

[54] CARTRIDGE FEEDING MECHANISM FOR FIREARMS

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[22] Filed: Apr. 30, 1971

[21] Appl. No.: 138,978

[30] Foreign Application Priority Data

May 2, 1970 Germany..... 20215978
Jan. 7, 1971 Germany..... 2100434

[52] U.S. Cl. 89/155, 42/1 S, 89/33 BC,

89/34, 89/129 B, 102/38, 102/45, 102/92.4

[51] Int. Cl. F41d 9/00, F42b 5/02, F42b 11/00

[58] Field of Search ... 89/33 BC, 33 MC, 34, 33.16,
89/17, 55, 33 CA, 35 R, 129 B, 140; 42/73, 1
B, 72, 39.5, 1 S

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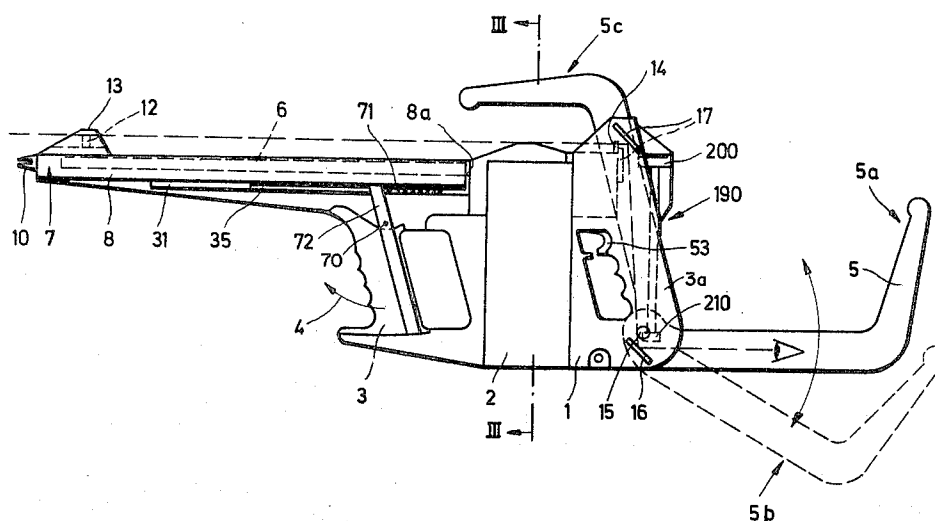
Attorney, Agent, or Firm—Oberlin, Maky, Donnelly & Renner; Donald D. Jeffery

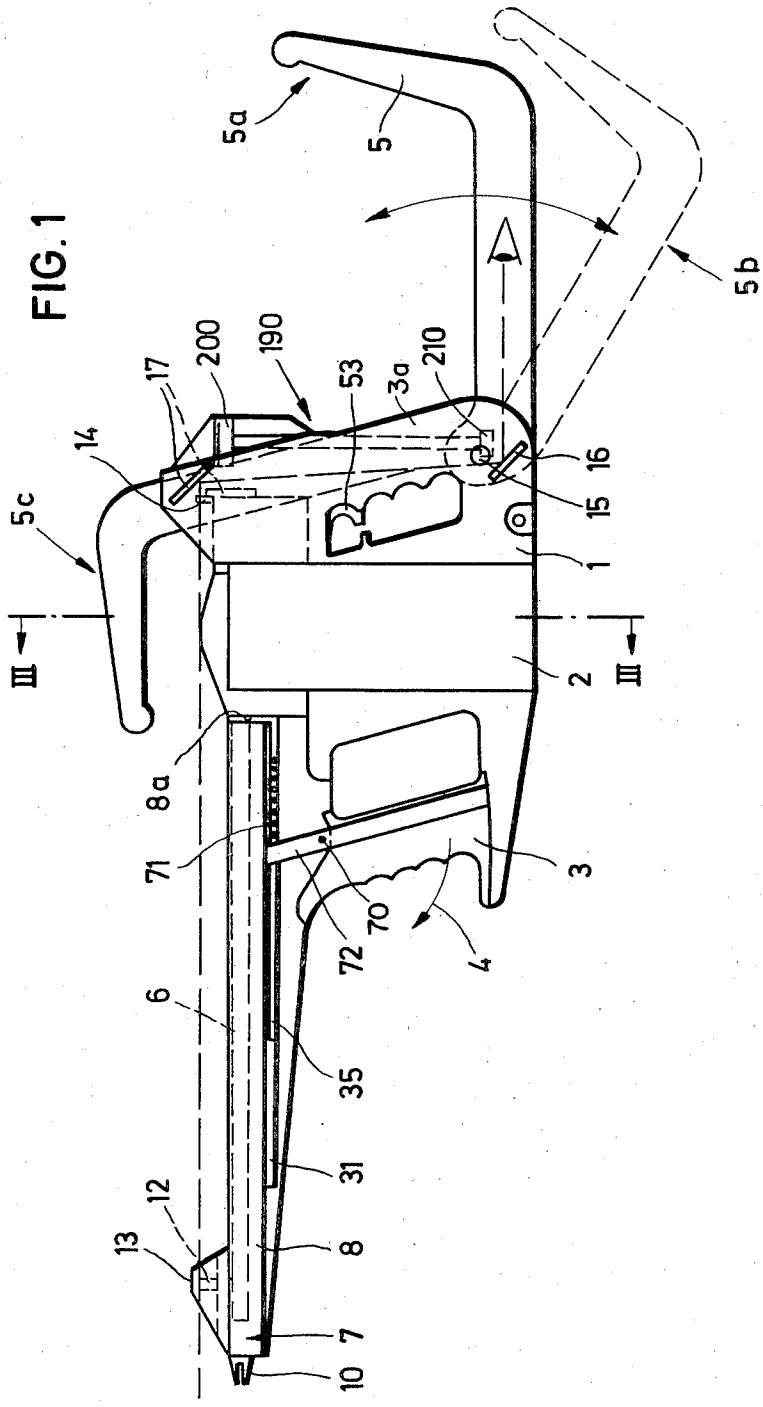
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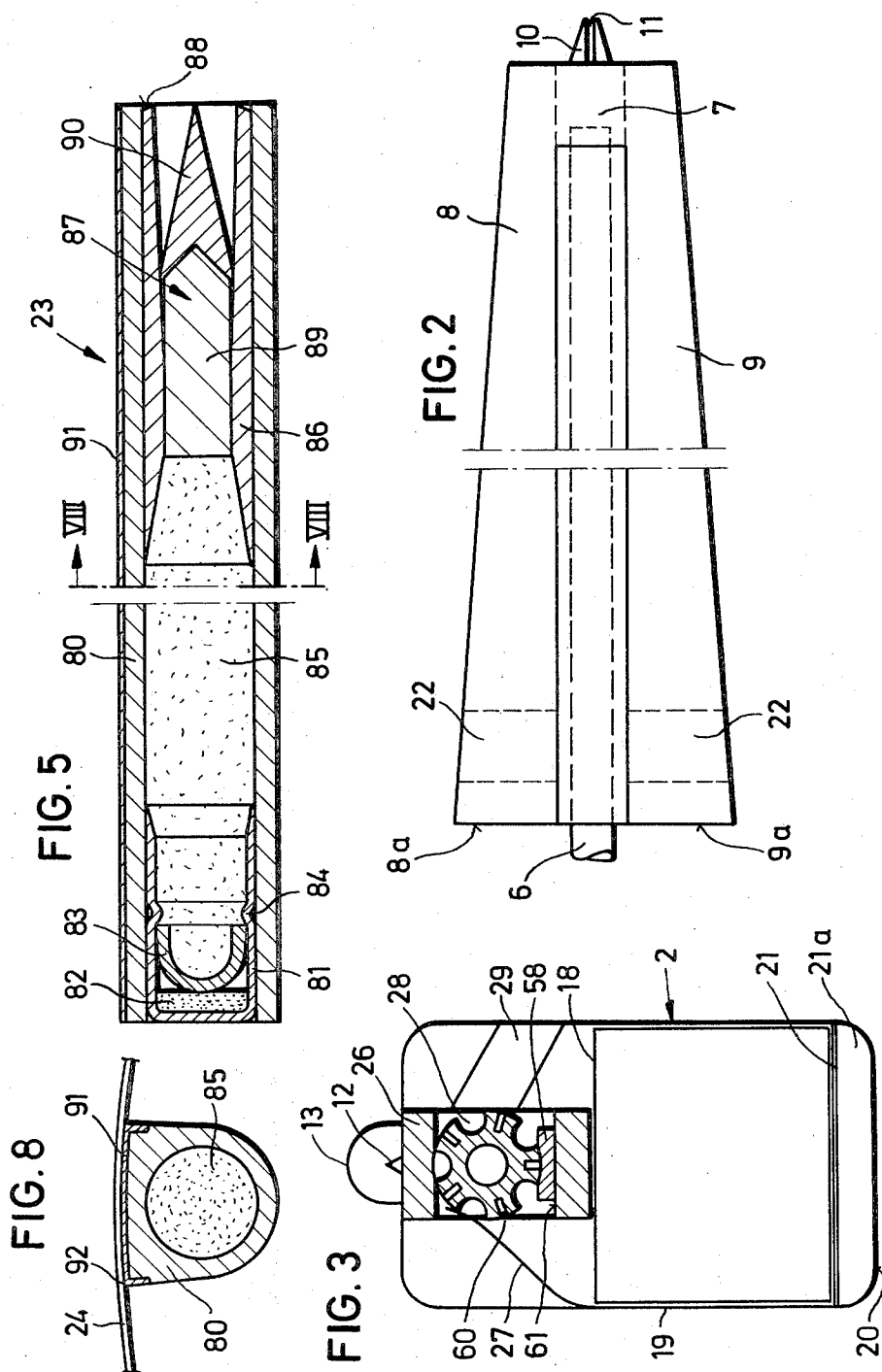
ABSTRACT

A small calibre rifle having an optical sighting mechanism for indirect or direct sighting and employing extremely small calibre cartridges thereby substantially eliminating kickback. A cartridge roller is provided having a plurality of axial bores for receiving the cartridges, and locking means are provided for locking the roller in aligned position with the bore during firing. The cartridges are fed into and ejected from the cartridge roller in the same direction.

27 Claims, 31 Drawing Figures







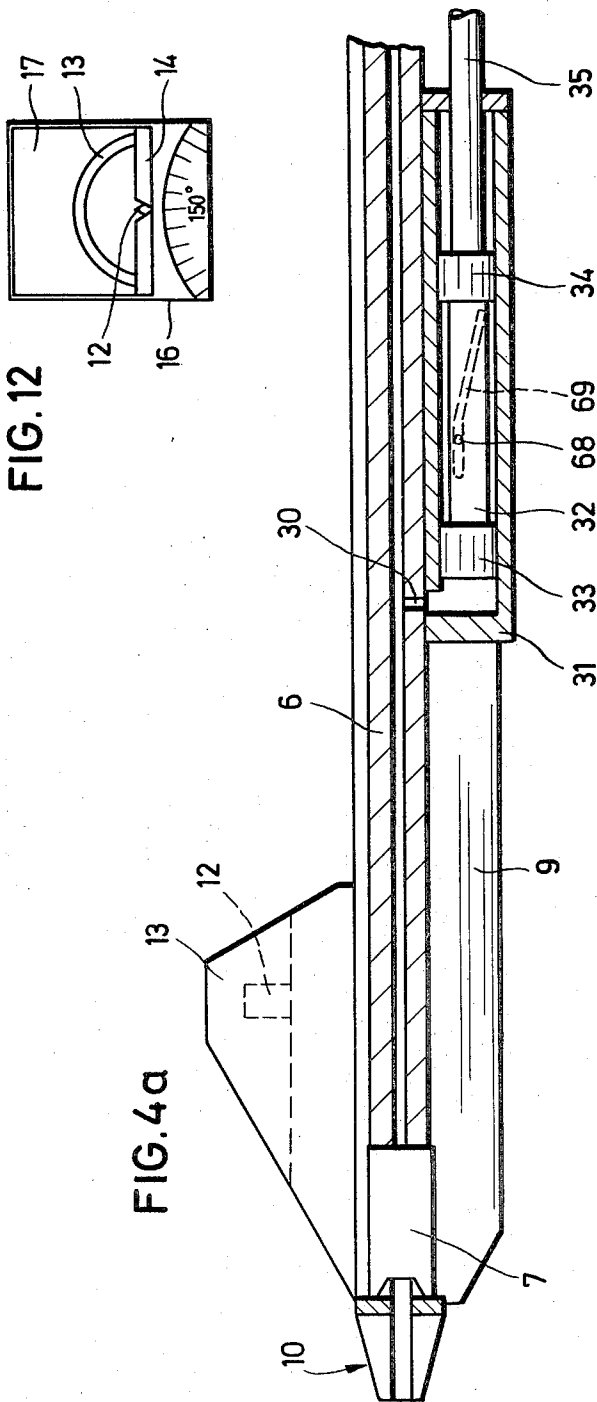


FIG. 4a

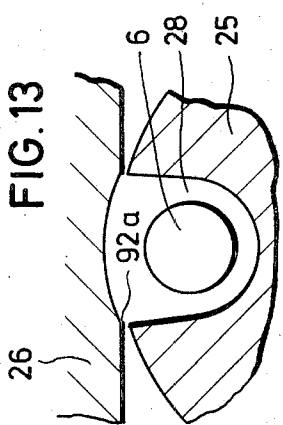
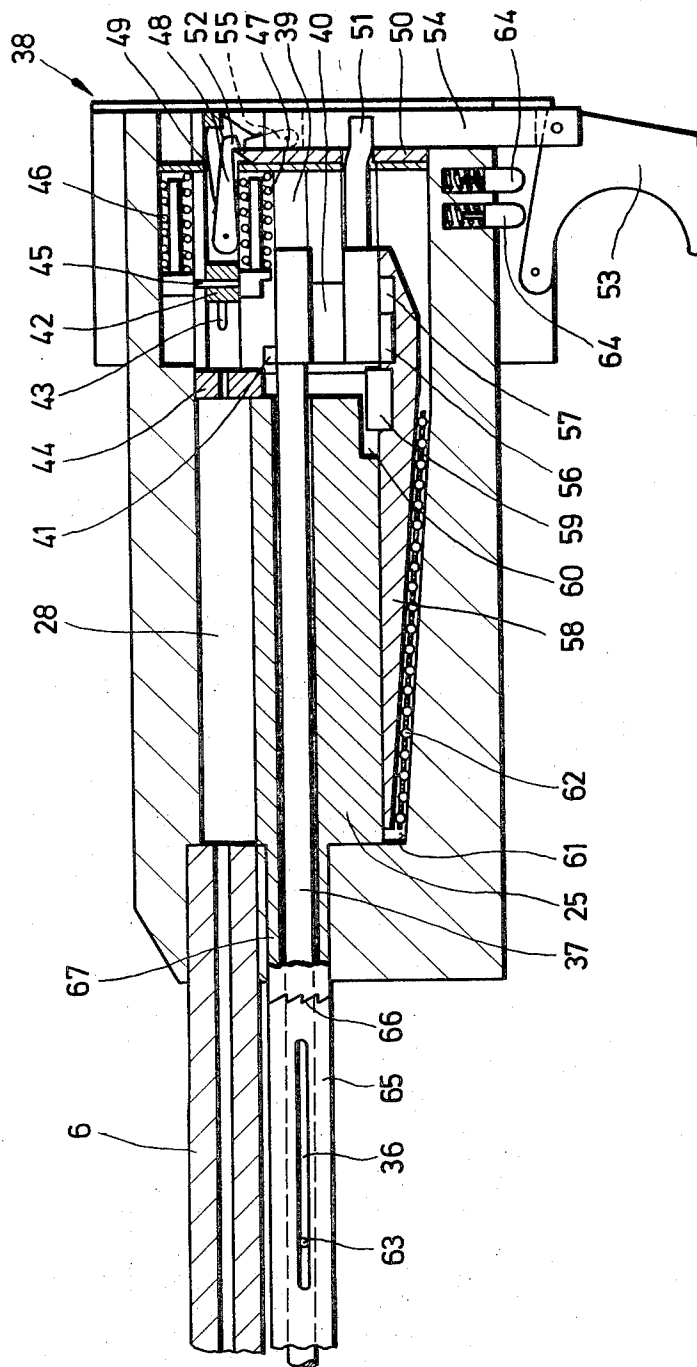
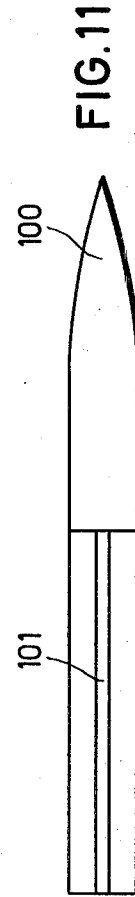
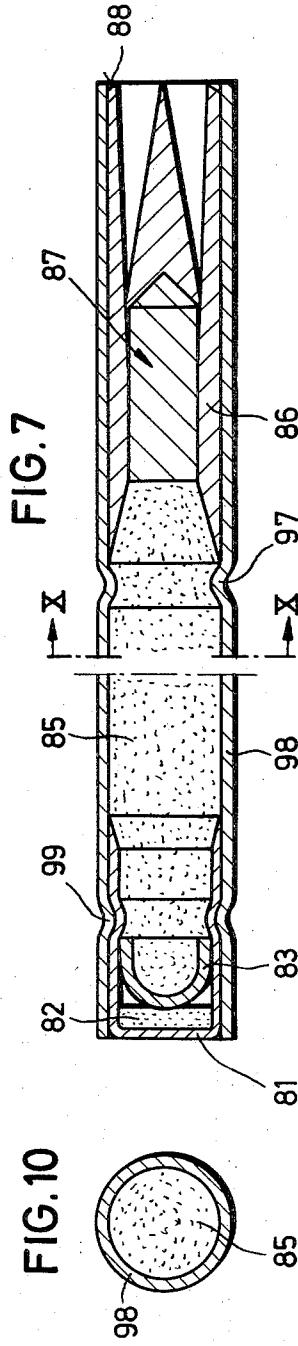
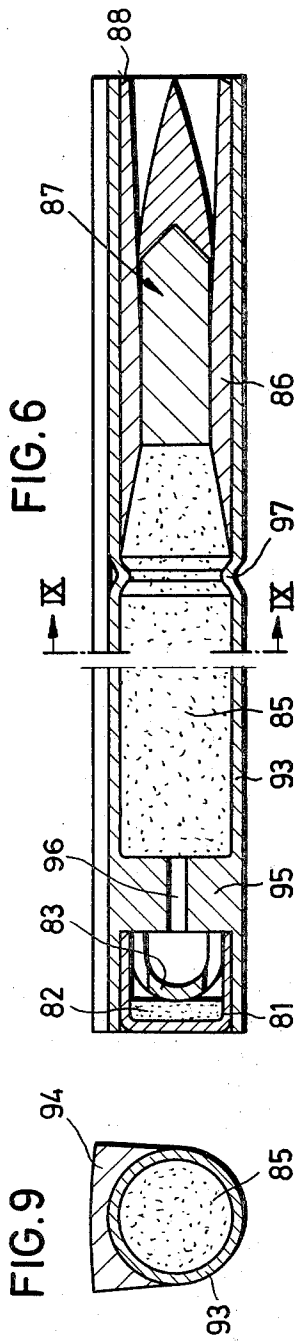
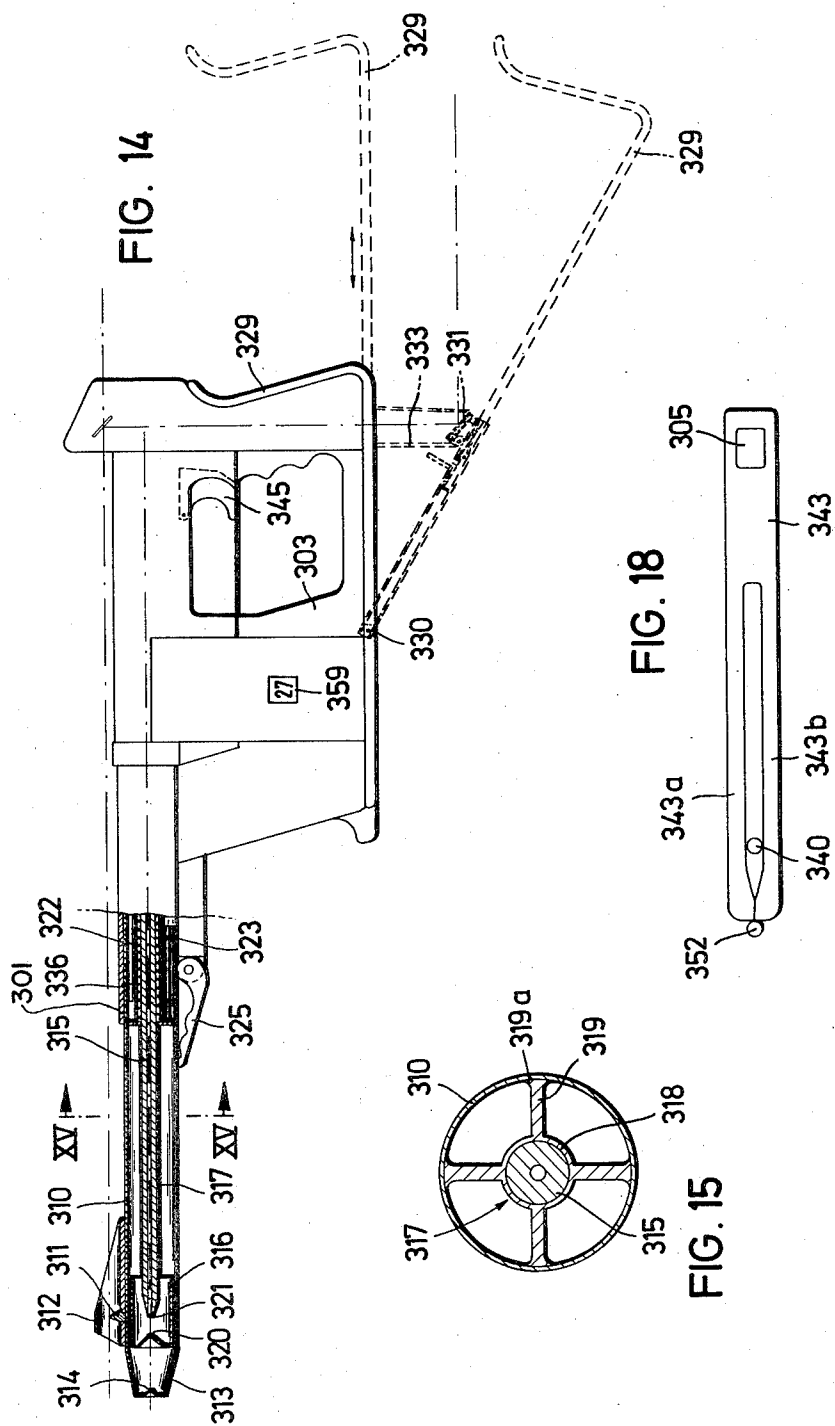
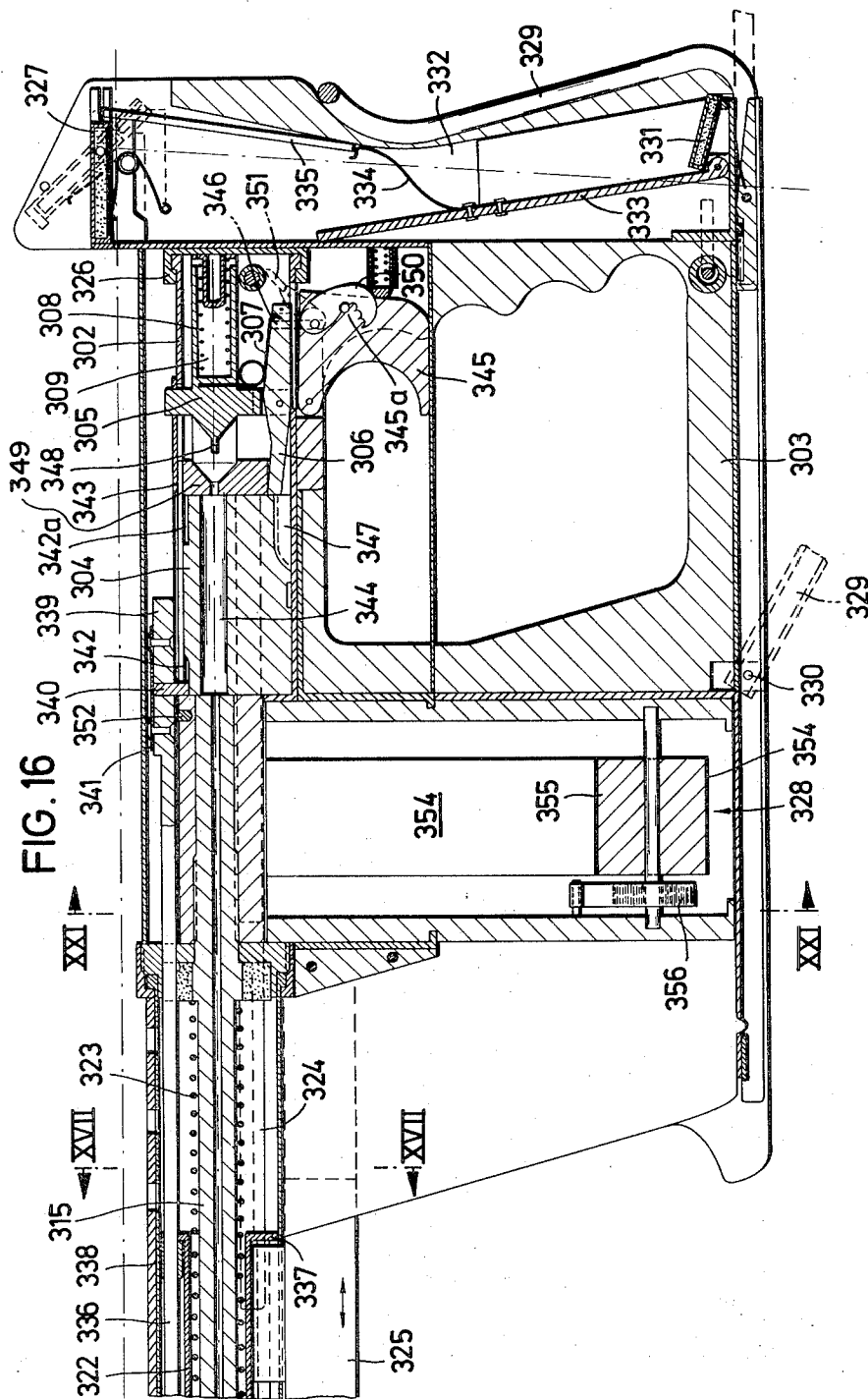


FIG. 4 b









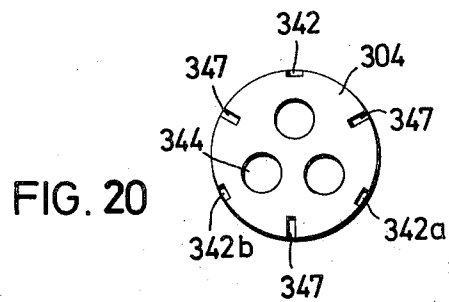
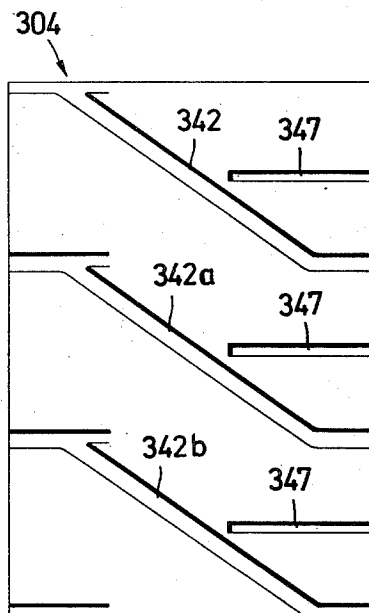
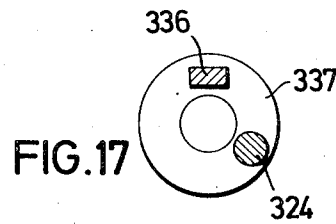
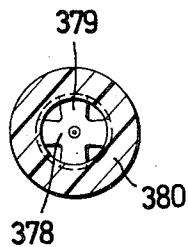
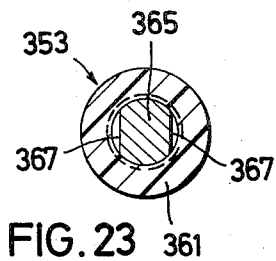
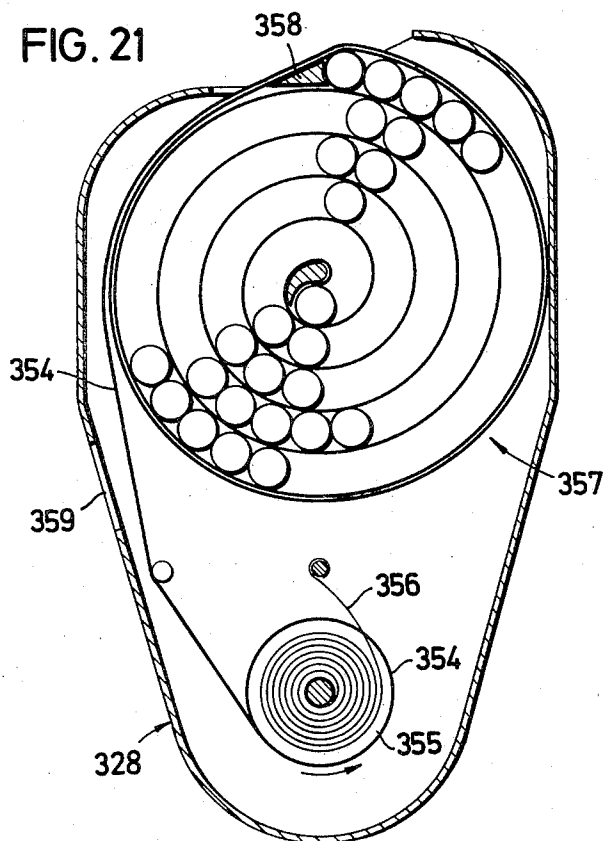
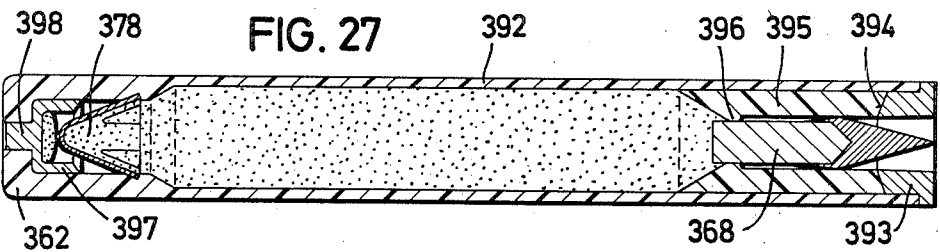
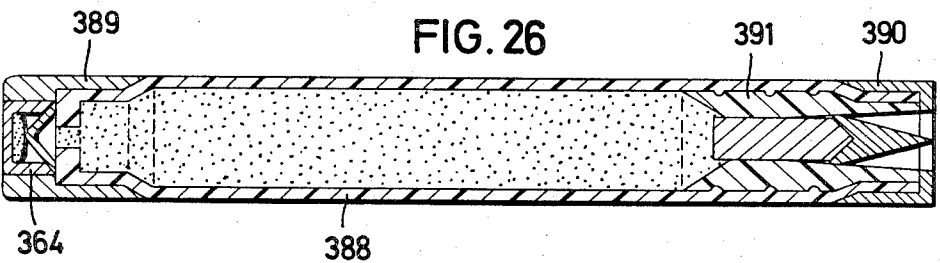
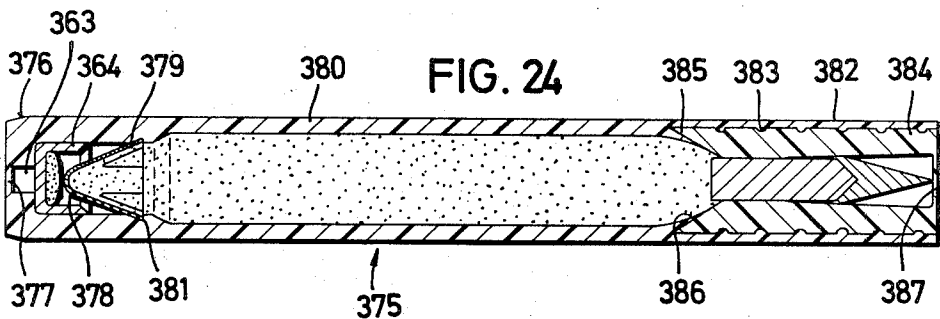
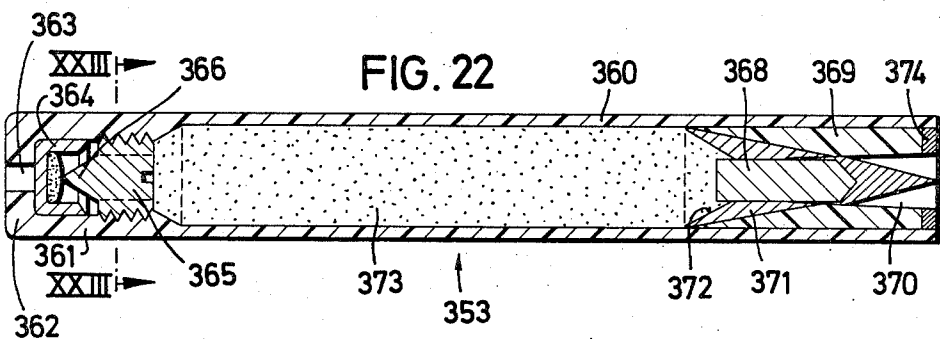


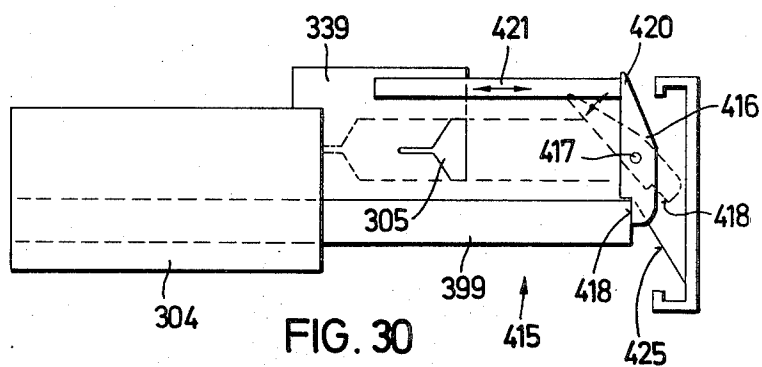
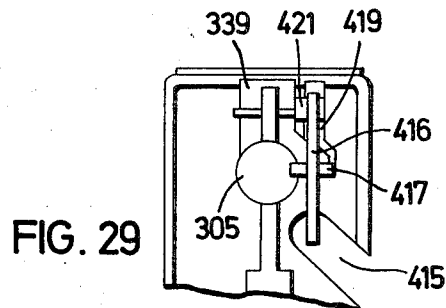
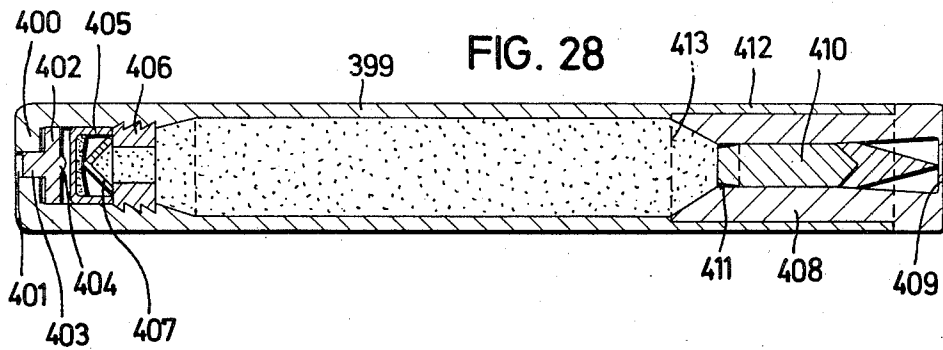
FIG. 21





INVENTOR

BY



CARTRIDGE FEEDING MECHANISM FOR FIREARMS

This invention relates to a hand firearm with an optical sighting mechanism for either direct or indirect sighting and, accordingly, for direct or indirect firing, and to ammunition specially developed for this firearm.

One of the principle objects in the development and improvement of firearms of all kinds has always been to increase the firing range and to improve the firing accuracy, especially in cases where the principle of continuous or automatic firing is adopted in hand firearms. The tactics of combat are largely governed by improvements in this respect.

Originally, attempts were made to increase the firing range along with the accuracy of fire. Recently, however, efforts have been directed to adjusting the firing accuracy of hand firearms, especially rifles and assault rifles, to a distance of approximately 300 metres as the optimum, so that it is possible without any need to alter the sighting mechanism to shoot accurately up to this distance under equal conditions. Accordingly, it is not absolutely necessary in the case of more recent hand firearms for the sighting mechanism to be adjusted for different ranges. This simplifies the use of hand firearms, especially rifles.

Unfortunately, the disadvantage common to all hand firearms used in practice is that the marksman always has to keep his head higher than the barrel in order to be able to aim. For this reason, the marksman is relatively easy to see in battle and is thus prone to injury, especially because muzzle flash and pressure waves from his firearm betray his position to the enemy.

The object of the present invention is to provide a completely new hand firearm using specially developed ammunition with which it is possible to shoot accurately either only one, sporadically or continuously, even from a position of complete cover, without the position of the marksman being betrayed in any way by the shots.

Firing from a position of complete cover means that the body of the marksman from the waist upwards cannot lie behind the barrel so that the kickbacks which occur during firing do not have to be absorbed by the shoulder of the marksman. It has been found that, in order to shoot from a position of complete cover, it is necessary to use ammunition that can be fired with hardly any kick-back because absorption of the kick-back by moving different components of the hand firearms relative to one another is only incomplete and is only possible with considerable outlay in terms of design and, hence, expense.

In order to solve the problem referred to above, it is proposed in connection with a hand firearm of the kind referred to earlier on that this firearm should comprise shoulder support which can be set at the required angle, in a downward direction at least, and in the stock a sighting mechanism with an optical redirecting means so that the weapon can be switched from direct to indirect sighting, and that the ammunition for the weapon should have an extremely small calibre, preferably less than 4.5 mm in diameter, so that there is hardly any trace of kick-back. It is possible in this way to obtain a hand firearm with which it is possible to aim and shoot even when the eye of the marksman is not above the barrel carrying the normal notch and bead sight, without any danger of the firearm being displaced from

the aiming direction adjusted by the kick-backs occurring during firing because the firearm can be fired both once and also continuously with hardly any kick-back.

It is known that the degree of kick-back is less violent, the lighter the weight of the bullets used. For this reason, the conventional steel-jacketed bullets have recently been made increasingly smaller. However, there are limits to the size of the bullets because although as light a weight as possible is required, a certain impact energy has to be applied to the target which should be about 300 metres away from the point of fire. Added to this there is the fact that, in the event of any reduction in calibre, allowance has to be made for the fact, in the case of rotation-stabilised bullets, the diameter to length ratio should not be any greater than about 1:5 because otherwise there is no guarantee that the bullets will still follow the required ballistic trajectory. On the other hand, however, the bullets have to have a certain weight in order to generate a load per-unit cross-section in the normally desired range of from 15 to 20 g/cm².

According to the invention, therefore, the ammunition required is based on the conventional steel-jacketed bullet with its lead core, modified to the extent that the bullets are made for example from a metal of high specific gravity, preferably from tungsten, and are provided with what is at best a needle-sharp tip of soft metal, for example copper. By making the main body of the bullets from substantially pure tungsten, a load per unit cross-section of from 15 to 20 g/cm², depending upon the length of the bullet, is obtained for a calibre of approximately 2.5 mm by virtue of the high specific gravity of 19.2. The relatively soft tip of copper or the like ensures that, on encountering a soft resistance, the tip is deflected spirally downwards, initiating the required tumble effect which is absolutely necessary to the effectiveness of small-calibre bullets. If, by contrast, a bullet of this kind comes into contact with a hard body, for example a steel body, the effect of the copper tip is that the bullet does not ricochet so easily and the hard tungsten core penetrates in to and right through the hard steel body.

However, the bullets can also be in the form of surface-stabilised arrow-like projectiles which optionally may also be additionally rotation-stabilised so that they can also be made from an expensive material such as steel. In this case, they do not necessarily have to be provided with a soft tip of another material, as in the case of tungsten bullets.

The cartridge cases which preferably consists of a plastics material have a uniform cross-section over the entire length of the cartridge so that they accommodate the bullet, the powder filling and the primer.

The weapon according to the invention is provided for example with a silencer whose inlet openings are situated laterally in front of the muzzle but which extends backwards parallel to the barrel so that the barrel only has to be negligibly lengthened by this silencer. Neither is the stability or handling of the proposed firearms adversely affected in any way by the silencer because the silencer does not displace the centre of gravity of the weapons frontwards to any appreciable extent.

In addition, according to the invention, the gas pressure generated during a firing of a cartridge is used to repeat the firearm. To this end, some of the gas given off during firing is directed for example through a ra-

dial outlet opening situated in the barrel near its muzzle into a cylinder containing a piston displaceable against spring pressure whose piston rod is coupled at one end to a continuous-advance mechanism for a cartridge drum rotatable in stages and, at its other end, to a cocking mechanism for the firing pin in such away that, after one shot has been fired, the firing pin is re-cocked and the cartridge drum rotated one step further so that there is a fresh cartridge in front of the barrel, in precise co-ordination with one another.

Instead of repeating by gas pressure, the repeating operation can also be carried out manually, for which purpose a handle for example is provided which can also be used to hold the weapon. In other words, manual repeating can be carried out without any time lag which is of considerable importance in combat if, for one reason or another, the automatic repeating mechanism should have failed or if the weapon has to be loaded for the first time following insertion of a new cartridge belt.

In one preferred embodiment of the invention, the hand firearm has a repeating repeating roller which can accommodate several, preferably three cartridges in to which the cartridges with a uniform cross-section over their entire length are pushed in one and the same direction and from which they are ejected again after firing. Accordingly, the cartridges are not secured to a belt but are pushed individually in to a roller with a corresponding number of openings and are then brought into the firing position by the repeating roller, being carried round and finally ejected from the repeating roller after firing. The cartridges are preferably pushed backwards into the repeating roller from the front, and, after firing, are ejected rearwards from the repeating roller through the insertion of a fresh cartridge. The lock can be designed in such a way that there is always one case that has already been fired in the ejection duct in order to prevent dirt or like from penetrating into the repeating roller through the ejection opening.

The automatic repeating mechanism consists of a repeating piston which is displaceable by the gases given off during firing and on which there is arranged a plunger or a rod which inserts the cartridges individually in to the repeating roller from a magazine and ejects the fired cartridges one at a time from the opposite end of the repeating roller. The repeating roller is provided on its outer surface or outside with helically extending grooves in which a carrier pin axially displaceable by the repeating piston engages in order to turn the repeating roller one step further after each firing and hence following each insertion of a fresh cartridge, in other words the repeating roller can be rotated in steps with each loading operation. However, the repeating roller does not begin to rotate until a fresh cartridge has been completely inserted into it and a fired cartridge ejected from it, in other words the carrier pin which rotates the repeating roller is arranged with a delayed action on the repeating piston so that it only becomes active after the cartridge has been inserted into the repeating roller.

The repeating piston itself is accommodated in a cylinder housing which is also the housing of the silencer. This silencer is designed in such a way that the gases given off during firing are unable to overtake the bullet fired from the barrel, but instead escape largely to the rear which has the advantage that these gases do not reduce the velocity of the fired bullet (high V_0), whilst

on the other hand these gases can be used to actuate the repeating piston. The repeating piston is axially displaceable against the pressure of a compression spring, its working surface being adjustable in accordance with the normally occurring pressures of the gases given off during firing, for example by means of openings arranged in its end face whose cross-section can in some cases also be varied by a rotatable cover plate.

However, the repeating piston not only reloads and, thereafter, further rotates the repeating roller, it also cocks the firing pin. To this end, the rotational movements of the repeating roller are coordinated with the cocking movements of the firing pin.

In addition, the invention affords a simple method of safe-guarding the weapon as and when required and of switching it to on-off fire, sporadic fire or continuous fire.

Where the ammunition according to the invention consists of cartridges whose shells are cylindrical with a circular cross-section over the entire length and which are made of a material of limited resilience such as a plastic material, they can be stored and magazined easily without any danger of twisting. In addition, cartridges of this kind can readily be inserted into the repeating roller acting as the cartridge chamber because the cartridges do not have to be set in any particular angular position relative to the repeating roller, which is the case with a non-circular cross-section. Since the cartridge cases consist of a resilient material such as plastics, they are in no danger of jamming or seizing in the cartridge chamber of the repeating roller because the deformations that occur during firing are not permanent, in other words the cartridge case returns almost to its original form after firing which is not the case for example with brass or steel shells. Accordingly, the cartridge cases proposed in accordance with the invention can be ejected just as easily from the repeating roller.

The cartridges according to the invention are further distinguished by a novel arrangement of the percussion cap and of the anvil in the shell and by a novel mounting of the bullet in a sealing piston. All these components are co-ordinated with one another in such a way that extreme reliability is guaranteed despite minimal production costs.

Finally, the invention also provides a special magazine for the cartridges consisting essentially of a metal box accommodating a plurality of cartridges which are secured to a tape of stable fabric or which are wrapped in a tape of this kind or several parallel tapes. This wrap is arranged for example in such a way that the leading cartridge is pressed against a stop which holds it in front of the loading opening of the repeating roller so that this cartridge can be inserted from the magazine into the repeating roller. The cartridges remaining in the magazine are then pulled forward until the next cartridge comes into contact with the stop which, according to the invention, is achieved by virtue of the fact that the tape holding the cartridges is wound onto a roller under spring pressure. The package accommodating the cartridges can also be mounted on a roller which is pivotally mounted in the magazine and contains a spring which tightens as the package is unwound, thus constantly maintaining throughout the tape a degree of tension sufficient to prevent the loosely wrapped cartridges from sliding. In addition, the cartridges situated in the outermost layer of the package are safely held

therein by virtue of the fact that the tape is guided once again around the outside of the package in the absence of further cartridges so that the tape is doubled on the outside of the package.

The tape by which the cartridges are held in the package can also be provided with numbers of other markings showing how many cartridges are left in the magazine. These markings can be made visible through an opening in the side wall of the magazine.

The magazine according to the invention can accommodate a large number of cartridges, for example 400 cartridges, which can be quickly and conveniently inserted in one go so that the rifle can be loaded very quickly.

As already mentioned the sighting mechanism can be switched in such a way that the target can be sighted either directly or indirectly. A conventional bead and diopter can be used for the direct sighting of a target. This diopter is formed by the notch and an upper covering therefor. For indirect sighting, an optical mirror system is provided in the grip portion of the stock by means of which it is possible to keep the eye substantially level with the lowest point of the hand firearms according to the invention. To this end, the upper deflecting mirror is adjustable so that it can be swung as required into a rest position or into an operative position. In the rest position, the back of the mirror holder can form part of the diopter. In order, however, to be able to look into the lower mirror, the shoulder support has to be swung downwards so that it is situated at an angle to the axis of the barrel. In this position, any kick-backs occurring during firing can no longer be absorbed by the shoulder of the marksman so that the hand firearms have to fire with hardly any kick-back, as already explained above.

For orientation and in the interest of better combat strategy, the optical system can have incorporated in it a compass whose compass card or scale can be read either directly or through the optical deviating system so that, even in the case of indirect sighting, exact orientation by compass is possible. However, the compass needle must be situated in an area in which there are no parts of iron or other magnetizable materials. According to the invention, therefore, the stock and the cartridge chamber are made of a non-magnetizable material such as aluminum or plastics whilst the joints and connecting elements consist of brass for example. This has the further advantage that the hand firearms according to the invention are relatively light in weight.

A telescopic sight in the form of a scissor telescope can also be fitted into the grip portion of the stock instead of the mirror system.

Where the upper deflecting mirror measures 30×30 mm, visibility is in the range from 25.20 to 100 metres, in other words is considerably greater than in the case of a telescopic sight with lower magnification.

In addition, a receiver for electromagnetic waves and, optionally, a transmitter as well can be built into the stock or into the shoulder support so that it is possible for information to be transmitted to a marksman on the wireless principle or even for wireless conversations to be held between a marksman and his commander. This also considerably simplifies combat leadership.

Where the weapon according to the invention is used, a combat detail, especially one fighting on the defensive, is considerably superior to the enemy because

it can fire from a position of complete cover without being visible and without being betrayed by muzzle blast, pressure waves and muzzle flash, even when it is under heavy enemy small arm fire, for example in the event of an attack by the enemy giving the advance details cover by direct machine gun fire.

Other features and advantages of the invention will become apparent from the following description of the drawings and from the claims.

Embodiments of a rifle built in accordance with the invention and of the ammunition suitable for use therein are diagrammatically illustrated in the accompanying drawings, wherein:

FIG. 1 is a side elevation of one embodiment of the rifle.

FIG. 2 is a plan view of the silencer fitted on to the barrel.

FIG. 3 is a cross-section on the line III—III of FIG. 1.

FIGS. 4a and 4b are a longitudinal section through the rifle shown in FIG. 1 on a larger scale.

FIGS. 5, 6 and 7 are longitudinal sections through a few embodiments of the cartridge of scale larger than its true size.

FIGS. 8, 9 and 10 are cross-sections on the lines VIII—VIII, IX—IX and X—X, respectively, through the cartridges shown in FIGS. 5, 6 and 7, respectively.

FIG. 11 shows a modified arrow-like bullet.

FIG. 12 is a plan view of the lower deflecting mirror of the indirect sighting mechanism with the image visible thereon.

FIG. 13 is a detail of FIG. 3 on a larger scale.

FIG. 14 is a partly sectional side elevation of a modified embodiment of the rifle.

FIG. 15 is a cross-section through the barrel and the housing surrounding it on the line XV—XV of FIG. 14 on a larger scale.

FIG. 16 is a longitudinal section through the rear part of the rifle shown in FIG. 14 on the same scale as FIG. 15.

FIG. 17 is a cross-section on the line XVII—XVII of FIG. 16.

FIG. 18 is a plan view of a spring U-bolt fixed to the firing pin as shown in FIG. 16 in what is substantially its natural size.

FIG. 19 is a developed projection of the repeating roller according to the invention shown in FIG. 16 in what is substantially its natural size.

FIG. 20 is an end view of the repeating roller.

FIG. 21 is a cross-section through the magazine of the rifle according to the invention on the line XXI—XXI of FIG. 16.

FIG. 22 is a longitudinal section through another embodiment of a cartridge according to the invention on a scale considerably larger than its natural size.

FIG. 23 is a cross-section on the line XXIII—XXIII through the cartridge shown in FIG. 22.

FIG. 24 is a longitudinal section similar to that of FIG. 22 through another embodiment of the cartridge.

FIG. 25 is a cross-section on the line XXV—XXV of FIG. 24.

FIGS. 26 to 28 are longitudinal sections through another three embodiments of the cartridge.

FIG. 29 is a vertical section through the ejection end of the rifle.

FIG. 30 is a side elevation of the mechanism shown in FIG. 29.

The rifle shown in its entirety in FIG. 1 comprises a housing-like stock 1 with a housing 2 for accommodating the lock with its repeating mechanism, a front handle 3 which can be pivoted forwards in the direction of an arrow 4 for loading purposes, and a fixed rear handle 3a. Linked to the rear end of the stock 1 there is an angular shoulder support 5 which can be locked in three positions so that, in the two lower positions 5a and 5b, it acts as a support for the shoulder of the marksman whilst in its upper position 5c, it acts as a carrying handle. In addition, the rifle shown in FIG. 1 has the usual barrel 6 whose front end opens into a housing 7 from the side of which project two tubular, rearwardly extending silencers 8 and 9 which are open at their rear ends 8a and 9a, respectively. At the front end of the housing 7, in an extension of the barrel 6, there is an ejection nozzle 10 with grooves 11 machined cross-wise in it so that it is impossible for any particles of dirt to settle in this ejection nozzle. In addition, a bead 12 is arranged in a sight tube 13 on the housing 7, whilst an associated notch 14 is situated at the rear end of the stock 1.

The stock and the components associated with it is made of aluminum and partly of plastics as well so that the weapon according to the invention is relatively light, weighing only 2 to 3 kg for example.

Following the pivot 15 of the shoulder support 5 situated at the lower and rear end of the stock 1, there is arranged in the stock 1 a fixed optical deflecting mirror 16 to which corresponds an adjustable mirror 17 arranged at the upper rear end of the stock 1. When the two mirrors 16 and 17 are in the position shown in FIG. 1, the marksman is able to take aim through this optical system using the notch and bead when his eye is substantially level with the mirror 16, i.e., considerably lower than the barrel 6, so that the marksman is able to shoot with the rifle without having to lift his head above the barrel 6, in other words his head can be completely covered in cases where it is desired to shoot accurately with the rifle according to the invention over a cover. If, by contrast, it is desired to take aim directly using the notch 14 and the bead 12, the adjustable mirror 17 is displaced into the vertical position shown in chain lines in front of and below the notch. In this position, an iron bolt arranged in front of and above the mirror 17 rests on the notch 14 so that the notch then acts as a diopter.

As shown particularly clearly in FIG. 3, the housing 2 projects laterally beyond the barrel and can accommodate a cartridge box 18 acting as magazine in which a cartridge belt described in detail further below is situated. One of the side walls 19 of the housing 2 is designed to be opened about a hinge 20 in order to change the cartridge box 18, an intermediate plate 21 on to which the cartridge box 18 is placed being provided in the housing 2. Beneath this intermediate plate 21, there is a recess 21a in the housing 2 which can be used for example to accommodate cleaning materials.

The housing 2 is not only used to accommodate the ammunition, but also has the advantage that the marksman, when taking aim directly with the notch and bead, only ever sees the front end of the barrel or rifle with one eye, in other words the other eye does not have to be used for correct aiming, something which many people find difficult.

When taking aim indirectly through the deflecting mirrors 16 and 17, the marksman can in any case only look into this optical deflecting system with one eye so that in case too there is no need for the other eye to be used.

In addition, a compass 190 is fitted on to the rear end of the stock 1. Its upper end 200 which carries the scale or compass card is situated immediately beneath the inclined upper deflecting mirror 17 so that, in the case of indirect aiming through the deflecting mirrors 16 and 17, the compass position can be directly read off. However, even in the case of direct aiming or even in cases where no aim at all is taken, the compass card or scale can be read off by directly looking downwards on to it. The compass needle itself is situated at the lower end 210 of this compass 190 in a small housing provided there which is remote from any magnetizable parts of the rifle according to the invention.

If desired, a miniature wireless receiver and/or miniature wireless transmitter can be accommodated in the pivotal shoulder support 5, so that it is possible for instructions or orders to be transmitted to the marksman, even over considerable distances, in such a way that he will hear them even in cases where battle noise makes it impossible for commands to be given orally over relatively long distances or in cases where, for other reasons, it is desirable for orders to be given in the absence of noise and movement out in the open.

Provision of the compass in conjunction with a wireless order transmission facility allows completely new tactics to be adopted because neither the giver nor the receiver of the commands has to leave their cover for the effective direction of combat. For example, the marksman can receive a radio message from his group commander that an enemy has been seen and is to be fought in the direction of, for example 212° at a distance of approximately 150 metres.

In order that the marksman does not betray his position especially when aiming and shooting from a position of complete cover, through a movement of surrounding grass or similar camouflage produced by a pressure wave emanating from the barrel 6, by muzzle flash and by noise, the barrel 6 terminates in the housing 7 which is adjoined laterally by the tubular silencers 8 and 9 which extend rearwards adjacent the barrel 6 and which are open at their rear ends 8a and 9a but which, just before these ends, contain a wool-like or other packing 22 which guarantees the required degree of silencing in conjunction with the relatively long pressure-equalising chambers of the silencers 8 and 9. Since the gases issuing from the end of the barrel 6 can directly expand on both sides into the silencers 8 and 9, no muzzle flash, pressure waves or even muzzle noise emerges from the housing 7. The packings situated at the rear end of the tubular silencers 8 and 9 can consist of glass wool, wool, asbestos fibres or a similar material whose structure prevents the pressure waves generated during firing from directly issuing outwards undamped.

The cartridges 23 accommodated in the cartridge box 18 are secured at a certain distance from one another to a belt 24 consisting of a woven fabric for example, the arrangement being such that one cartridge box 18 can accommodate for example one belt with 400 cartridges as the packaging and supply container. It is preferably in the form of a one-way box which is only opened by the marksman just before use and is thrown

away after the cartridge belt accommodated in it has been fired.

The cartridges 23 pass from the cartridge box 18 in to a cartridge roller 25 which can be advanced in steps and which is rotatably mounted in a fork 26 adjoining the barrel 6. Arranged on the inside of the hinged side wall 19 of the housing 2 there is a leaf spring 27 or the like which bears from one side against the cartridge roller 25 and, in doing so, forces the following cartridges one by one into the uppermost empty groove 28 of the cartridge roller. These grooves 28 have a cross-section identical with that of the cartridges 23.

The cartridge roller 25 brings the individual cartridges 23 from the cartridge box 18 into a position from which they are situated in front of the rear end of the barrel 6, and holds them in the firing position, i.e., for firing purposes the cartridges do not have to be inserted into the barrel 6 or into an extension thereof, thus increasing the rapidity of firing and simplifying the lock mechanism.

On that side of the housing 2 opposite the side wall 19 to be opened, the cartridge roller 25 is adjoined for example by an ejection duct 29 for fired cartridges.

The rifle according to the invention can be loaded by pivoting the handle 3 in the direction of the arrow 4, although it is preferably loaded with the assistance of the gases given off when a shot is fired. To this end, the barrel 6 is provided near its front end with a radial bore 30 which opens into a cylinder 31 arranged below the barrel 6. This cylinder 31 contains a piston 32 axially displaceable against spring pressure with two guide ring surfaces 33 and 34. The piston rod 35 is guided rearwards out of the cylinder 31 and is used to re-cock the lock of the weapon after a shot has been fired and to rotate the cartridge roller 25 one step further so that a new cartridge arrives in front of the barrel 6.

The piston rod 35 is partly hollow and provided with an elongated hole 36. A control rod 47 which, at its rear end, carries a slide 40 displaceable in guide grooves 39 in the lock 38, projects into the piston rod 35. This slide 40 has an upper carrier pin 41 which is designed to entrain rearwards with clearance a piston 42 carrying at its front end the firing pin 43 which can break through a wall 44 situated at the rear end of the cartridge roller 25 or through a hole provided therein. The piston 42 of the firing pin is designed to be placed under tension through two compression springs 46 and 47 arranged above and below it and permanently connected to it through a pin 45, so that when the piston 42 is released the firing pin 43 rushes forward with great energy without tilting and fires a fresh cartridge.

A latch 48 is so mounted in the piston 42 as to be pivotal against the action of a leaf spring 49. In the lowermost position of the piston 42 this latch 48 engages over the blade-like upper edge of a locking plate 50 which is situated at the rear end of the lock and which can be displaced upwards or downwards by a distance of 1 mm through an extension 51 acting as an adjusting cam. The hook 52 of the latch 48 has a height of more than 1 mm for reasons that will be explained further below.

Mounted behind the locking plate 50 in the lock 38 there is a plunger 54 which is vertically displaceable by the trigger 53 and which, at its upper end, carries a pin 55 which can be swung out rearwards against spring pressure and which is normally able to lift the latch 48

above the locking plate 50 when the trigger 53 is actuated for an individual shot. However, by pushing the trigger 53 away completely, continuous fire is obtained in which case the plunger 54 stays in its elevated position and engages beneath the hook 52 of the latch 48 and keeps it at such a level that, when the locking plate 50 is pulled downwards by the cam-like extension 51 of the slide 40, it can be moved away over the upper edge of the locking plate 50, in other words the slide 42 carrying the firing pin 43 is released in this position. Since, with each shot, the piston 32 is displaced rearwards by the gases given off in the barrel 6 taking the slide 40 with it the locking plate 50 is moved downwards with a certain time lag after each shot so that the next shot is automatically released after the lock 38 has been cocked. If, by contrast, the trigger 53 is only pulled so far as to release a single shot, the plunger 54 returns to its lowered starting position after each pull of the trigger with the result that, when it is vertically displaced again the pin 55 arranged on it has to lift the latch 48 beyond the locking plate 50. In this case, continuous fire is impossible because the plunger 54 itself is not pushed high enough automatically to release another shot.

After it has been released, the trigger 53 is swung back into its neutral starting position by spring-loaded push rods 64.

In addition, there is arranged on the slide 40 a downwardly projecting nose 56 which projects with axial clearance into a groove 57 in a sliding wedge 58 which is situated below the cartridge roller 25 in the fork 26 and which urges the cartridge roller 25 upwards into the requisite position in front of the barrel 6 before and during firing of a cartridge. In addition, the sliding wedge 58 is provided with a fitting key 59 which can engage in corresponding grooves 60 in the cartridge roller 25 so that the sliding wedge 58 not only urges the cartridge roller 25 upwards, but also prevents it from rotating during and before firing of a cartridge. The sliding wedge 58 rests on a wedge surface 61 which is situated in the fork 26 and which, to reduce friction, can carry a flat needle bearing 62 arranged between it and the sliding wedge 58.

After a shot has been fired, the rod 37 is displaced rearwards by way of the piston rod 35 and a pin 63 engaging in the elongated hole 36, the piston rod 35 initially travelling a distance of approximately 20 mm before it picks up the rod 37 which travels a total distance of approximately 14 mm. After the rod 37 has travelled a distance of about 3 mm, the nose 41 of the slide 40 comes into contact with the piston 42 of the firing pin 43 and takes the firing pin 43 over a distance of 11 mm into its cocked position. In addition, the tongue 56 displaces the sliding wedge 58 rearwards by a distance of approximately 6 mm after initially overcoming the axial clearance. When the sliding wedge 58 is in its rearmost position, the cartridge roller 25 can be rotated in a manner described further below.

Following return of the slide 40 under the effect of a compression spring arranged on the rod 37 after the gas pressure in the cylinder 31 has collapsed, the sliding wedge 58 is again pushed forwards so that the fitting key 59 engages in the next groove 60, moving the cartridge roller 25 into a position in which the next cartridge can be fired. The locking plate 50 is then displaced downwards by a distance of 1 mm so that, if the trigger 53 has been pulled through to the continuous

fire position, the next shot is automatically released. Otherwise, the pin 55 of the plunger 54 would have to lift the latch 48 beyond the upper edge of the locking plate 50 in order to release the next individual shot through the trigger 53.

The cartridge roller 25 is moved another step forward through a ratchet coupling when the piston rod 35 is moved rearwards under gas pressure as a result of a shot being fired. However, the same movement is initiated when the handle 3 is pivoted upwards to the front in the direction of arrow 4 and back again, as a result of which the lock 38 is simultaneously cocked.

Arranged on the piston rod 35 is front of the roller 25 there is a sleeve 65 provided at its end with teeth 66 which correspond to teeth provided on the spindle 67 of the cartridge roller 25 provided with a central full-length bore. The teeth 66 are in the form of ratchet teeth. By virtue of the elongated hole 36 and the pin 63, the sleeve 65 can be displaced axially relative to the piston rod 35, but has to follow any rotational movements of the piston rod.

The piston 32 is guided by means of a pin 68 and an elongated slot 69 provided in the cylinder 31 in such a way that, during its return movement, it makes a partial revolution which it repeats in the opposite direction during its forward movement. The slot 69 is designed in such a way that the partial revolution only begins after the piston 32 has already completed some of its return movement or forward movement. As a result of the partial revolutions, the sleeve 65 is also rotated, jumping forward by a distance corresponding to one tooth relative to the spindle 67 of the cartridge roller 25. When the cartridge roller 25 is released on completion of the return movement of the piston 32 with the sliding wedge 58 pushed back, the sleeve 65 can rotate the cartridge roller 25 by a distance corresponding exactly to one tooth before the re-advancing piston 32 returns the sliding wedge 58 into its locking position. The sliding wedge 58 is only returned after the pin 68 has reached the last, straight part of the elongated slot 69.

The sliding wedge 58 has to have a certain wedge angle in order to be able to exert the required locking effect and, on the other hand, in order to be readily displaceable in the manner required. In the embodiment illustrated, this wedge angle is 4.5°.

Return of the piston 32 and of the piston rod 35 takes place under the effect of the gas pressure prevailing in the cylinder 31 or by pivoting the handle 3 about a pin 70. In this case, a compression spring 71 arranged on the piston rod 35 is placed under tension, being released on completion of the return movement with the result that the piston rod 35 together with the piston 32 hurries back frontwards, thus initiating the corresponding return movements in the lock and further rotation of the cartridge roller 25.

For placing the compression spring 71 under tension, the handle 3 comprises a carrier fork 72 which, during pivoting of the handle about a pin 70, is connected to the compression spring 71 or to a slide arranged in front of it.

The lock 38 is made very short in order not to interfere with the sighting mechanism, especially the mirror section in the stock 1, and in order to be able to keep the hand firearms as short as possible. The distance travelled by the firing pin 43 is also intended to be as short as possible and it is for this reason that compression

sion springs 46 and 47 which provide for the requisite impact energy over an extremely short distance are arranged on both sides of the firing pin.

The cartridge 23 shown in FIGS. 5 and 8 intended for use in the above-described embodiment of the rifle according to the invention is adapted in its cross-section to the shape of the grooves 28 in the cartridge roller 25. This cartridge 23 comprises an elongated shell 80 of glass-fibre-reinforced polyamide in whose rear end is fitted a detonator 81 containing a detonator composition 82 and anvil 83 in the usual way. The anvil is prevented from being displaced axially frontwards by means of a bead 84 surrounding it.

The space 85 in front of the detonator is filled with powder. An insert 86 made of brass, steel or the like acting as holder for a bullet 87 is situated in the shell 80 near the front end thereof. This tubular insert 86 widens frontwards and has a frustoconical end face 88 which, when the cartridge is fired, is applied valve-seat-fashion to the inlet end of the barrel 6 so that the gases given off during firing are unable to escape laterally between the cartridge and the inlet end of the barrel.

The bullet 87 consists of a core 89 of tungsten and of a copper tip 90 fused on to it in such a way that it also projects laterally beyond the front end of the tungsten core. This part of the copper tip 90 acts as a kind of guide ring in the barrel, in other words the rotation-producing grooves of the barrel merely dig into the relatively soft copper but not into the hard tungsten.

In order to prevent the deposition of copper in the barrel 6, the bullet 87 consisting of a combination of tungsten and copper can be provided with a nickel covering applied by electroplating.

The bullets 87 consisting of a combination of tungsten and fused-on copper are relatively easy to produce because pure tungsten can be machined in the requisite manner. Although the material costs are high, the bullets are so small by virtue of their low calibre that the material costs are justified because the production costs, compared with those of conventional steel-jacketed bullets, are very much lower so that, overall, the individual bullets are even cheaper than conventional steel-jacketed bullets of any calibre. In addition, the tungsten cores 89 can be reused by collecting them in the target area, thus further reducing the total material costs.

In the embodiment shown, the cartridge 23 is inserted into a steel rail 91 which forms the upper wall of the cartridge shell 80 when the cartridge is inserted into a groove 28 of the cartridge shell 25. However, this steel rail 91 is not absolutely necessary. Instead, the cartridges 23 can also be directly attached to the belt 24. On one side, the steel rail 91 is provided with a shearing edge 92 whose effect is that, under the effect of the forces generated during firing the belt 24 is separated between this shearing edge 92 and the inner wall of the fork 26 so that the fired cartridges can be individually ejected.

The cartridge shell 80 preferably has the cross-sectional form shown in FIG. 8, in other words it is circular at its lower end, whilst its outer surface corresponds to the curvature of the cartridge roller 25 which is circular in cross-section. In the firing position, the cartridge roller 25 forms the firing chamber in conjunction with the fork 26, the arrangement being such that the cartridge 23 is held in such a way that the pressure generated by detonation of the powder can only ever

escape frontwards so that the bullet 87 is propelled through the barrel 6 in the required manner.

However, the cartridges 23 can also have other cross-sectional forms as shown in FIGS. 9 and 10, but they must adhere to the contour of the outside of the cartridge roller 25. If, by contrast, two co-rotating cartridge rollers are used with each cartridge held between them during firing, the cartridges can have a completely circular cross-section (FIG. 10), in which case the cartridges can be secured between two belts 24.

The cartridge shown in FIGS. 6 and 9 differs from the cartridge shown in FIGS. 5 and 8 in the shape of the cartridge shell 93. This cartridge shell is circular in cross-section and has attachment 94 which enables it to be adapted in the manner required to the contour of the cartridge roller 25.

The detonator 81 with the plug 82 and the anvil 83 is separated from the powder-filled inner space 85 by an intermediate wall 95 with a full-length bore 96 through it. The insert 86 for the bullet 87 bears against a bead 97 formed in the periphery of the cartridge shell 93. This bead 97 enables the cartridge shell to be extended during firing, thus ensuring that the conical end face 88 of the insert 86 bears against the inner end of the barrel, and that the required sealing effect which prevents the gases given off during firing from escaping before the barrel is obtained.

The cartridge shown in FIGS. 7 and 10 comprises a shell 98 circular in cross-section which is fired between two cartridge rollers each containing semi-circular cartridge grooves. This cartridge shell again has a bead 97 which acts as a holder for the insert 86 and which provides for the elongation required during firing. Another beam 99 is provided for axially retaining the detonator 81 and the anvil accommodated in it.

The bullet 100 shown in FIG. 11 is an arrow-like bullet with stabilising surfaces 101 which can also show some twist. This bullet is considerably longer than the bullets 87 shown in FIGS. 5 to 7 so that it does not have to be made of a heavy metal such as tungsten, instead it can even be made of steel optionally provided with a nickel coating. This arrow-like bullet can also be fired from cartridges of the kind shown in FIGS. 5 to 10.

The belt 24 can be provided with a marking extending from the beginning to the end thereof, for example in the form of a coloured marking which is short at the beginning and which, at the end of the belt, extends for example over the entire width thereof so that it is possible with one look to see the extent to which the belt has already been fired. This is important because several hundred cartridges can be accommodated in the cartridge box so that the marksman is hardly able to notice when his supply of cartridges will be exhausted. However, a quick look into the cartridge box or into the housing 2 or at the cartridge shells which have been ejected is sufficient to determine when the rifle will probably have to be reloaded.

By virtue of the extremely low calibre and the reduction in weight and space associated therewith, the marksman is able to carry much more ammunition than before, in addition to which the cartridges are much easier to feed into the gun.

The weapon according to the invention can also be simply designed in such a way that it can be used not only for single shots and for continuous fire, but also for sporadic bursts in which case only a certain small number of shots can be fired at once before the trigger

mechanism has to be recocked. To this end, the cartridge roller can be provided with a locking mechanism intended for sporadic fire which holds the cartridge roller after it has completed one revolution, i.e., after 5 shots have been fired in the embodiment shown. The locking mechanism is only released again after the trigger has been re-actuated. Accurately regulatable and repeatable sporadic fire such as this is not readily possible in the case of conventional firearms.

FIG. 12 shows the image which the marksman sees on looking at the lower mirror 16 in the case of indirect aiming. In the upper mirror 17, he sees the notch 14 and the bead 12 including the tube protecting the notch referred to here as the sighting tube 13, and the terrain situated behind it. In addition, part of the compass card or scale is visible below the notch 14 and can be correctly read off because the marksman looks at it from beneath through the mirror 16. The firing direction of the weapon can be immediately read off because the angle which has just been adjusted appears immediately below the notch 14.

FIG. 13 shows a detail of FIG. 3 on a larger scale. FIG. 13 shows the shearing edge 92a arranged on the inside of the fork 26 which separates the cartridge situated in the uppermost groove of the cartridge roller 25 in front of the barrel 6 from the belt during firing because the bullet is sheared along the edge 92a under the effect of the pressure which is developed in the cartridge during firing and which also acts outwards.

The rifle shown in FIGS. 14 to 21 consists essentially of a tube 301 which is offset by some 6 to 7 mm in its rear part 302 which makes up about one third of the overall length of the tube. This tube is fixed to a handle 303 which corresponds to the stock and butt of conventional rifles.

A repeating roller 304 and a firing pin 305 are accommodated in the rear, offset part 302 of the tube 301. A firing lever 306 acting as trigger is so mounted on the firing pin that it can be pivoted against the pressure of a spring 307. The firing pin 305 can be cocked against the pressure of a compression spring 308 which is accommodated in a recess 309 in the firing pin 305.

The front part of the tube 301 consists of a cylindrical housing 310 which can be screwed on and which carries the bead 311 accommodated in a sighting tube 312. In addition, the front end 313 of the tubular housing 310 tapers conically and has an ejection opening 314 set back to the inside.

The cylindrical housing 310 surrounds the front part of the barrel 315 and forms the outer skin of a silencer which inside contains a rearwardly open silencer pot 316 with a support 317 cruciform in cross-section attached to it. This cruciform support consists of a sleeve 318 accommodating the barrel 315 which is supported through radially extending vanes 319 and widened feet 319a by the inside of the tubular housing 310 in such a way that heat bridges are present outside so that the barrel can be cooled through the dissipation of heat. The barrel 315 is further cooled by air drawn into the housing 310 after a shot has been fired, as will be explained in detail further below.

The vent opening 320 of the silencer pot 316 which is set back inwards is at a distance corresponding substantially to the length of a bullet from the muzzle 321 of the barrel 315, which prevents the gases issuing from the barrel from overtaking the bullet inside the silencer

pot 316 and the housing 310 and hence from reducing the muzzle velocity of the bullet because substantially all the gases have to escape rearwards from the silencer pot 316 as long as the bullet has not yet left the silencer pot.

In addition, the housing 310 accommodates a repeating piston 322 which surrounds the centrally arranged barrel 315 and which can be displaced rearwards against the pressure of a spring 323 either under the effect of the gases given off during firing or even by means of a hand lever. A rod 324 intended to be used as a plunger for loading is attached to the repeating piston 322. Its function will be explained in detail further below. In addition, a manually operated repeating lever 325 is pivotally mounted below the tubular housing 310 with which the repeating piston 322 can be displaced rearwards in cases where it is intended to load or even unload the weapon in the absence of previous firing.

The rear end of the tube 301 or of its rear offset part 302 is closed by means of an end plate 326 which can be fixed on bayonet-fashion and on which the rear part of the sighting mechanism, namely a diopter or the notch and a pivotal mirror 327, is arranged.

A magazine 328 for the ammunition is accommodated in an opening in the handle or stock 303. This magazine can be removed from the handle or stock 303 for replacement or refilling.

A telescopically extendable trigger guard 329 which can be swung out downwards about a pivot 330 is arranged on the underneath of the handle or stock 303. This trigger guard also carries the lower part of the sighting mechanism, namely a mirror 331 and a rod 333 which engages in a duct 332 in the handle 303 and which is pivotally arranged on the trigger guard 329, carrying a spring 334. This rod 333 cooperates with a spring-loaded push rod 335 which, when the rod 333 is displaced downwards, moves downwards and in doing so swings the mirror 327 upwards in to the position shown in chain lines. If, therefore, the trigger guard 329 is extended and at the same time swung downwards so that it can be used as a shoulder support by the marksman, the marksman is able to take aim through the mirrors 331 and 327 and hence indirectly to sight a target and also to shoot indirectly.

In addition, the repeating piston 322 has arranged on it a repeating rod 336 which is guided axially rearwards and which projects displaceably through the rear end plate 337 of the repeating piston 322, having a bushing 338 attached to it. In this way, it is possible for the repeating rod 336 to be entrained with a certain time lag by the repeating piston 322 during its forward and return movements. A foot 339 is arranged at the rear end of the repeating rod 336, being situated above the rear part 302 of the tube 301. This foot 339 contains a downwardly projecting stud 340 which can be pressed by means of a spring 341 into grooves 342 formed on the outer periphery of the repeating roller 304. Beneath the foot 339 there is a forked, flat spring 343 which is fixedly connected to the firing pin 305 and whose shape can be seen from the plan view in FIG. 18.

For firing, a full magazine 328 is initially inserted into the opening in the handle 303 of the rifle. The repeating piston 322 is moved backwards with the repeating lever 325 so that the loading rod 324 fixed to the repeating piston pushes a cartridge from the magazine 328 backwards into the repeating roller 304. When the

repeating lever 325 is released, the repeating piston 322 is again pushed back forwards by the compression spring 323. As a result of the movements of the repeating piston 322, the repeating rod 336 was also pushed backwards with some delay, so that the pin 340 is forced out of the straight groove 342a, for example, and, sliding backwards over the smooth outside of the repeating roller 304, is pushed into another groove 342 which comprises the straight end portion of such groove and which lies in the same path as the straight groove which forms the beginning of groove 342. During the forward return movement of the repeating piston 322, the repeating rod 336 is again entrained with some delay, except that on this occasion the pin 340 remains in the groove 342 and is guided helically over part of the outer periphery of the repeating roller 304 so that the repeating roller is rotated one step further during this movement. Since the repeating roller has three axial bores 344 for accommodating cartridges and hence three grooves 342, 342a and 342b as well distributed helically over its outer periphery, the repeating roller 304 is rotated through 120° during the return movement of the repeating rod 336.

The cartridge which is pushed into the repeating roller during this movement is now situated in the firing position behind the barrel 315. Since, in addition, the firing pin 305 is cocked by way of the repeating rod 336 during the return movement of the repeating piston 322, the cartridge which has been pushed in can now be fired.

If the trigger 345 situated below the firing pin is then pulled backwards, a spring pin 346 mounted in it which, in some cases, can also be laterally deflected, presses against the rear end of the firing lever 306 and pivots this end upwards so that the front end of the firing lever 306 is moved downwards and can be pushed into a groove 347 in the repeating roller 304. The repeating roller 304 is accurately aligned in this way so that the cartridge lying behind the barrel 315 ready to be fired is situated exactly in front of the bore of the barrel. The firing pin 305 which has now been released by the firing lever 306 is urged forwards by the spring 308 and with its tip 348 breaks through a plate 349 and strikes the percussion cap of a cartridge, releasing the shot.

After the bullet has left the barrel 315, the powder gases flow into the silencer pot 316 and, for the most part, are deflected rearwards. At the same time, they are relieved of some of their pressure, although the pressure of the powder gases is sufficient to move the repeating piston 322 rearwards against the pressure of the spring 323 so that the weapon is automatically reloaded in the manner described. If a total of three cartridges had been fired in succession, the fired cartridge shell lying in the corresponding bore 344 is ejected rearwards by the new cartridge, i.e., during insertion of the fourth cartridge into the repeating roller 304.

The function of the flat, forked spring 343 is to hold the firing pin 305 in its cocked position until the repeating roller 304 has been rotated the required step forward after loading. This is particularly important in the case of sporadic and continuous fire so that the firing pin 305 is only released when a new cartridge is situated exactly behind the barrel 315.

As already mentioned above, this rifle can be used selectively for individual fire, sporadic fire and continuous fire. Finally, the weapon can also be safeguarded in

the usual way. To this end, a stop disc 350 is rotatably mounted in the handle 303 behind the trigger 345, being rotated through a lever 351 arranged on the outside of the handle 303. In the neutral position of the lever 351, the trigger 345 cannot be pulled back at all on account of a pin 345a arranged on it so that the gun cannot be fired. In the position intended for single-shot fire, the trigger 345 can be pulled back about 2 mm, in the sporadic-fire position, about 4 mm and in the continuous fire position about 6 mm.

In the single-shot position, the firing lever 306 is simply forced upwards and hence pivoted by the pin 346 of the trigger 345 so that the front end of the firing lever 306 snaps into the preceding groove 347 in the repeating roller 304. During the return movement made by the firing pin 305 after the shot has been fired, the pin 346 is forced to the side by the similarly returning firing lever 306 so that, to release the next shot, the trigger 345 has to be released beforehand with the result that the pin 346 again moves into a position below the firing lever 306.

In the sporadic-fire position, the trigger 345 is pulled further backwards so that the firing lever 306 is no longer forced upwards by the laterally deflectable pin 346, but by the upper side of the trigger 345 instead which keeps the firing lever 306 in its elevated position following the lateral deflection of the spring 346. Three grooves 347 into which the front end of the firing lever 306 can engage are distributed around the periphery of the repeating roller 304. Two of these grooves are made deeper than the third. In the sporadic-fire position, however, the upper side of the trigger 345 can only force the firing lever 306 downwards to such an extent that it is able to snap into and engage in the two lower grooves. By contrast, the firing lever 306 remains suspended in front of the third shallower groove. In order to release another shot, the trigger 345 has to be released again after which another sequence of three shots is fired until the repeating roller 304 has completed one revolution about its longitudinal axis. It is only at the beginning of sporadic firing that less than three shots can be fired in one burst.

By contrast, the trigger 345 can be pulled back even farther in the continuous-fire position. As a result, the firing lever 306 can be pivoted to such an extent that its front end can also engage in the shallower of the three grooves 347. It is possible in this way to reach the continuous-fire position in which there are no mechanical obstacles to the continuous delivery of shots.

The flat forked spring 343 attached to the firing pin 305 has two fork arms 343a and 343b which normally contact one another at their front end as shown in FIG. 18. This front end normally abuts against a pin 352 fixed to the rear part 302 of the tube. However, the pin 340 belonging to the foot 339 of the repeating rod does engage between the arms 343a and 343b of the spring 343. During the final millimetres of the return movement of the repeating rod 336, this pin 340 spreads the spring arms 343a and 343b apart so that they are able to slide laterally past the pin 352, thus releasing the firing pin 305.

The barrel 315 is additionally cooled during the return movement of the repeating piston 322 because air can be drawn into it by this return movement. This is of particular significance in the case of continuous fire.

The magazine 328 according to the invention is particularly suitable for cylindrical ammunition which is inserted into the repeating roller 304 from the front and ejected rearwards from it. The cartridges 353 are wrapped in a belt 354 attached at its end to a roller 355. On one side, this roller 355 is provided with a helical spring 356 under tension so that the belt 354 is always under axial tension. The package 357 consisting of the belt and the cartridges inserted loosely between the individual layers thereof has a double layer of belt around its outer periphery so that the package 357 can easily be held together. The width of the magazine 328 is such that it corresponds substantially to the length of the cartridges inserted, i.e., the cartridges slide with their two ends along the inner walls of the magazine.

The belt 354 is guided through the magazine 328 in such a way that it pulls the cartridges wrapped in it successively into a position in front of a wedge 358 arranged in such a way that the cartridge in contact with it is situated immediately in front of the bore 344 of the repeating roller 304 situated in the loading position and, hence, can be switched from the magazine 328 into the repeating roller 304 by the loading rod 324 attached to the repeating piston 322.

After the loading rod 324 has been withdrawn from the magazine, the belt 354 is pulled forward under the tension of the helical spring 356 and hence pushes the next cartridge 353 into the loading position in front of the wedge 358. The belt 354 is designed in such a way that it runs along the inside of the curved outer wall of the magazine 328 and is visible through a window 359 provided therein. Figures or other markings printed on the belt, indicating the extent to which the magazine is still full, can be seen through this window 359.

The belt 354 can be fixedly connected to the roller 355, although it is also possible for the belt to be detachably secured to the roller. In this case, the cartridges wrapped in the belt can be accommodated in a box to be inserted into the magazine 328 from which the end of the belt projects. When the side wall of the magazine is closed, hooks connected to the winding roller are pressed into the projecting end of the belt, and a lock for the helical spring 356 is released to enable the belt to be wound up in the manner described above. If the box is empty, the belt is manually unwound from the roller 355 so that the helical spring 356 is again placed under tension before a new box can be inserted. In its engaged position, the lock ensures that the helical spring can only be wound up, but only runs down again after the magazine has been closed following insertion of a new box.

Another possibility is to arrange the cartridge pack 357 on a roller which is pivotally mounted in the magazine 328 and which also comprises a helical spring or the like so that the belt is kept constantly under tension as it runs down and the leading cartridge of the pack can also bear against the wedge 358.

It is also possible, instead of one belt extending more or less over the entire width of the magazine 328, to use two parallel belts which leave a space free in the middle so that a recess can also be left in the middle on the wedge 358, being used for manually introducing fresh cartridges into the magazine.

The weapon according to the invention can be kept relatively short and light because the ammunition is introduced from the front and ejected from the rear. Sound is damped and muzzle flash made invisible by a

silencer coupled with the repeating system whilst at the same time the weapon repeats. The silencer lengthens the weapon to a negligible extent only and is so light that it does not increase the weight of the weapon to any appreciable extent. Overall, the weapon according to the invention is simple in design and substantially troublefree, extremely handy and easy to operate although it can be fired both directly and indirectly from a position of absolute cover. The weight of the rifle could be reduced even further by having the repeating roller accommodating only two cartridges at a time because in this way its diameter would be reduced. However, the result of this would be that, in the case of sporadic fire, it would only be possible for two shots to be delivered successively in one burst after which a mechanism would have to be recocked which, in some cases, would not be regarded as adequate.

Naturally, it is also possible to use a telescopic sight instead of the mirror system shown in the drawings for the optical redirection of the sighting mechanism, or to couple a telescopic sight of this kind with the optical re-directing system.

As shown in FIGS. 22 and 23, each cartridge 353 has a cylindrical shell 360 of a plastics material with a certain degree of resilience. The advantage of this is that the shells can be produced inexpensively by injection moulding, are light in weight and are unable to remain in the bores 344 of the repeating roller 304 after firing.

The rear end 361 of the shell 360 has fairly considerable wall thickness and is closed by a plate 362 with central opening 363 in it to allow through the tip 348 of the firing pin 305. A percussion cap 364 is accommodated with a gentle press fit in the rear end 361 of the shell in which there is also fixed an anvil 365 which with its tip 366 faces the percussion cap 364. Openings 367 through which the detonating flame can penetrate inside the cartridge shell 360 are provided laterally of the anvil 365.

The press fit of the percussion cap 364 is tight enough to prevent it from being unintentionally displaced but loose enough to allow it to be pushed further into the cartridge shell 360 by the tip 348 of the firing pin 305 until it comes into contact with the tip 366 of the fixed anvil 365 as a result of which detonation occurs. Under the effect of the pressure generated inside the cartridge shell during firing, the percussion cap 364 is displaced back towards the plate 362 and, at the same time, pushes back the firing pin. In this way, the percussion cap seals off the opening 363 so that gases given off inside the cartridge shell 360 can only escape forwards, propelling the bullet 368 accommodated at the front end through the barrel 315.

Also accommodated at the front end of the cartridge shell 360 there is a plastics sealing piston 369 which accommodates the bullet 368 in a central bore 370 which widens slightly conically at its front end. The sealing piston also performs the function of sealing the cartridge shell 360 with respect to the rifle so that no gases are able to escape laterally. To this end, it is provided at its rear end with a conical insert 371 made of metal, preferably steel, which has a funnel-like inlet opening 372 and which supports the bullet 368. The advantage of this is that the rear end of the sealing piston 369 which is intended to provide a seal with respect to the inner wall of the cartridge shell 360, does not melt during combustion of the powder filling 373 of the car-

tridge, but instead presses the plastics sealing piston 369 firmly against the inner wall of the shell. By virtue of the slight conical widening of the central bore 370 in the sealing piston 369, the bullet projecting into it is automatically centred in the barrel 315 during firing if it has not been aligned accurately enough in front of the barrel by the repeating roller 304. The front end of the cartridge 353 carries an annular disc 374 made of metal such as steel or brass so that the cartridge shell 360 remains absolutely cylindrical, even during firing, and does not form a seam projecting beyond its front end which could interfere with loading.

The powder accommodated in the cartridge 353 burns during detonation and the pressure suddenly generated in consequence of this displaces the insert 371 of the sealing piston 369 slightly forwards so that the resilient part of the sealing piston 369 expands and is pressed against the inner wall of the cartridge shell 360. Accordingly, the gases are unable to escape laterally, but flow completely into the barrel after they have forced the bullet 368 out of the cartridge into the barrel. Accordingly, there is no danger of some of the gases escaping around the sealing piston 369 or to the rear because the percussion cap 364 seals the inside of the cartridge shell 360 at its rear end whilst expansion of the sealing piston 369 provides a seal at the front end.

In the embodiment shown in FIGS. 24 and 25, the rear part of the cartridge 375 is provided with a conical trimming means 376 to make it easier to insert the cartridge into the repeating roller 304. In front of the percussion cap 364, the bore 363 for the firing pin is covered by a thin integrally moulded plastics cover 377. This provides the cartridge with greater protection against moisture and dirt. The anvil 378 is in the form of a split ring of resilient material comprising four spring arms 379 which snap into a corresponding groove 381 in the shell 380. The front part 382 of the cartridge shell 380 is made relatively thin and provided with small annular beads 383 extending fully around it. As a counterpart to these beads, the sealing piston 384 is provided externally with annular grooves into which the beads 383 fit. This arrangement prevents excessive displacement of the sealing piston 384. The inner edge 385 of the sealing piston 384 is prevented from melting by injecting into the shell 380 a thin lip-like sealing ring 386 below which the sealing piston slides when pressed into the shell. The sealing piston 384 is also closed at its outside end by means of a thin integrally injection-moulded wall 387. This wall is destroyed and burnt during firing.

In the embodiment shown in FIG. 26, metal caps 389 and 390 are pushed on to the rear end and front end, respectively, of the cartridge shell 388. The percussion cap 364 which, in this case, is detonated in the usual way is accommodated in the rear cap 389. Since the plastics sealing piston 391 melts at its rear end during firing, the gas penetrating between the sealing piston and the wall of the shell, the necessary seal has to be provided by the metal cap 390 pushed on to the front end of the cartridge shell 388.

In the embodiment shown in FIG. 27, the cartridges are detonated in the same way as the cartridges shown in FIGS. 22 and 25. The front end of the cartridge shell 392 is sealed by a sealing ring 393 inserted as closure into the cartridge shell. That end face 394 of this sealing ring 393 which faces the percussion cap 397 is con-

cal in shape. When the powder gases come into contact with the rear end of the plastics sealing piston 395, the sealing piston is displaced forwards and slides off outwards on the conical part of the sealing ring 393. As a result, the front end of the sealing piston is expanded and pressed firmly against the wall of the shell. The steeper the cone of the sealing ring, the firmer the contact with the shell. With the exception of a small guide ring 396, the internal diameter of the sealing piston 395 is greater than the external diameter of the bullet held in it so that the bullet 368 cannot be held over-strongly.

As shown in FIG. 27, the back of the percussion cap 397 is provided with a stud 398 which projects into the opening 363 in the plate 362 of the cartridge shell 392, substantially filling this opening. Like the percussion cap 397, the stud 398 consists of metal and prevents small deformations during firing. In this embodiment of the cartridge as well, the firing pin can be made relatively short, and dirt or the like is prevented from penetrating into the opening 363.

Another embodiment of a cartridge according to the invention is shown in FIG. 28. This cartridge comprises a shell 399 which once again has an opening 401 in the plate 400. A stud 403 fixed to a cover plate 402 is arranged in this opening 401. The cover plate 403 carries a projection 404 which lies behind the percussion cap 405. The percussion cap 405 is supported by a ring 406 which is screwed or otherwise positively inserted into the cartridge shell 399 and which carries a pointed anvil 407. In this case, the percussion cap is not pushed forwards onto the anvil for detonation. On the contrary, detonation takes place through penetration of the projection 404 of the cover plate 402 into the percussion cap which is thereby deformed. In this embodiment, the bottom of the percussion cap 405 can be kept thinner than in the embodiments described in the foregoing so that it can be deformed as readily as possible. However, a cover plate of steel or the like is necessary to prevent the percussion cap from bursting.

A sealing piston 408 closed at its front end by a thin wall 409 is inserted into the front end of the cartridge shell 399. This sealing piston contains a bullet 410 according to the invention which is bevelled at its rear end 411 to give it a better aerodynamic form. The sealing piston 408 is inserted into a section 412 of the cartridge shell 399 of reduced wall thickness so that its rear end can be supported by a surrounding shoulder 413. In addition, the sealing piston 408 is welded firmly to the cartridge shell 399 either by ultrasonic welding or even simply by friction welding.

In all of the last five embodiments of the ammunition, the bore of the sealing piston of the cartridge widens slightly in the forward direction in order to compensate any dislocation of the repeating roller relative to the barrel. Accordingly, the bullet has a little air and is automatically centred on entry into the barrel.

Naturally, it is also possible to combine individual features of the cartridges discussed in the foregoing with one another, in other words for example the detonation system shown in FIGS. 26 or 28 can be provided in a cartridge comprising a sealing piston of the kind shown in FIG. 24. It is apparent from the foregoing that the sealing of the cartridges proposed in the foregoing is necessary on account of the sudden pressure and the fast movement of the gases from the percussion cap towards the barrel, and on account of the sudden im-

part of the gases on the sealing piston and on account of the high temperatures (approximately 3,500°C.), and cannot be compared with seals known from pneumatic machinery, hydraulic machinery etc. In addition to the advantages discussed in the foregoing, the use of plastics for producing cartridges shells has the further advantage that the heat generated during detonation is not transferred to the repeating roller and hence to the entire lock system quite so effectively as it is in the case of metal shells. There is no need for a pull-out groove on the outside of the cartridge shell because cartridges that have been fired are of course not pulled out but rather ejected or pushed out from the cartridge roller.

FIGS. 29 and 30 show how, during ejection of the cartridges from the cartridge roller, the fresh cartridge remains in exactly the correct required position in the cartridge roller. To this end, there is arranged in the ejection opening 415 a stop mechanism for the particular cartridge shell ejected which consists essentially of a lever 416 pivotally mounted on a pin 417. At its lower end, this lever carries a stop 418 which, when the lever 416 is in the vertical position shown in solid lines in FIG. 30, is situated behind the repeating roller 304 by a distance corresponding exactly to one cartridge length. Accordingly, it also acts as a stop for the fresh cartridges inserted into the repeating roller 304 when a spent cartridge shell is ejected rearwards from the repeating roller 304 following insertion of a fresh cartridge.

The lever 416 mounted vertically in a slot 419 in the rear breach block-mechanism part of the rifle operates as follows:

The upper end 420 of the lever 416 projects upwards from the tube 302 by a distance of a few millimetres. Attached laterally to the foot 339 of the repeating rod 336 there is a push rod 421 which extends the foot rearwards by a distance of approximately 30 mm. When the foot has moved into its rear position during repeating, pressing the firing pin 305 into its rearmost position, the lever 416 or its upper end 420 is also pushed into its rearmost position so that the lever 416 stands vertically and, with its lower end in the form of a stop 418, projects downwards into the ejection opening 415, as shown in particular in FIG. 29. Accordingly, the spent cartridge shell 399 ejected during repeating is stopped by the lever 416. The stop 418 must lie at a distance corresponding exactly to one shell length from the rear side of the repeating roller 304 to ensure that, during repeating, the spent cartridge shell leaves the repeating roller whilst the fresh cartridge shell introduced does not project from the cartridge roller and interfere with the further rotation thereof.

If a new repeating cycle is initiated, the repeating rod initially moves into the magazine and pushes a fresh cartridge from the magazine rearwards into the cartridge or repeating roller 304. A spent cartridge shell present in the cartridge or repeating roller is pushed by the fresh cartridge rearwards out of the repeating roller into the ejection opening 415. A spent cartridge shell present in the ejection opening 415 can leave the ejection opening 415 because at this stage in the repeating cycle the lever 416 is freely pivotal so that the spent cartridge shell initially retained by it is deflected downwards over a sloping surface 425 situated at the end of the ejection opening 415. The lever 416 is only pushed into its vertical position by the push rod 421 and held

there after the cartridge originally present in the ejection opening 415 has dropped out and most of the following spent cartridge shell has been pushed out of the repeating roller 304.

It is pointed out that, instead of having bores, the front plate of the repeating piston 322 can also have a reduced diameter. The advantage of this is that the friction of the displaceable repeating piston is reduced, thus also reducing the danger of this piston jamming. The repeating piston is of course guided on the barrel so that the front piston plate does not itself have to perform any guiding functions.

The repeating cycle can also be carried out as follows:

The repeating piston 322 together with the repeating rod 336, the foot 339, etc., moves forward during firing. At the same time, the firing pin 305 automatically moves forward and detonates the percussion cap of the cartridge situated in front of the barrel. The gases issuing frontwards from the barrel during firing press the repeating piston 322 back again and at the same time push a fresh cartridge into the repeating roller 304. In this position, the repeating piston 322 is held by a suitable mechanism so that it is only after recocking that the aforementioned operation of firing and repeating is repeated. In a repeating cycle of this kind, the cartridge about to be fired does not stay overlong in front of the barrel which can be of advantage in cases where the barrel is fired hot because in this way the cartridge still waiting to be fired is unable to absorb any appreciable quantities of heat from the barrel. It is only during firing itself that the fresh cartridge present in the repeating roller moves into a position in front of the barrel and is immediately fired. The spent cartridge shell only remains in front of the barrel until the next shot is released. Any heat that may be transferred to the spent cartridge shell is harmless.

I claim:

1. A small calibre rifle with an optical sighting mechanism for direct and indirect sighting and hence for direct and indirect shooting, said rifle comprising a stock, a barrel, a shoulder support, a cartridge roller with a plurality of axial bores for receiving cartridges having a regular cross-section over their entire length, means for inserting cartridges for firing into and ejecting cartridges after firing from said cartridge roller in a direction parallel to the axis of said barrel, means for rotating said cartridge roller, and means for preventing rotation of said roller when in the firing position.

2. The rifle of claim 1, wherein a housing is arranged in the vicinity of said cartridge roller for accommodating a replaceable cartridge magazine for cartridges which are wrapped in a row on a belt.

3. The rifle of claim 2, wherein said cartridge magazine is in the form of a pre-filled disposable container provided with a tear-strip closure.

4. The rifle of claim 2, wherein for sporadic fire said cartridge roller is associated with locking means whereby said roller can be locked each time it completes the selected revolution.

5. The rifle of claim 4, further including a trigger operable with an adjustable stop which limits the displaceability of said trigger as required so that it can optionally be adjustably locked for to individual fire, sporadic fire and continuous fire.

6. The rifle of claim 5, further including a firing pin and a firing lever pivotally mounted on said firing pin,

and wherein said trigger cooperates with said firing lever through a laterally deflectable pin depending on the position of said stop, the forward end of said firing lever engaging as a lock behind the back of the repeating roller under the effect of a spring.

7. The rifle of claim 2, further including a repeating piston which is displaceable by gases given off during firing and on which there is arranged a plunger which pushes the cartridges individually from a magazine into said cartridge roller and which in doing so ejects a spent cartridge present in the cartridge roller from the opposite end thereof.

8. The rifle of claim 7, wherein said cartridge roller is provided externally with helically extending grooves in which engages a carrier pin axially displaceable by said repeating piston in order to rotate the cartridge roller one step further after each shot has been fired, each of said grooves beginning and ending with a straight portion extending axially of the cartridge roller.

9. The rifle of claim 8, wherein at its rear end said cartridge roller carries further straight grooves of which one has a depth differing from that of the other grooves.

10. The rifle of claim 2, wherein said cartridges are pushed into the front of said cartridge roller and are ejected rearwardly therefrom.

11. The rifle of claim 2, wherein said magazine is designed to be inserted in front of said cartridge roller and to be closed like a box.

12. The rifle of claim 11, wherein said cartridges accommodated in said magazine bear with their two ends against the end walls of the magazine containing said cartridges which can be inserted into the housing.

13. The rifle of claim 11, wherein said cartridges have a circular cross-section over their entire length and are pulled against a stop provided at the upper end of said magazine which is arranged in such a way that the cartridge bearing against it lies in the path of a loading rod attached to a repeating piston in front of one of the cylindrical openings in said cartridge roller.

14. The rifle of claim 11, wherein said cartridges are held spirally in said magazine between individual layers of at least one reeled belt which is wound gradually onto a roller under spring pressure following the removal of cartridges from it.

15. The rifle of claim 14, wherein the belt between whose layers the cartridges are loosely inserted is wound double around the outer periphery of the magazine of cartridges and a stop wedge without any cartridges in between.

16. The rifle of claim 15, wherein one end of said belt is mounted on a roller which is displaceably mounted in said magazine and which contains a spring that is placed under tension during winding of the belt and hence maintains a certain belt tension.

17. The rifle of claim 14, wherein said belt holding the cartridges carries markings visible from the outside through a window in the magazine in order to show the extent to which the magazine is full.

18. The rifle of claim 2, wherein a stop is arranged in an ejection duct for holding each cartridge shell ejected from said cartridge roller.

19. The rifle of claim 18, wherein said stop is arranged on a lever which is pivotal about a pin extending perpendicularly of the longitudinal axis of said cartridge roller and which, when a fresh cartridge is

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loaded, is turned into its vertical position in which said stop is situated behind the rear of said cartridge roller by a distance corresponding exactly to the length of the cartridge.

20. A small calibre rifle with an optical sighting mechanism for direct and indirect sighting and hence for direct and indirect shooting, said rifle comprising a stock, a barrel, a shoulder support, a cartridge roller with a plurality of axial bores for receiving cartridges having a regular cross-section over their entire length, means for inserting cartridges for firing into and ejecting cartridges after firing from said cartridge roller in one and the same direction, means for rotating said cartridge roller, and means for preventing rotation of said roller when in the firing position, said means for preventing rotation of said cartridge roller when in the firing position comprising a sliding wedge which engages beneath said roller and at the same time is centered by means of a fitting key arranged on the sliding wedge.

21. The rifle of claim 20, further including a firing pin having a cocking mechanism, and wherein said sliding wedge is actuated by said cocking mechanism.

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22. The rifle of claim 20, wherein said sliding wedge is supported by a flat roller bearing.

23. The rifle of claim 20, wherein a housing is arranged in the vicinity of said cartridge roller for accommodating a replaceable cartridge magazine for cartridges arranged in a row on a belt.

24. The rifle of claim 23, wherein a recess for cleaning materials is provided in the housing beneath the cartridge magazine.

25. The rifle of claim 23, wherein said housing is closed on both sides, one side consisting of a flap while the other side contains an ejection opening for the spent cartridges, said flap carrying on its inside a spring resting against said cartridge roller.

26. The rifle of claim 23, wherein there is situated in a holder for said cartridge roller a shearing edge cooperating therewith for separating the spent cartridges from the belt.

27. The rifle of claim 23, wherein the cartridges are stored in the cartridge magazine under gentle end-face friction.

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