Nov. 17, 1970 D. F. BUTLER 3,540,141

REPEATING MECHANISM FOR IMPACT IGNITION PELLETS

Filed Oct. 25, 1968 3 Sheets-Sheet 1

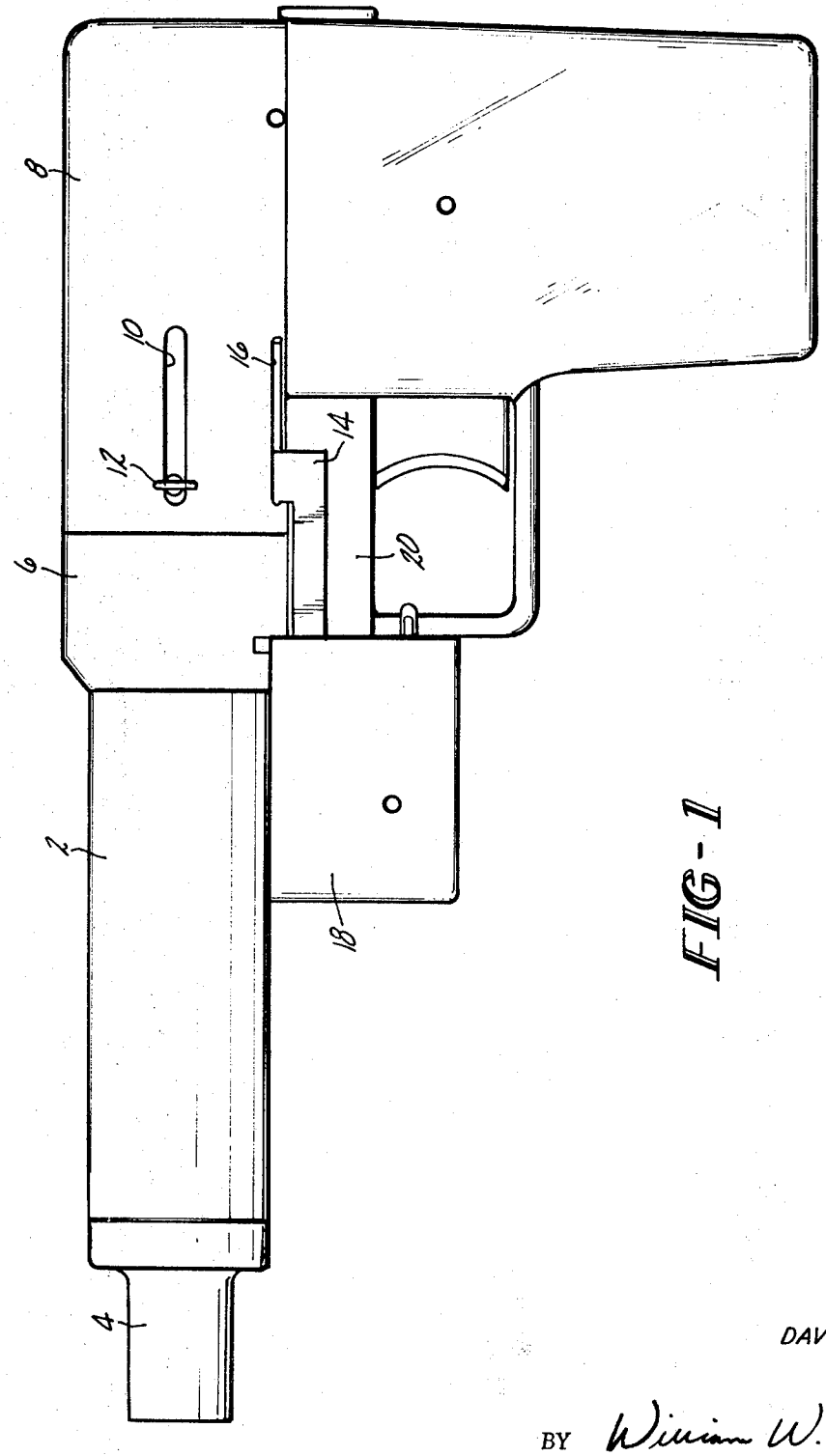


FIG - 1

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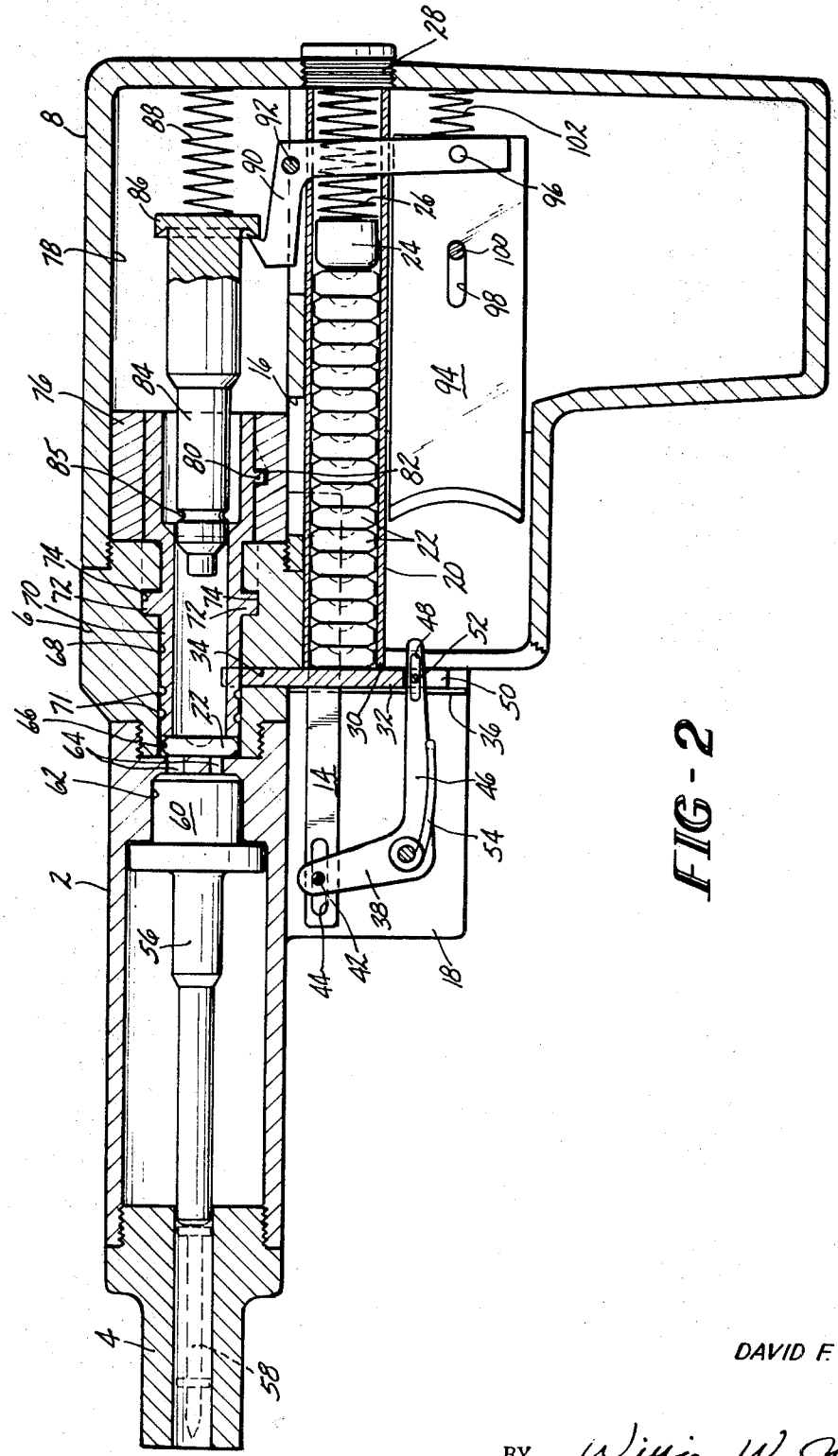


FIG-2

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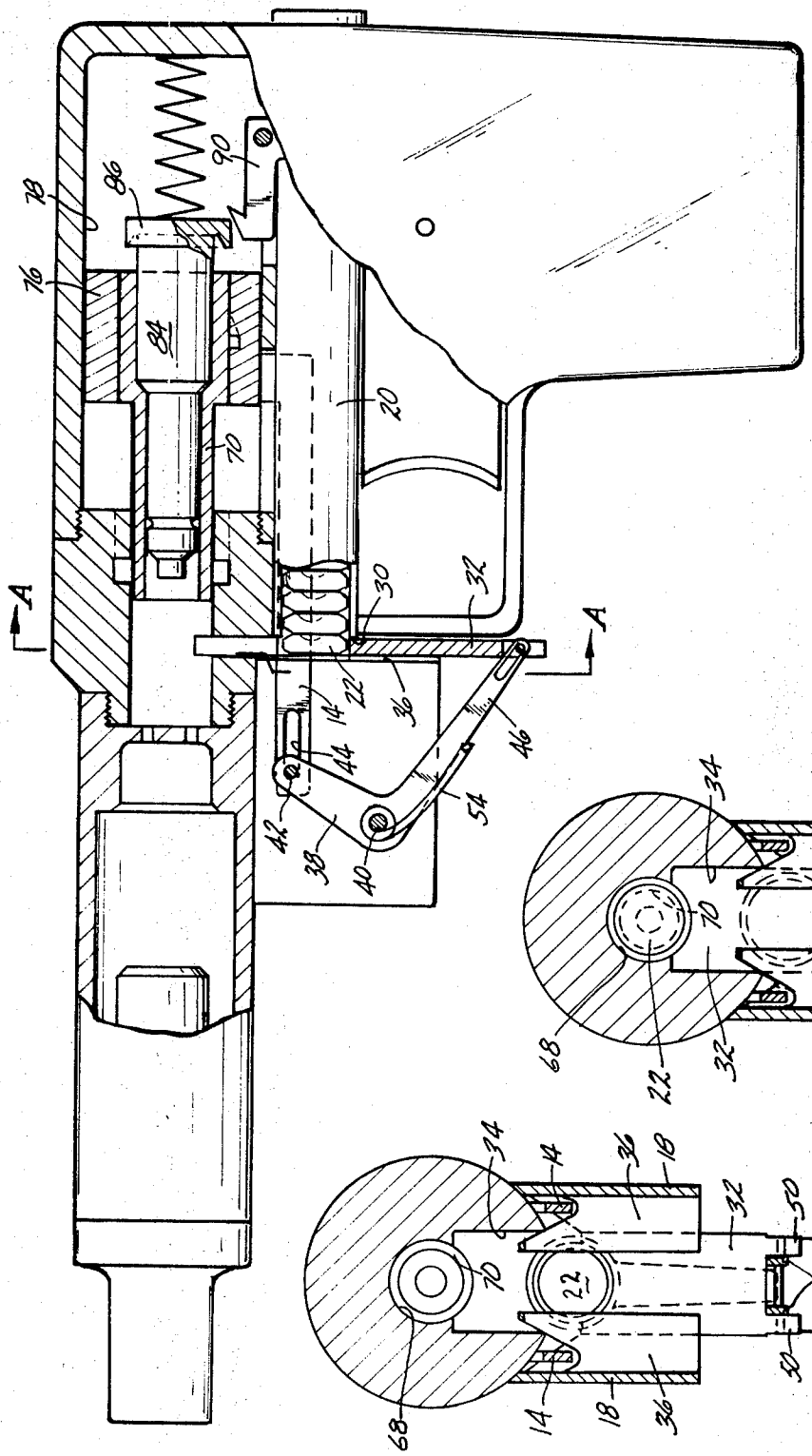


FIG-3

FIG-5

FIG-4

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REPEATING MECHANISM FOR IMPACT IGNITION PELLETS

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U.S. Cl. 42—17 2 Claims

ABSTRACT OF THE DISCLOSURE

A power actuated device utilizing caseless ammunition and including an ammunition magazine, and an ammunition carrier for transferring individual rounds of the caseless ammunition from the magazine to a position wherein the round is picked up by a bolt and moved into a firing chamber. The ammunition carrier is automatically operated when the bolt is reciprocated after a round is fired.

This invention relates to an explosively actuated device, such as a power tool, firearm, or the like, which device utilize caseless ammunition. The device of this invention includes a magazine containing a plurality of rounds of caseless ammunition, and an ammunition carrier for transferring individual ones of the ammunition rounds from the magazine to a position for pick-up by a bolt. The bolt moves the picked-up round into a firing chamber. The ammunition carrier is automatically operated when the bolt is reciprocated after the device is fired, and the ammunition carrier also serves to protect the rounds in the magazine against flame and hot gasses when the device is fired.

Recent industrial accent has been directed toward the development of explosively actuated devices which utilize caseless ammunition, such as compacted nitrocellulose, or the like, as a source of power. These explosively-actuated devices may be in the form of power-actuated tools for driving nails, studs or the like, or may take the form of a firearm, such as a rifle or a pistol. The substitution of caseless ammunition for the conventional cased ammunition permits more economical operation, but at the same time, presents certain problems primarily relating to the sealing of the firing chamber when the device is fired. A further problem relating to a caseless device of the character described concerns the provision of an ammunition magazine for the device and the necessity to protect the sensitive ammunition from flame and hot gases when the device is fired.

The device of this invention includes an ammunition magazine which houses a plurality of rounds of caseless ammunition, and which also houses a spring-biased cartridge follower to urge the ammunition rounds toward the mouth of the magazine. A cartridge carrier is disposed adjacent the mouth of the magazine for reciprocating movement between the magazine and a bolt-containing bore. The carrier operates to transfer individual rounds of ammunition from the magazine to the bore, where the transferred round is picked up by the bolt and moved into a firing chamber. The bolt is operatively connected to the cartridge carrier so that a round is transferred simultaneously with reciprocation of the bolt after the device is fired. The cartridge carrier is spring biased toward the bolt-containing bore so that the carrier normally covers the mouth of the magazine to protect the ammunition. The only time that the mouth of the magazine is uncovered is when the bolt is moved to a retired position after the device is fired.

It is, therefore, and object of this invention to provide an explosively actuated device which utilizes caseless ammunition rounds, and which includes an ammunition magazine for storage of the caseless rounds.

It is a further object of this invention to provide an explosively actuated device of the character described having a cartridge carrier operative to transfer ammunition rounds from the magazine to a position for pickup by a bolt.

It is yet another object of this invention to provide an explosively actuated device of the character described wherein the cartridge carrier is operatively connected to the bolt so as to be automatically operated upon reciprocation of the bolt after the device is fired.

It is still another object of this invention to provide an explosively actuated device of the character described wherein the cartridge carrier overlies the magazine mouth when the bolt is in its battery position to protect the stored caseless rounds against flame and hot gases when the device is fired.

These and other objects and advantages of this invention will become more readily apparent from the following detailed description and accompanying drawings, in which:

FIG. 1 is a side elevated view of a preferred embodiment of the device of this invention in the form of a power actuated tool for driving nails, studs, and the like into supporting surfaces;

FIG. 2 is a side sectional view of the tool of FIG. 1 showing a caseless round in the firing chamber, the bolt in its battery position, and the firing pin cocked for firing;

FIG. 3 is a side view partially in section showing the tool after firing, with the bolt being rearwardly reciprocated and the cartridge carrier being dropped into position to pick up a new round from the magazine; and

FIGS. 4 and 5 are sectional viwes taken along line A—A of FIG. 3 and showing the cartridge carrier as it picks up a round from the magazine and moves the round into position for chambering by the bolt.

Referring now to FIG. 1, a preferred embodiment of the device of this invention in the form of a power actuated tool for driving studs, nails, rivets, or the like, is shown. The tool includes a barrel **2** fitted with a muzzle bushing **4** and connected to a firing block **6**. The firing block **6** is secured to a handle portion **8** having a first slot **10** through which a cocking handle **12** extends. A pair of slide arms **14** extend through a pair of slots **16** cut in the handle portion **8**. A pair of downwardly extending plates **18** are connected to the firing block **6**.

Referring to FIG. 2, the internal elements of the tool are shown in positions prior to firing the tool. An ammunition magazine **20** is mounted in the handle **8** of the tool, the magazine **20** containing a plurality of caseless rounds **22** of ammunition and a cartridge follower **24** biased by a spring **26**. The rear end of the magazine **20** is closed by a threaded plug **28**, and the forward end of the magazine **20** defines an ammunition feed mouth **30** through which the rounds **22** are expelled, one at a time. As shown in FIG. 2, the magazine feed mouth **30** is closed off by an ammunition carrier **32** which is movably mounted in a slot **34** cut into the firing block **6**. Each of the plates **18** includes an inwardly directed flange **36** adjacent to the carrier **32** to confine the carrier in its movement.

An L-shaped lever **38** is pivotally mounted on a pin **40** which extends between the plates **18**. One arm of the lever includes a laterally extending pin **42** which is slidably mounted in a slot **44** cut into each of the slide arms **14**. The other leg of the level **38** is bifurcated at **46**, with each bifurcation being provided with a slot **48**. The lower end of the carrier **32** is also preferably bifurcated, as at **50**. A pin **52** is connected to the carrier bifurcations **50** and extends through the lever slots **48** to establish a driving connection between the lever **38** and the carrier **32**. A

spring member **54** is mounted on the pin **40** and engages the lever **38** to bias the latter in a counter-clockwise direction. Thus the carrier **32** is biased into its magazine-blocking position by the lever **38**.

The tool barrel **2** contains a work piston **56** which is shown in its firing position in FIG. 2. A fastener **58** (shown in phantom) is housed in the muzzle bushing **4** in a position to be driven by the piston **56**. The head **60** of the piston **56** is disposed in a restricted bore **62** in the barrel **2** when the piston is in its firing position. A plurality of passages **64** provide fluid communcation between the restricted bore **62** and a firing chamber **66** in the forward portion of a bore **68** in the firing block **6**. It is noted that the carrier slot **34** laterally intersects the bore **68**. A bolt member **70** is slidably mounted in the bore **68**, the bolt member **70** being shown in FIG. 2 in its battery position with a caseless round **22** disposed in the firing chamber **66**. A pair of gas sealing grooves **71** or other gas sealing means, such as piston rings are formed on the bolt **70** to insure a gas tight seal between the bolt **70** and the wall of the bore **68**. The bolt member **70** includes a pair of laterally extending lugs **72** which extend into respective slots **74** in the firing block **6** to lock the bolt **70** in its battery position.

The bolt **70** is rotatably mounted in a bolt slide **76** which reciprocates in a bore **78** in the handle **8**. The slide arms **14** and the cocking handle **12** are secured to the bolt slide **76**. The bolt **70** includes a laterally extending lug **80** which is disposed in a camming slot **82** in the bolt slide **76**. As the bolt slide **76** is reciprocated within the bore **78**, the lug **80** and camming slot **82** cooperate to rotate the bolt locking lugs **72** into and out of their respective locking slots **74** in a well known manner.

The bolt **70** houses a firing pin **84** which includes a rearward lateral flange **86**. The firing pin **84** has a gas sealing groove **85** formed thereon to seal the bolt bore. A spring member **88** is mounted in the handle **8** and bears against the firing pin **84** to urge the latter toward a fired position. As shown in FIG. 2, the firing pin **84** is retained in a cocked position by a sear **90** which engages the pin flange **86**. The sear **90** is pivoted about a pin **92** and is curved around the magazine **20**. The lower end of the sear **90** is connected to a trigger **94** by means of a pin **96**. The trigger **94** includes a slot **98** containing a post **100** and slot **98** combining to retain the trigger **94** in place while permitting the same to be actuated. A spring **102** is mounted in the handle **8** in contact with the trigger **94**. The spring **102** biases the trigger **94** forwardly, and also biases the sear **90** in a clockwise direction about the pin **92**.

As is clearly shown in FIG. 2, the cartridge carrier **32** is urged by the lever **38** into a position to block the mouth **30** of the magazine **20** when the bolt **70** is in its battery position. Thus the carrier **32** serves to protect the ammunition rounds **22** from flame and hot gases generated when the tool is fired.

Referring now to FIG. 3, the manner in which the carrier **32** operates to transfer a fresh round into position to be chambered is shown. After the tool is fired, the cocking handle **12** is grasped and moved rearwardly to slide the bolt slide **76** rearwardly through the bore **78**. The initial rearward movement of the bolt slide **76** causes the bolt **70** to rotate and unlock the locking lugs **72**. Further rearward movement of the bolt slide **76** carries the bolt **70** and firing pin **84** back through the bore **78** until the pin flange **86** is engaged by the sear **90**. The rearward movement of the bolt slide **76** causes the slide arms **14** to move rearwardly also, and the lever pin **42** is engaged by the end wall of the slide arm slots **44**. This engagement between the pin **42** and slots **44** plus further rearward movement of the slide arms **14** cause the lever **38** to pivot in a clockwise direction about the pin **40** and against the bias of the spring **54**. This pivotal movement lowers the arms **46** which in turn drops the cartridge carrier **32** to a cartridge pickup position, shown in FIG. 3. In the cartridge pickup position, the carrier **32** is clear of the magazine mouth **30**, and the foremost round **22** in the magazine **20** is forced out of the latter onto the top concave edge of the carrier **32**. The plate flanges **36** serve to insure that the round **22** remains on top of the carrier **32** by blocking the round **22** from further movements. (See FIG. 4.) After the firing pin flange **86** has engaged the sear **90**, the bolt slide **76** is moved forwardly in the bore **78** by means of the cocking handle **12**.

FIG. 4 shows the carrier **32** in its cartridge receiving position, also shown in FIG. 3. As the bolt slide **76** is returned to its original position, the bolt **70** moves toward its battery position. Also the end walls of the slide arm slots **44** move away from the lever pin **42**, and the spring **54** returns the lever **38** and carrier **32** to their respective original or pellet feeding positions. The carrier **32** moves the round **22** upwardly through the slot **34** and into the bore **68** before the bolt **70** passes by the slot **34**, as clearly shown in FIG. 5. Thus the round **22** is moved into the bore **68** and is picked up by the closing bolt **70** and carried forward into the firing chamber **66**. It is thus apparent that the cartridge carrier is operative to protect the ammunition remaining in the magazine when the tool is fired, and yet the carrier will operate to transfer a round from the magazine to the firing block bore automatically when the bolt is reciprocated after firing the tool. When the magazine is empty, it can easily be removed and replaced with a filled one.

Prior to firing the chambered round, the piston **56** is returned to its firing position, as shown in FIG. 2. This may be accomplished in a number of known ways, either automatically or manually simply by inserting a new fastener into the muzzle bushing bore.

It will be readily appreciated that the device of this invention is of a rugged, yet simple construction while providing dependable performance. The provision of a magazine for the caseless ammunition permits the device to be used with greater ease and greater speed since no manual loading of ammunition rounds is necessary. The device of this invention also permits smooth transfer of ammunition from the magazine to the firing chamber which takes place automatically upon reciprocation of the bolt. Furthermore, adequate protection of the comparatively sensitive ammunition housed in the magazine is provided by the ammunition carrier which blocks the mouth of the magazine when the device is fired.

Since many changes and variations of the disclosed embodiment of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. An explosively actuated device for use with caseless ammunition, said device comprising:

(a) a firing block having a single bore defining a firing chamber at one end thereof, said firing block further including an ammunition feed slot intersecting said bore at a point spaced apart from said firing chamber;

(b) bolt means slidably mounted in gas sealing engagement with said firing block bore, said bolt means being slidable between a battery position adjacent to said firing chamber, and a retired position remote from said firing chamber;

(c) locking means operative to lock said bolt means in said battery position;

(d) a bolt slide mounted on said bolt means and movable therewith;

(e) an ammunition magazine having a mouth communicating with said ammunition feed slot;

(f) carrier means mounted in said ammunition feed slot, said carirer means being movable between a pickup position adjacent said magazine mouth and a feeding position adjacent said firing block bore, said carrier means overlying and blocking said

magazine mouth when the former is in its feeding position;

(g) biased lever means drivingly connected to said carrier means, said lever means being operative to urge said carrier means toward its feeding position; and

(h) at least one slide arm means secured to said bolt slide and drivingly connected to said lever means, said slide arm means being operative, upon movement of said bolt means toward its retired position, to drive said lever against its bias and cause said lever to drive said carrier means to its pickup position to receive a caseless ammunition round from said magazine.

2. The device of claim 1, further comprising:

(i) a firing pin slidably mounted in gas sealing engagement with said bolt means, said firing pin being movably between a cocked position and a fired position, said cocked position being reached by movement of said bolt means to its retired position;

(j) spring means connected to said firing pin to bias the latter toward its fired position;

(k) sear means operative to engage said firing pin to retain the latter in said cocked position; and

(l) trigger means connected to said sear means, said trigger means being operable to release said sear means from engagement with said firing pin.

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60—26.1; 89—7, 33; 227—10