present time have one dominating ambition when shooting their coverts, and that is to make their pheasants fly as high as possible and thereby afford difficult and sporting shots to their guests.

There is no doubt that for some reason or other a really high pheasant is more difficult for most men to kill artistically and regularly than many other seemingly awkward shots, even though the latter may be further out than the high birds are.

The object of this article is not to discuss how best to obtain the required result of making the birds fly high, but to try and find out why the fact of a bird being high up overhead seemingly makes it more difficult than the same bird would be when flying a parallel course at a lower elevation, and to ascertain the best method of overcoming the difficulty.

In order to get good opinions on this subject from various points of view, the writer has first communicated with several friends, who, besides being the happy possessors of first rate shooting, are themselves exceptionally good shots.

Although they are first rate performers with the gun, they desire that their names should not be published, as, being of a naturally shy and unboastful temperament, they do not wish to pose as professional dictators; so they are referred to by alphabetical letters.

Secondly, there is a short addition from the scientific point of view, which is contributed by one of the very best authorities on ballistics.

The writer has had many opportunities of watching most of the best game shots in England shooting at high pheasants and grouse, and so far as his observation goes the most successful performers at very high birds seem to wait until the bird is almost straight above their heads, and then chuck their guns and fire.

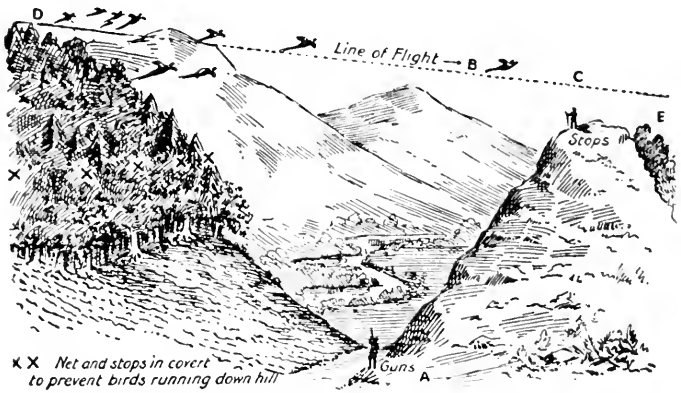
With regard to the actual height at which pheasants can be killed, there are two trees in Lord Darnley's park at Cobham Hall, Kent—one of these is 116 feet high and the other is, I believe, about 130 feet high.

Over the first tree, behind which the ground falls considerably, very many pheasants have been killed clean and well, which shows that provided one shoots forward enough there is plenty of penetration in the shot to kill at this height. I have also been told that pheasants have flown over the higher tree and been killed.

On one occasion, in the West of England, pheasants were driven off the side of a hill across a valley and over another hill into a wood on the further side. The guns were standing in the valley (A). The birds rose at D and flew across the next hill at C, which they cleared by some 8 to 12 feet (as there were "stops" standing there) and made their way into covert at E, B being approximately the line of flight.

The writer, knowing these high birds of old, had brought a surveying aneroid in his pocket, and having set it at A, and proceeding to C, the latter point was found to be 116 feet above A. Therefore any bird that cleared

C must have been a good 120 feet up, and when passing over the guns at A, must have been many feet higher. Several of these birds were killed instantaneously, many gave a quiver of the tail, showing they were hit too far back, whilst a considerable number were apparently quite unaware that anyone was shooting at them at all.



An interesting question in relation to this discussion on high birds is the best size of shot to use. It must be more a question of "pattern" than of penetration, as we know that No. 7 will kill a bird at 45 yards if it hits him in the head or neck, from underneath especially.

Therefore the writer is inclined to think that No. 7 for an ordinary or even "improved" cylinder gun is likely to be more effective provided one shoots far enough ahead.

In the case of a full choke, 5 or 5½ may give a close enough pattern to get the head or neck with reasonable regularity.

The point to remember is that the target, i.e., the head and neck, is a very small one, and therefore a small

pattern is absolutely necessary for regular success. If you compare the pattern of No. 7 from a cylinder gun to that of Nos. 5 or 4, it will be readily seen what a much better chance there is of hitting the head and neck with the smaller sized shot.

With regard to this question of pattern, there is a very important point which the writer believes has never been properly thrashed out, i.e., how many of the shot that go to make the beautiful patterns we see on the plate are killers?

We know that the shot arrive one after the other. Those that arrive first have considerably greater velocity and therefore "killing" power than the later arrivals.

Will some public spirited experimenter fit up a revolving target with Pettitt pads at different points, to ascertain the actual penetration of the first and last arrivals?

In "Shooting Guns and Gunpowder," published by Horace Cox, page 56, the length of the column of shot fired from a cylinder loaded with 42 grains Schultze and $1\frac{1}{8}$ oz. of No. 6 shot is given as $7\frac{1}{2}$ feet long at 30 yards, 12 feet at 40 yards, and about 25 feet at 30 yards. Now, if all these shots were killers is would be almost impossible to shoot too far ahead of a bird. But the question is, are they? Of course, the majority of misses are caused by shooting behind and below.

We will now consider the remarks on this subject which have been contributed by several first-class and experienced shots, who shall be designated by the letters A, B, C, D, whilst that signed G.H. is the contribution from the more scientific side of the question. It may be mentioned that the above correspondents occupied very high places in "Bailey's list of the twelve best shots."

A. writes : "I can't explain why really high birds are so difficult, for I have no theory to account for the fact.

"I should have thought that, clearly outlined against the sky as they are, high birds ought to be easier than others, but they are certainly not so. . . . . Of course an approaching high bird presents a convex target with the feathers in the best position for resisting penetration ; we all know how difficult it is to break a bottle owing to its convexity. Possibly the chief difficulty with the very high bird is the necessity, for the above reasons, of getting him in the centre of the shot pattern, a difficulty increased by the natural tendency to stop the swing of the gun as it approaches the vertical."

[N.B.—With reference to the latter remark, D.'s tip for an extra chuck of the gun, is worth noting.—Ed.]

B. writes : " I do not believe there is much, if any, difference between the penetration of small shot fired vertically or horizontally. We have tried shooting at tin boxes hauled up to the top of a flagstaff 40 yards high, and we were able to penetrate these with from 10 to 15 shot clean through. These must have killed any pheasant provided it was hit in the head or neck. At anything like this distance, a bird fired at from below and hit only in the breast, would not be killed clean because the shot had to penetrate close fitting feathers, an inch or more of flesh, and finally the breast bone before a vital spot is touched. Hit in the usual spot 'behind,' the bird will carry on, but it may die in the next beat.

"In my opinion the reason why a 'straight over' high pheasant is so difficult to kill is not because an experienced gunner has not made sufficient allowance in front, but

because it is hard to keep the left arm travelling in the true line with the bird to be killed, i.e., when we make 'the chuck' the inclination is for the arm to swing outwards, and the object to be missed or only winged on its right, our left side. A high bird crossing is, in my opinion, far easier to kill. It seems better seen, and it is easier to make the right allowance ; we have a chance of finding a vulnerable spot under the wing and for the shot to penetrate which it will not do when fired into the breast.

"Forty yards, I believe, is not a very high pheasant, though so difficult to kill clean. This can only be done by hitting the head or neck, and this small portion of the bird may often go through the pattern."

C. writes on this subject : (N.B.—He is a very brilliant all round shot).

"A high pheasant has always been my bête noire. I simply don't know how to do it, or what happens, or where the shot goes to.

[The Editor does not agree with this humble estimate by any means.]

"Of course, as you say, it is extraordinarily difficult to judge the pace of a high bird, and how much easier it is to shoot them coming over high trees than out in the open, where there is nothing to guide one's eye as to the rate they are travelling.

"Personally, if I had a pheasant held stationary above my head 40 yards up, I should be very sorry to back myself to kill it more than once in six shots with an ordinary cylinder and 5½ shot. I don't believe my guns make a good enough pattern to do it ; I mean to put pellets in the head and neck every time, even if I held quite straight.

"I have often tried to shoot further and further in front (as I thought) of these high birds, but never with any success. I suppose it is exceedingly difficult to shoot a long way in front and yet keep the straight line of the birds. Of course if the bird is dropping it further complicates matters. Have you ever tried to shoot high coots? Didn't you find them most difficult, and yet they seem to go awful slowly."

D. writes: "I think we are pretty well agreed that, to kill a high bird of any sort, the head and neck are the only really deadly places. These in a very high bird are small objects; therefore accuracy is very necessary, and the sized shot that suits your gun, and makes the best pattern, should be used. (Different sized shot make different patterns out of different guns).

"A high cock pheasant is the most difficult bird I know to kill properly and regularly; he looks higher than he is and flies faster than he appears to.

"I think the two chief causes of failure—I speak feelingly—are that you misjudge his pace, make allowance leisurely and do not "carry on," or that you turn your sight sideways and miss clean. The latter may be remedied by getting the left hand more forward.

"Personally, I miss pheasants which, had they been woodpigeons or partridges at the same height, would have been a pretty good certainty. But why? And to this I answer, because the latter look as if they were in a hurry and I shoot accordingly; whereas the former look as if they were taking it easy, so that the 'chuck forward,' so indispensable to success, is omitted.

"I have, on occasions, when in despair at missing several

birds in succession, struck the barrels of my gun with the left hand when shooting at a pheasant right over head, and have found this extra 'chuck,' which you could not make up your mind to give in the ordinary way, has proved successful."

To sum up the above opinions, the general reason why we make such moderate practice at "high birds" appears to be threefold :—

1. We do not shoot far enough in front, i.e., "chuck" enough, owing to the difficulty of estimating the pace.
2. The small vulnerable target, offered by the head and neck, is difficult to hit, unless we either shoot with small sized shot or a very fully choked gun.
3. For birds coming straight over, we are apt to lose the correct line of flight, and in some cases to turn the barrels over, and therefore to shoot crooked.

One thing is quite certain ; it is possible to kill any bird at 40 yards, and even up to 45 yards, above us, provided we hit him, or her, in the head or neck, and to do this one must "chuck" a lot ; an assistance to this end is to bend back from the hips.

CONCLUDING SUMMARY

It is interesting to compare the above notes, which, including those by the Editor, may be taken as embodying the experience of some of the best shots in the kingdom, with certain results that may be arrived at from theoretical conditions. I will take first one of B's experiences. He says—"We have tried shooting at tin boxes hauled up to the top of a flagstaff 40 yards high, and we were able to penetrate these, with from 10 to 15

shots, clean through." This is a fair test for 40 yards horizontal. Now let us see what theory has to say to it. The appropriate equation is

$$v^2 = V^2 - 2gh,$$

when v = the diminished velocity due to counteraction by gravity, V = the average velocity, say 850 ft. per second, g = 32, and h = 120 ft. (40 yards). Anyone who cares to work out this equation will find that the reduction of velocity is only about 5 ft. per second, or less than ·6 per cent., and, consequently, that the striking energy is reduced by less than $1\frac{1}{4}$ per cent.—a quite inappreciable amount. So that B's conclusion that the killing powers of the shot are not appreciably interfered with is entirely borne out by theory.

The Editor, also, dealing with somewhat higher marks, still considers that "there is plenty of penetration in the shot to kill at this height," and he has reason. The simple fact is, that the (negative) velocity due to the action of gravity during the extremely short time that it takes the shot to reach its mark, say, one sixth of a second, is inappreciable compared with the velocity due to the explosion. In other words, there is no appreciable difference in striking force at 40 yards vertical and 40 yards horizontal.

D makes an interesting remark. He says—"A high cock pheasant . . . . looks higher than he is." This also is in accordance with more general experience. The effect is due to a simple and well known, if not so well understood, optical illusion. If at equal distances we view equal discs, one being a black disc on a white ground, and the other a white disc on a black ground, it is extremely

difficult to believe that the two are really equal in size—the white disc appears so strikingly the larger. Viewed against the background of the sky, a pheasant is under the conditions of the black disc on a white ground, and appears much smaller than it would if seen against a dark ground, such as the trees of a covert, or the side of a hill. In shooting, we judge the distance of a bird from the gun chiefly by its apparent size; so that a bird that from any other cause than actual distance appears small, is judged to be further off than it really is. If we habitually limit ourselves to a 40 yard shot (I say habitually), a bird that is 40 yards up in the air is, from its apparent smallness against the bright sky—and all skies are bright compared with trees and hills—judged to be further away than the prudent and self-respecting 40 yards, and is let off, though the shot will strike it just as hard as one crossing, and harder than one going away, horizontally.

The esteemed Editor, himself, I have reason to know, a shot in the same brilliant class as A, B, C and D, makes a remark that possibly involves a misconception. After noting the fact that at 40 yards the stream of shot is about 12 feet long, he says—"Now, if all these shots were killers, it would be almost impossible to shoot too far ahead of a bird." On the contrary, theory shows that it would be quite easy; though in practice, owing to the human weakness which makes us all more liable to shoot behind than in front, it is comparatively difficult. Let us consider. The bird at 40 miles an hour is going about 60 ft. a second; the shot at 40 yards distance from the gun is going about eleven times as fast; so that, while the last shot is travelling the 12 ft. that separate it from the

first, the bird will travel only about 13 inches. Consequently this extra allowance of 13 inches is the most that we have to reckon on, not the almost unlimited margin that the Editor seems to imply. Calculation shows that just to kill a bird (i.e., just bring it within the killing circle) going 40 miles an hour, we may shoot 9 ft. 9 in. in front of it and no more. The stringing out of the shot gives about another foot, or even less ; since the stretching of the 30 in. circle into an ellipse of 30 in. × 43 in. increases the space between the shot, especially in the part of the ellipse that strikes last. It seems to me, though I may not be doing him justice, that the Editor has not quite appreciated the fact that the distance that the bird travels in about the sixth of a second is covered by the shot in less than a sixtieth.

The Editor also raises the question of the penetration of these late arrivals. It is an interesting point and one that can be finally settled only in the way he suggests, viz. : by actual experiment with pads on a revolving target. Of course, if we knew exactly the history of each shot in the 12 ft. string at 40 yards, we could easily make the necessary calculation ; but this we do not know, and R. H. Housman thought that the rear guard were, from various causes, reducing the difference of velocity between themselves and the van. I should be sorry to set my opinion against his. In fact I have no doubt he is right. But, looking at the fact of the regular increase of the stringing-out at the various distances up to 50 yards, I do not think the effect can be important. And therefore, it seems to me that the simple calculation based on apparent loss of velocity in the lagging pellets will be

correct for practical purposes. Thus at 40 yards, or 120 feet, a difference of 12 feet in position represents a loss of 10% of velocity as compared with the leading shots, and this represents a loss of nearly 20% of penetration. In other words, if the foremost shot would penetrate 40 thicknesses of paper, the last would penetrate only 32. This is probably somewhere about right.—G.H.

NE often hears the question asked, why is the noise and recoil less with smokeless than with black powder cartridges? At first sight it seems curious that whilst the propulsive effect on the shot is the same, the backward recoil of the gun, and the disturbance of the air which causes sound, should be so much heavier in one case than in the other. The phenomena of extra noise and recoil are, in fact, closely related as action and reaction one to the other, just as the main recoil is connected with the velocity and weight of the projectile.

We showed in No. 14 of the Journal that recoil might be divided into two parts, viz., that due to the velocity imparted to the shot and wads, and that caused by the escape of the gases. It is found by experiment that the extra momentum due to the escape of the gases is with black powder about 35% of the momentum of the shot. In the case of bulk smokeless powder the excess is only 25%; with "extracted" powder, 20%; and with concentrated powder, about 15%. The weights of the charges are about 16%, 8%, $6\frac{1}{2}$%, and 5% respectively of the weight of shot and wads. If we divide the percentage of excess recoil by the ratio of weight of powder and shot, we get for black powder, $\frac{35}{16} = 2{\cdot}18$, for bulk powder, $\frac{25}{8} = 3{\cdot}12$, for "extracted" powder, $\frac{20}{6{\cdot}5} = 3{\cdot}03$, and for concentrated powder, $\frac{15}{5} = 3{\cdot}00$.

If the muzzle velocity in each case is multiplied by this ratio it will give what may be considered as the average velocity of the escaping gases as they leave the muzzle. Taking the muzzle velocity in each case as 1,230 ft. per sec., this gives the velocity of the gases as 2,680 ft. per sec. for black, and 3,910 ft. per sec., 3,840 ft. per sec., and 3,690 ft. per sec. respectively for the three types of smokeless powder. It will be noticed that all these velocities are much above the velocity of sound, which is about 1,100 ft. per sec.

Now, when the velocity of the expanding gas is greater than 1,100 ft. per sec., the surrounding air is piled up in front of it, forming a dense envelope, which is driven outward by the high pressure gas inside. As the gas expands its pressure falls until it is below that of the atmosphere, but the envelope of the compressed air still travels outwards and further diminishes the pressure of the gas immediately behind it. The disturbance then becomes a wave of compressed air followed by a wave of rarefied air, and after travelling a certain distance this settles down to a velocity of 1,100 ft. per sec., and is recognised as a sound wave. The character of the sound depends upon the nature of the impulse given by the original explosion.

An air-gun makes practically no noise, because the muzzle pressure is very low ; a pop-gun makes much more noise, because the muzzle pressure is considerable. A small pile of loose gunpowder makes very little noise upon being fired, because the pressure, and consequently the velocity, of the gases is low. The same amount of fulminate of mercury makes a very sharp stinging report,

the pressure and velocity being high, and the quantity of the gas evolved small.

The exhaust from a steam engine is different in character from that of a gas engine, even when the exhaust pressures and cylinder volumes are the same. The gas engine, without a silencer, gives a sharper sound of much less volume than the steam engine, the reason being that the steam, being loaded with particles of water, moves much more sluggishly and gives a more prolonged impulse to the surrounding air. This sluggishness considerably increases the back pressure on the piston.

With black powder, the gases as they leave the muzzle bear a distinct resemblance to exhaust steam, being loaded with solid or liquid particles, and are therefore sluggish as compared with the less loaded gases of bulk powder, or the unloaded gases of extracted or concentrated powder.

The report is, therefore, heavier and more prolonged, whilst the back pressure, which is another name for recoil, is greater than with smokeless powder.

MODERN modes of shooting and game preserving give little time to sportsmen and gamekeepers to perfect their retrievers in the field. It is rare now to find a keeper with any taste for a dog of any sort, hence a good one is the exception and not the rule. But still a good retriever is as necessary and as valuable as ever, if not more so; and I venture to suggest how, by early tuition, to make a good one in spite of the before-named handicaps.

My father, who was very clever with dogs, and always broke his own pointers and retrievers, used to say "you can break any dog in the kennel or in your own room, and when you take it into the field it will soon learn the rest"; and I expect he was pretty right, for he never kept a bad one.

It is difficult to begin the tuition of a retriever puppy too young, but first, I say, make sure you have a natural carrier (and at two months old, or less, you can make pretty sure of that), otherwise your time may be wasted and bitter disappointment ensue.

First make your puppy know its name, and by degrees "sit down" to order, your hand being held up at the same time. When it will allow you to walk away a few yards without its moving, call it up to you with a whistle, always rewarding it with a bit of biscuit; in time it will connect the whistle with reward, and through life never

forget it. Having achieved this, use your voice as little as possible, but draw attention with the whistle and make the dog drop to hand at any distance away. Next, begin to make it retrieve properly to hand, by throwing a glove or something soft, and when it picks it up walk away, slowly at first, to encourage it to bring direct and not stop and play with it. When it has entered into the fun of retrieving (but don't do it more than twice or thrice at one lesson), never let it see you throw anything again, but cover its eyes and have the thing dragged along the ground and hidden, and it will soon learn to use its nose and not depend on its eyes. When it has found the thing, run away; this will make the puppy return quickly, and keep moving on, till it comes right up and delivers into your hand. Never stand facing, or go towards it to take anything from its mouth, and, above all, never drag anything out of its mouth; but if it is unwilling to give it up, say "drop it," and quietly coax its mouth open with your hand till the thing it is carrying is released.

Never fire a gun close to a puppy the first time, as you may make it gun-shy, but first from a distance; and later, when you are sure it does not mind the noise, accustom it to drop to shot instead of considering it a signal to run in and pick something up.

At all times give a puppy the greatest liberty to run about and use its nose and hunt every scent, only calling it to heel now and then to enforce discipline, but check it slightly when running fur by sight: it will soon begin to understand that it is not the right thing to do, and make it easier for you to entirely break the habit before its education is completed, as hereafter. Always carry

some biscuit in your pocket to reward every right deed, and talk to and scold it for every wrong one, but never beat till wrong is thoroughly known from right, and then only for rank insubordination, and on these occasions, if possible, let the punishment be administered by another person, as after it, your dog will run for your protection instead of evading you. At, say, six months old, it should be ready to retrieve dead game, and for this purpose take it down wind to give it the scent till it has had plenty of practice at this. It is not wise to send it after wounded game, for in the excitement some young dogs are apt to kill, which is the last thing you want, as it may lead to a hard mouth, which I consider only curable by an ounce of shot. To break a young dog entirely from fur is the most difficult thing of all; if very eager, the only sure method is a collar and ten yards of strong line. Take it to a field where there are plenty of hares, or out ferreting rabbits, or have some bagged ones to let loose. If the dog runs in, let it go to the end of its tether, when the jerk will turn it over. Draw it back to you and scold. A few repetitions will cure nearly any dog, but don't let anyone think that a retriever once broken is broken for ever. The very best can be spoilt in a fortnight by a man who does not care for nor understand dogs, and when this happens it is a great question if you can ever make one as steady as it was before.

HE fact that a tallow candle can be shot through a barn door has been so long familiar that it is now seldom referred to even in the smoking room after a day's shooting ; but we wonder how many of those who have outlived their interest in it could give a rational account of the ancient paradox. As a matter of fact, the original wonder itself has in more modern times been greatly surpassed. A No. 4 shot has been driven through $\frac{1}{8}$" of tough iron, and a ·303 bullet through $\frac{1}{2}$" of mild steel. If we simply pressed the candle against the deal plank, and the No. 4 shot against iron, or a ·303 bullet against a plate of steel, we should produce no effect worth mentioning on the wood or the iron or the steel whatever pressure we applied ; yet if we drive the tallow or the lead with a sufficient velocity we punch a clean hole. What is the reason of this ?

Before attempting to answer this question we may ask one or two more. Why does a stone, or a cannon ball, rebound from the surface of water, and make ducks and drakes ? Why does water when struck with the flat of an oar, or the chest of a man who has made a mistake in his dive, give the sensation of a solid ? Why does a shot from a shot-gun make a small round hole in a pane of glass, when the same shot, if pressed against the pane, would break the entire sheet into large pieces, and not, strictly speaking, make a hole at all ? Why can a visiting

card be flipped from under a penny, when balanced on the finger, without disturbing the penny? Why, pasted upon a block of stone, with no other backing but the air, does a dynamite cartridge split the stone block when it is exploded?

We could ask more, but perhaps these questions are enough.

It is common knowledge, that the striking force of a moving body is proportional to the square of its velocity. If, of two similar projectiles, the velocity of one is twice that of the other, it will strike with four times the force; if three times, then a blow will be nine times as energetic, and so on. But this law equally applies to the body struck. The greater the velocity of the moving body or projectile, the greater the resistance of the body struck to having that velocity communicated to it. It also applies to the particles of the body struck, and of the projectile itself, which particles in their turn resist relative movement—i.e., changing their positions among themselves—with a force proportional to the square of the velocity of impact.

Under this law liquids, and even gases, if the velocity be high enough, will act as solids; and the principle will be found to explain all the paradoxes under notice.

Take the simplest first. In the card and penny trick, if we pull the card away somewhat slowly, we pull the penny with it—the card communicates its own velocity to the penny. But if we pull or flip the card away ten times as fast as before, the resistance of the penny to assume such increased rate of movement is 100 times as great, and it apparently remains undisturbed on the finger.

Now consider the candle and the barn door. If we simply press the candle, end-on, against the wood, the candle gives way and breaks up; in other words, its different parts change their relative positions. But if they are called upon to do this in an extremely short space of time, say the 20,000th part of a second (which is somewhere near the mark), they offer so effectual resistance that the candle retains its form, and the door gives way. But how about the door? What happens to that? The answer is best given by the pane of glass, in which, we know, a shot moving at a sufficient velocity will punch a little round hole. Consider what would happen if we simply pressed the shot against the pane until it broke. We should find, if we made delicate measurements, that, before it broke, the whole pane would bend; which means that the entire mass of the glass was coming to the assistance of the part attacked. But in the case of piercing by a shot, the same measurements would not show any movement of the rest of the pane under the impact. That impact lasts only about the 100,000th part of a second, and in this minute space of time the mass of the glass may be said not to move at all, its resistance to movement at the rate of the shot being enormous. The consequence is that the part attacked is unsupported, and gives way—the effect being strictly local. If a punch supplied the place of the shot, and if a die could be made which gave absolutely equal support to the glass round the part attacked by the punch, a round hole could be made without splintering. The inertia of the mass of the glass in the case we are considering exactly fulfils the conditions of such a die, and a round hole is punched.

The same happens in the case of the barn door. By virtue of the inertia of the mass of the wood, the attack of the candle is strictly localised, and the part attacked gives way.

But the velocities we have so far been dealing with are insignificant compared with the velocity of the gases in the explosion of dynamite. These are so enormous that under their influence the particles of air themselves develop an astonishing inertia, and air itself acts as a solid. We paste a dynamite cartridge on a slab of stone; we fire it, and the stone is split. The particles of air have been suddenly required to move at such a velocity that they refuse to do it; or, at any rate, they respond to so small an extent that they force pressure in the opposite direction sufficient to split the stone.

One word as to what happens when a stone makes ducks and drakes. The stone is travelling at a high velocity, but this velocity is in a horizontal, not a vertical, direction; its vertical velocity is very small. Consequently when it first strikes the water it delivers only a slight vertical blow. It begins to sink, but the moment it begins to sink there is water in front of it—a little hill of water—and this little hill is opposed to the horizontal velocity of the stone, which is very great. As in the other cases, it refuses to move; it solidifies so to speak, and forms a little solid, smooth, inclined plane up which the stone glides, and flies off the surface of the water again.

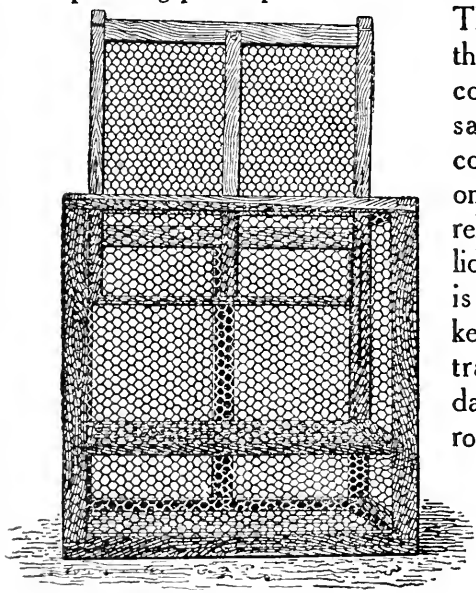
It has recently, and quite rightly, been made illegal to use a pole-trap in any form for the capture of hawks, owls, etc., whether the trap be fixed on a pole or cairn of stones.

This decision will meet with the approval of everyone who is possessed of any sort of feeling for the terrible agonies that the unfortunate trapped birds went through, often hanging head downwards for hours, and sometimes days, with a broken leg firmly secured in the iron teeth of the gin. And, apart from the cruelty which this system of trapping inflicted on the real marauding culprits, many perfectly innocent birds were caught which do more good than harm to game-preservers and farmers.

During the past shooting season the writer came across two traps, one for catching hawks, and the other for capturing jackdaws, rooks, and pheasants, alive, which combined efficiency with a minimum of physical pain, and as they may prove of interest to game preservers, a short description is given of them.

The hawk trap is the invention of and has been, patented by, Mr. Black, head keeper to M. Sibthorpe, Esq., of Canwick Hall, Lincoln. By catching all its victims without physical injury, it enables the keeper to release harmless winged vermin such as kestrels, owls, etc.

The trap consists of a square wire box in two tiers, the lower one forming a wired-in chamber in which four sparrows are placed, duly provided with food and water, perches being placed at the corners. The lid of the upper part of the box is opened and secured by a catch to a "perching-piece" placed in the middle of the upper cage.

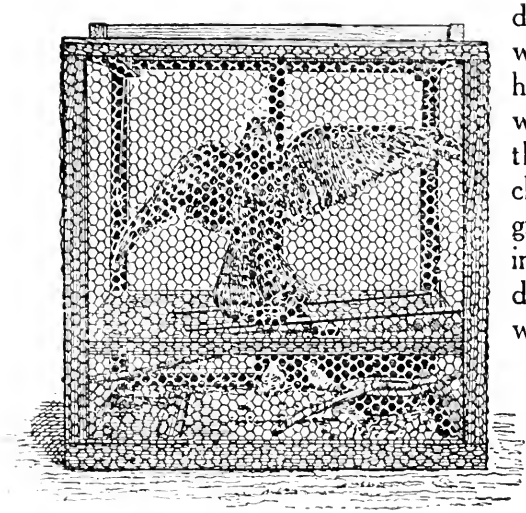


The Trap Set.

The hawk, on sighting the sparrows, who of course are perfectly safe in their lower compartment, settles on the perch; its weight releases the catch, the lid falls, and the hawk is imprisoned. The keeper should visit the trap at least twice a day, and should a sparrow hawk be captured, it can be knocked on the head. If, on the other hand, a kestrel or some harmless owl be found in the trap, it can be released unhurt.

Mr. Black writes as to his practical experience as follows:—

"I find the best months for catching hawks in this trap are April (if the weather is fine), August and September. During the latter months they come from the surrounding woods, and as the weather is usually warm and fairly



The Trap Closed, the hawk having knocked down the perching piece.

dry, the sparrows will keep their health for several weeks provided their cage is kept clean and they are given regular feeding and fresh water daily, but if the weather should be stormy or cold they should be released every other day.

"I have not found the trap much good during the early summer months, as there are plenty of all kinds of small birds about which are easily caught.

"After working the trap for two years, I find it will capture every, or nearly every, hawk that comes within sight of the sparrows, which should never be more than four at a time.

"After carting young pheasants from the rearing fields to the woods, it is a good plan to fix a trap in an open space, some little distance from the coops. If hawks are about they must be caught.

"Altogether this year we have captured eighty-one hawks of all sorts here, nine in April, the remainder in August and September."

Although the principle of this trap is by no means new, the writer had never seen it in use until last spring, when the head keeper of an estate in Lincolnshire made one or two for catching up hen pheasants for penning purposes.

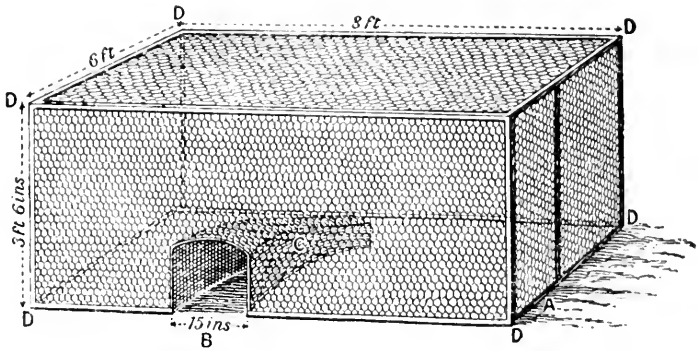
This trap proved so successful both with the pheasants and the jackdaws that the writer feels he will be doing a good turn to brother sportsmen and to keepers by giving a short account of it.

The trap is about 8 feet long by 6 feet wide and $3\frac{1}{2}$ feet high, with an entrance door at the side to allow the keeper to go in, the uprights being made of common stakes.

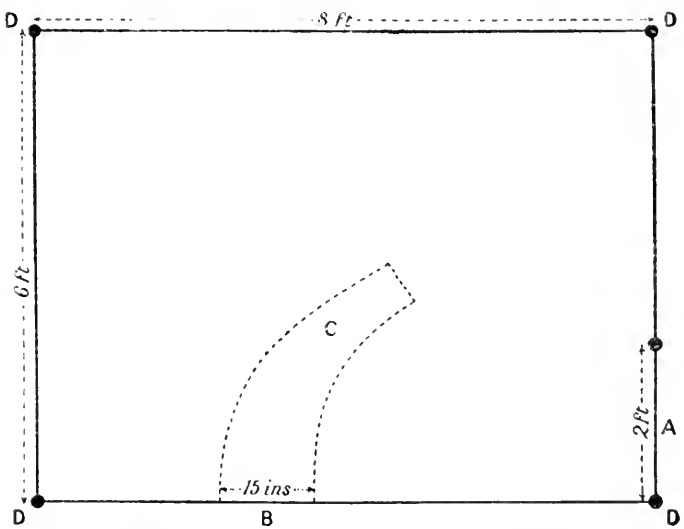
If intended mainly for catching pheasants, it is advisable to make it entirely of string netting, but if solely for jackdaws and crows, the sides can be made of ordinary rabbit wire-netting, with the top in each case made of string netting.

In the centre of the longer side an opening 15" square should be made, and a curved passage of rabbit wire be brought from the entrance to the centre of the cage, this passage gradually tapering, until, on reaching the centre, there is just comfortable room for a pheasant, jackdaw or crow to pass through. Food should be strewn inside the cage and a little in the passage.

The trap should be placed near a feeding place in the coverts. Once the birds have found their way in, they have not the sense to seek the only exit in the middle, but walk round and round the inside of the cage trying to get out.



View of Trap



Ground Plan

To show how effective this trap is, last February the keeper in question, having put the feed into No. 1 cage, which was put near the feeding place in a small covert, went off to visit a second trap which he had placed in another covert about a mile off. On his return, perhaps an hour later, he found in No. 1 trap four hen pheasants and forty-seven jackdaws. Having caught the pheasants in a small landing net and put them in a place of safety, he caught the jackdaws and knocked them on the head.

His catch with two traps going during the month of February was thirty hen pheasants, about one hundred and eighty jackdaws, over one hundred rooks and five carrion crows.

Later on in the season he placed one of these traps outside the rearing field and he caught several more jackdaws.

The largest catch made during the season was sixty-seven jackdaws and rooks at one time!

Now, the jackdaws are the most inveterate egg stealers; so are the rooks, or some of them, whilst the carrion crows are the worst offenders of all.

Some people think that rooks are not egg stealers, but it is an undoubted fact that, in this part of Lincolnshire at any rate, certain old rooks have a great partiality for both game eggs and the young pheasants and partridges and chickens.

It is quite a common sight on an early summer's morning to see half-a-dozen jackdaws or rooks mobbing a crowd of young chickens or pheasants, and the trap will assist to keep the number of jackdaws within reasonable bounds, and it will not take up too much of the keeper's valuable time at that busy season.

A number of burst guns come under our notice every year, the accidents having happened sometimes with our cartridges, sometimes with other English makes and sometimes with foreign-made ammunition

The majority of these guns are sent to us to prove conclusively that the gun has burst, it being evidently believed that in the absence of any obvious cause to the contrary, the accident must be due to a cartridge having given too high a pressure. Especially fixed is this belief if the gun has fired, without casualty, many hundreds or thousands of cartridges previously.

No belief could be more erroneous, and we can unhesitatingly assert that, in most of the cases, a cursory examination of the fracture enables us to absolve the cartridge from blame; and in the remaining instances, a more prolonged examination accompanied by, perhaps, micro-photographical and metallurgical research again enables us to acquit the cartridges in nearly every instance.

However, the belief continues to exist, and we constantly have to write letters explaining the reasons for accidents. These reasons are, for the most part, few in number; so much so that it would be quite possible to compose several forms of letters referring to these complaints and to send them out as occasion required, filling in merely the name and address of the complainant. We propose,

therefore, briefly to describe the usual bursts and the causes most commonly responsible for them.

The bursts in guns may be divided into two groups :—

1. Bursts at the muzzle end of the barrels.
2. Bursts at the breech end of the barrels; these bursts often strain and sometimes crack the action of the gun as well.

No. 1 is invariably caused by an obstruction in the barrel at the muzzle end of the gun. Snow, mud and bits of peat from a grouse butt, or turf from a ditch in the case of partridge driving, are probably the commonest form this obstruction takes. With snow on the ground and hedges to climb over, or gates and fences to slip through, it is very easy to allow the muzzle of the gun to dip a little and catch a plug of snow. A burst muzzle is the almost invariable result. The sudden check to the charge of issuing shot causes a momentary increase of pressure just where the gun is thinnest and least able to withstand it, so that the barrel gives way.*

Now, the only way in which a cartridge could cause such a burst as this, is for one of the wads of the last cartridge fired to have remained in the barrel. This could only have happened if the cartridge gave a very poor velocity, "squibbed" off, in fact, which again could only be caused either by the cartridge having been allowed to get very damp, which would affect the powder, (in which case, obviously, the cartridge maker could not be blamed) or,

*Editor's note.—Some years ago, when shooting in deep snow, I happened to notice a loader brush his master's gun against a laurel bush, heavily laden with snow ; at the next shot, and before I had time to warn him, the gun burst at the muzzle.

if the cartridge had a "short" charge of powder in it, which would likewise cause a "squib." Or again, it might be caused by the wad, which ought to lie on the powder having been put in edgeways.

Now, we have already shown that our cartridges are loaded by automatic machines whereby this liability to loading error is eliminated. The wad can only get edgeways if it is so small to gauge that, instead of exactly fitting the cartridge case, it drops in of its own weight, tilts over, and is pressed by the rammer edgeways into the powder. This is not likely to happen at the Kynoch factory, where all the wads are carefully gauged, and, in addition, special contrivances are attached to the loading machines to detect a "small" wad should one have escaped rejection at the hands of the inspectors. Therefore, it may be taken for granted that a Kynoch factory-loaded cartridge cannot be responsible for a burst of No. 1 description unless the shooter has allowed the ammunition to get thoroughly damp.

No. 2 is caused by the pressure set up on the ignition of the cartridge being greater than the gun can stand. Here again, the use of factory-loaded cartridges practically puts the possibility of the cartridges being at fault out of the question.

We have already shown that the use of an automatic machine makes it almost impossible for the shot and powder charges to vary. It is quite impossible, for instance, for two powder charges to be put in one cartridge case. Therefore an increase of pressure can only be a small one above the standard provided for. This standard is about $3\frac{3}{4}$ tons per square inch. But all guns are tested

by the Proof-house before a gunmaker sells them, and the charge used by the Proof-house gives a much higher pressure than a standard cartridge, so we see that if a gun retains its pressure-resisting qualities, there is practically no chance of a factory-loaded cartridge giving a pressure that could cause a burst. Nevertheless, bursts are frequent.

To understand the causes of these bursts, it is necessary to know a good deal about the nature of steel. Much has been found out on this question in late years, the lines of research having been extended to the closer study of chemical analysis and micro-photography. It is sufficient here to say that it is now realised that steel, in common with many other metals, suffers from "fatigue" unless it is, from the nature of its mixture and the temperature and time of annealing it has undergone, left in its finished state in a condition of comparative repose, i.e., the different molecules must not be unduly striving to break apart.

Unless, therefore, the gunmaker anneals his material so as to leave the molecules in a state of rest, they are striving all the time to break apart. Probably if left long enough, the gun would crack spontaneously without ever having a cartridge fired in it, but the continual jar of firing quickens the disruption of the molecules. According to the nearness to the state of equilibrium of the molecules the final breaking apart takes a shorter or longer time, but, sooner or later, the break must occur, and then, of course, without this knowledge and an examination of the crystals of the steel, it would appear as though there could be no reason for the accident except a high pressure given by the cartridge.

We can safely say that about 97% of this class of burst brought under our notice are due to this cause. It must be remembered, of course, that the majority of bursts submitted to us have occurred when decent cartridges were being used.

We do not say that 97% of all the burst actions occurring in England are due to too much or too little annealing; we only say 96% of the burst actions that we examine are due to this cause.

If sportsmen will use foreign cases or foreign powder, neither of which have been made for use with English powder or English cases, they must not be surprised if they get ammunition giving very irregular results, abnormally high pressures being one of them. Similarly, if sportsmen buy cartridges sold at ridiculous prices, they know that they are not buying that excellence of manufacture and care of inspection that is put into Kynoch "factory-loaded" cartridges, and they cannot expect the same results.

Under these conditions not only will bursts occur in good guns due to abnormal pressures, but they are more than ever liable to occur with guns not quite perfectly annealed owing to the irregularity of the pressures given by such ammunition.

We commenced "factory-loading" by automatic machinery in 1902, and since then we cannot call to mind a single instance of a burst being brought to notice where we could attribute the cause to one of our "factory-loaded" cartridges.

IN years gone by the facilities existing in this country for rifle practice were almost exclusively for long range shooting with the Service arm, hence the interest was largely confined to members of the regular and auxiliary forces, and the number of men who might be described as marksmen did not amount to more than a few thousands. Now there are thousands of civilian rifle clubs with a membership of some hundreds of thousands, using various weapons from air guns to ·303 rifles.

We are of opinion that the reasons for this sudden change were (1) the feeling engendered during the progress of the South African war that every man should know how to use a rifle, and (2) the introduction of the rifled air-gun and the "Witton" pellet, with which very accurate shooting is obtainable at short distances; being very cheap, this form of shooting enabled people to practise who would not otherwise have been able to do so.

Once started upon a shooting career very many of these air-rifle men were not content until they had become proficient shots with the miniature rifle and even in many cases with the Service rifle.

Cost, however, has been and always will be a most important factor where rifle clubs are concerned, and

after six years of experiments with various rifles and ammunition, the result from the "melting pot" of these years of experience is the almost general adoption of the ·22 rifle on account of the cheapness and accuracy of the ammunition for this rifle.

A ·22 rifle costs from 30/- to £5. The higher priced weapons are more highly finished and are fitted with expensive sights, apart from which we question whether they give more accurate shooting than do the 30/- rifles.

The best cartridges obtainable—long rifle Axite—cost 12/- per 1,000 only, and when it is remembered that the whole of the shots can be grouped within a 2" circle at 100 yards, it is a matter for surprise that such ammunition can be produced at such a low figure.

The rifles, ammunition and targets represent the bulk of a club's expenses, so that it will be seen that a rifle club is not nearly so costly as a cricket or football club, and it has this advantage, that it is a pastime equally suitable for young and old.

We are not forgetting the expense of fitting up the ranges and the cost of the upkeep ; these expenses will, of course, vary with the work required to be done, and according to whether the range is an outside or inside one, whether the club building is elaborately fitted up or plainly furnished, whether the range site is lent free of charge by some wealthy patron or hired at a high rental, can a club be run at a cost of from £10 to £1,000 per annum.

It is sometimes urged that only shooting with the Service rifle with full charge cartridges is of any utility, but with this we do not agree. The change from the

miniature rifle to the Service weapon is not a difficult one, as is proved by the successes achieved in the first season with the Service arm by men who previously have only used the miniature rifle, and this is particularly true if, as is now very often the case, the miniature weapon used is the Service one chambered to take the miniature cartridge.

Certainly practice with miniature rifles is all sufficient for the acquirement of perfect position, of the ability to align the sights correctly, and to the correct pressing of the trigger—points which may be said to be the first and essential principles of the art of rifle shooting.

The most serious criticism against rifle shooting is that it is dull work, and this, if true, is, we think, entirely due to a want of imagination on the part of club committees.

First of all, the men must learn to shoot at least fairly accurately at stationary targets before attempting shooting at moving or disappearing targets, but the need for the latter for the more advanced shots is sooner felt on miniature ranges than it is on open long ranges, where the variable weather conditions in themselves constitute obstacles which try the skill of the best shots. Where these conditions are absent, they should be created artificially, and it is quite an easy matter to introduce this variety. For instance, there is the running man target, which is at all times difficult to hit, and yet one which has the greatest fascination for all who have attempted it.

It is a pity that every Service rifle range is not provided with this target; we feel sure it would be popular.

Then there is the "Wantage" target, which appears and disappears at intervals of three seconds, which intervals might be increased on miniature ranges on

account of the extra time taken in loading the miniature cartridges.

When the members have become efficient individual shots, they should be trained in team shooting at these targets. We have in mind some fine performances of a team, from a well-known volunteer regiment, at the Bisley meeting, who did much of their training on an indoor range with rifles with adaptors, and now that it is possible to get the Service pattern weapon chambered for the more accurate ·22 cartridges, the training is the more valuable.

If and when it is decided to form a rifle club, we would suggest that it would be desirable for the management committee to consult some of the very interesting publications that have been issued from time to time dealing with the formation of clubs and the building of miniature ranges, notably amongst which we might mention the following :—

"The Citizen Rifleman," by E. J. D. Newitt, of the Council of Miniature Rifle Clubs;

"Rifle Shooting," by W. Winans;

"The British Miniature Rifle," by W. W. Greener.

Amongst the periodicals devoted to miniature rifle shooting, we might mention :

"The Rifleman," the official organ of the Miniature Rifle Clubs;

"The Rifleshot," the official organ of the Miniature Rifle Clubs affiliated to the National Rifle Association.

"The Marksman," published by H. Marks, 20 Bucklersbury, London, E.C.