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Goldin

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[54] LOCKLESS FIREARM SYSTEM

[75] Inventor: **Morris Goldin,** Orange, Calif.

[73] Assignee: **Hughes Tool Co., Aircraft Division,** Culver City, Calif.

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[52] **U.S. Cl.** **42/15,** 42/39.5, 89/24, 102/38, 102/DIG. 1

[51] **Int. Cl.**.....**F41c 11/00,** F41f 11/00, F42b 5/18

[58] **Field of Search**.....42/14-16, 39.5, 42/10, 11; 89/24, 26

[56] **References Cited**

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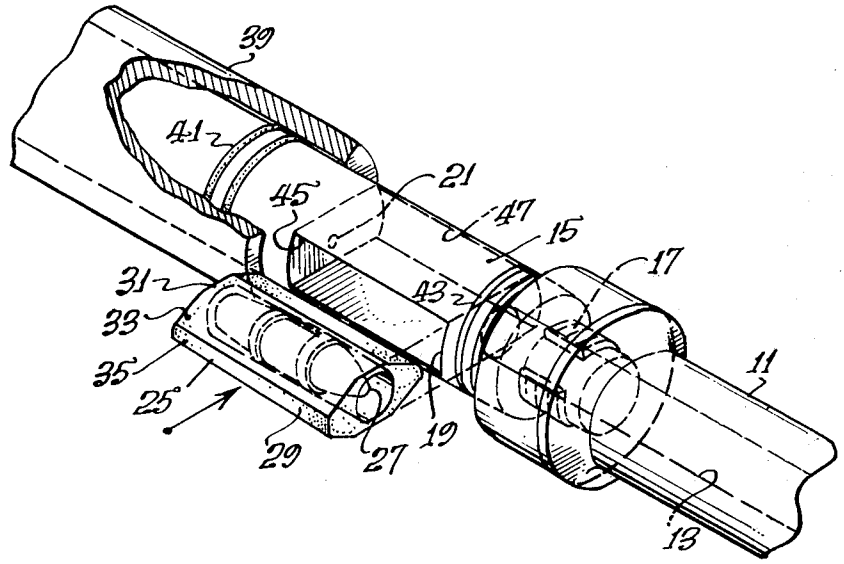
Primary Examiner—Benjamin A. Borchelt
Assistant Examiner—C. T. Jordan
Attorney—Smyth, Roston & Pavitt

[57] **ABSTRACT**

A firearm breech comprising a cylindrical breech section with a chamber cut through it to form a slot between a pair of straps which are integral with the portions of the firearm at the axial ends of the chamber. The chamber may be closed by an axially slidable sleeve which also thereby encloses the straps; the structure results in the elimination of all conventional gun locking structure.

11 Claims, 4 Drawing Figures



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SHEET 1 OF 2

FIG. 1.

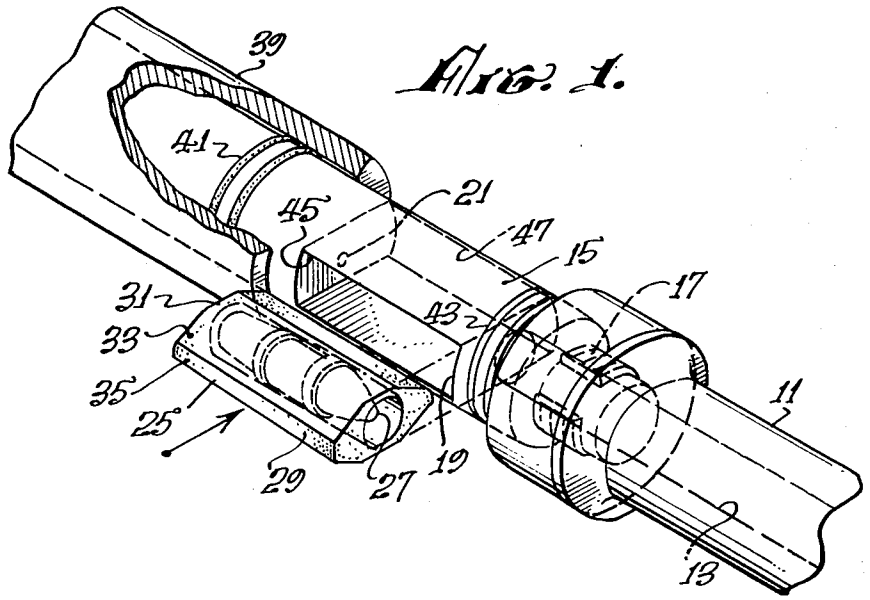


FIG. 2.

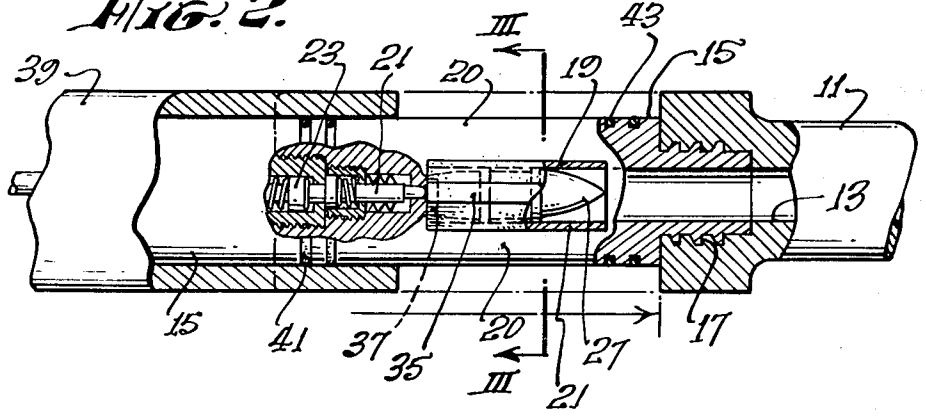
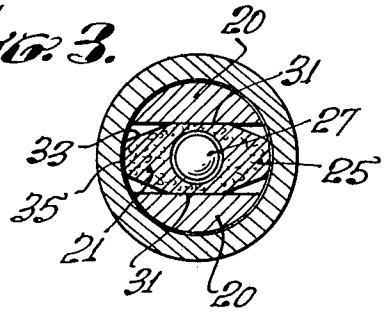


FIG. 3.



INVENTOR.
MORRIS GOLDIN,

By Smyth, Roston & Pavitt
ATTORNEYS.

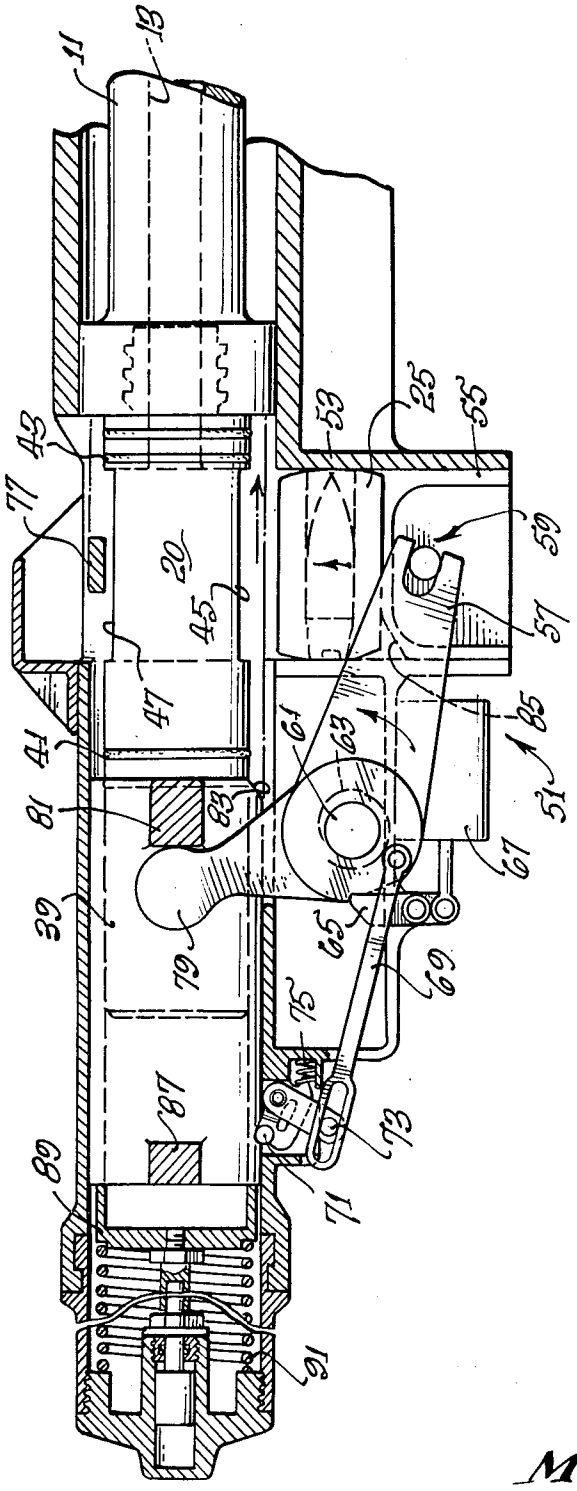


Fig. 4.

INVENTOR.
MORRIS GOLDIN,

By Smyth, Roston & Pavitt
Attorneys

LOCKLESS FIREARM SYSTEM

BACKGROUND OF THE INVENTION

When a firearm is designed, the cartridge to be used usually presents a large number of restraints upon the discretion of the designer. For example, in the most common firearms used today, using standard brass cartridges, the basic gun breech has a rather bulky exterior gun structure and requires a bolt locking system to carry the loads of cartridge ignition from the breech face to the barrel. Since the breech face and barrel are usually not permanently connected to or integral with the breech structure, the systems used for locking the breech or chamber are rather complex. Some firearms have been devised which use a sliding sleeve to close the firing chamber. Some of these firearms have required that additional structure be provided outside of the sleeve to hold the front and rear of the breech to one another. In other sleeve guns, the sleeve is used as a part of this holding structure and it must be rotated so that a pin and slot-type means holds the sleeve in place to attempt to provide solid support for withstanding the charge combustion pressures. In either case, if the holding structure is too weak, the combustion pressures will destroy the firearm by explosively rupturing the breech in the chamber area.

In either the conventionally used guns or in sleeve guns, relatively heavy and strong structure must be provided to hold the front and rear portions of the breech about the chamber together and to provide for axial movement and/or rotation of the breech locking or closing mechanism. The structure requirement adds both weight and bulk to the gun and the combination of these factors has resulted in the failure of the sleeve gun to be commonly used.

In applicant's copending U. S. application Ser. No. 5,031, filed Jan. 22, 1970, entitled FULLY TELESCOPED CASELESS CARTRIDGE and assigned to the Assignee hereof, a new type of cartridge has been disclosed which drastically reduces the weight of each individual cartridge and vastly increases the number of cartridges which may be stored in a given volume. Known as fully telescoped caseless cartridges, they may be provided with any desirable external configuration, including flat surfaces which extend from one end of the cartridge to the other.

Such cartridges will find many uses in a wide variety of firearms but it presently appears likely that they can be used to excellent advantage when fed into a chamber which is closed by a sleeve.

SUMMARY OF THE INVENTION

In view of the above facts, it has become necessary to design a firearm having a strong, sleeve-enclosed breech section which is lightweight and compact. Preferably, the concepts involved in the firearm may be used with standard brass cartridges, cartridge cases of other materials, or with caseless cartridges such as any of those described in the above-cited copending application.

The concepts of the present invention comprise a basic gun breech which is very strong and which can be designed to accept any type of cartridge, while being appreciably more compact than other firearms of similar performance levels.

In more detail, this invention may include a firearm having a circular breech section in which the firing chamber is formed as a slot which passes symmetrically through the axis. Integral straps at opposite sides of the chamber interconnect the portions of the breech at each end of the chamber. These straps serve to hold the breech section together and totally obviate both the need for additional structure external to the sleeve to strengthen the breech and other structure relative to which the sleeve must rotate to hold the sleeve in place during firing.

When a flat cartridge of the type disclosed in the above-cited copending application is used with such a firing chamber, excellent control of the movement of the cartridge may be assured by proper selection of a feed system which allows the cartridge to be guided into the firing chamber by the walls thereof formed by the straps and front and rear breech portions at the same time that it is still within the control of the feed system. In this way, cartridge movement is constantly controlled by the firearm structure. It should be realized that these features can be easily made available if cylindrical or othershaped cartridges are utilized and any limitations arising from their use shall be more due to the feed system than due to the breech section of the firearm.

A sleeve, surrounding the circular breech section, is axially movable relative to the firing chamber so that in one position, it allows cartridges to be moved into the chamber and in another position it obturates the chamber by covering the open portions thereof. The sleeve also encloses the straps in the latter position so that they absorb the cartridge ignition and combustion forces which are parallel to the chamber axis, while transferring the radially directed forces into the sleeve wherein they are absorbed as hoop stresses. The sleeve may be sealed to the receiver or breech section by sealing elements carried on the breech section at either end of the firing chamber.

The firing chamber design allows the major longitudinal gun loads on the breech to be carried through the breech straps, thereby eliminating the normally required exterior gun structure and bolt locking systems which carry such loads from the breech face to the barrel. Further, since the sliding sleeve effectively seals the firing chamber due to the action of the sealrings, only hoop-tension loads from the chamber pressure occur in the sleeve during firing.

Since the sleeve is acted upon during firing only by radially directed pressure forces, any simple mechanism may be used to move the sleeve along its axial path. In fact, the following description illustrates how normal recoil forces may by used to move it in one direction and simple spring structure can move it in the other. Thus, the structure embodied in such a firearm is less complex and more economical than that required in previous firearm systems.

In firearms utilizing the concepts of this invention, the inherent requirements of complexity and weight of presently known firearms are obviated, and the resultant firearm is one which is strong, simple to operate and maintain, and which may be utilized with a wide variety of cartridge feed systems.

Other advantages, objects, modes, and embodiments of the invention will become apparent to those skilled

in the art through reference to the Detailed Description and accompanying drawings which illustrate what is presently considered to be a preferred embodiment of the best mode contemplated for utilizing the novel principles which are set forth in the claims. For example, it should be understood that the inventive concepts are equally as applicable to a major artillery piece as to a small pistol.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective illustration of a firearm, showing the details of the concepts of the present invention;

FIG. 2 is a fragmentary sectional view of the firearm shown in FIG. 1;

FIG. 3 is an axial section of the firearm of the preferred embodiment, taken along a line III—III of FIG. 2; and

FIG. 4 is a top sectional view of a firearm formed in accordance with the present invention, illustrating one embodiment of a cartridge feed system which may be utilized therewith.

DETAILED DESCRIPTION

As shown in FIGS. 1 and 2, a barrel 11, having a bore 13, is fastened to a breech structure 15 by any suitable means such as cooperating thread members 17.

The breech structure is generally circular in shape and is provided with a rectangular slot or cavity 19 which is symmetrical with the axis of the breech structure 15 and rifle bore 13 so as to form a firing chamber which is situated between opposed symmetrical straps 20. The straps connect the breech portions at either end of the chamber to one another and act as the sole link therebetween as far as structural integrity of the firearm is concerned. A firing pin 21, actuatable by a mechanism 23, is positioned within the breech structure at the rear of the firing chamber so as to detonate a primer charge within a cartridge 25 in the chamber.

One type of cartridge which may be used with this firearm has been described in the previously cited copending U. S. application, although many other cartridge-types could be used. The cartridge illustrated basically comprises a projectile 27 surrounded by a powder charge 29. If desired, the cartridge may be provided with a plurality of flat, or nearly flat, surfaces, such as those shown at 31, 33, 35. A primer charge 37 is positioned within the powder 29 behind the projectile 27. As shown in FIG. 3, the opposed surfaces 31 are so positioned on the cartridge as to cooperate with the upper and lower surfaces of the firing chamber 19.

A sleeve 39 is axially movable over the breech structure from the position shown in FIGS. 1 and 2, to the position illustrated in phantom in FIG. 2. One or more sealing elements 41 at the rear of the firing chamber and one or more sealing elements 43 at the front of the firing chamber act between the outer periphery of the breech structure 15 and the inner wall of the sleeve 39 so that, when the sleeve is in the position illustrated in phantom, a feed opening 45 and an ejection opening 47 — between the straps 20— of the firing chamber 19 are closed by the sleeve and sealed from the atmosphere by the elements 41 and 43. These elements may be of any desired type, such as standard piston rings.

Referring now to FIG. 4, a firearm embodying the invention as described with reference to FIGS. 1 and 3, has been provided with a cartridge feed system, generally illustrated at 51. As shown in the drawing, a ready round 25 within a magazine 53 is ready to be moved through the feed port 45 into the firing chamber 19 by a feed slide 55. The feed slide is moved by a feed lever 57 acting through a pin and slot connection 59.

A feed lever 57 is actuated to pivot about a feed pivot 61 by a spring 63 when a feeder sear 65 is triggered by a suitable mechanism 67 which may, for example, be a firing solenoid or air actuator.

As the feed lever 57 rotates counterclockwise about the pivot 61, a link 69 which is pivoted thereto will be drawn to the right, as viewed in FIG. 4, so as to withdraw a sleeve sear 71, through a pin and slot connection 73, against the force of a sleeve sear actuating spring 75. Movement of the ready round 25 into the firing chamber 19, will be limited by a retractable or movable round stop 77 so that the round is properly positioned within the chamber.

When the feeder sear 65 is released, the spring 63, which causes the feed lever 57 to rotate counterclockwise, also acts against a feeder cocking lever 79 to bias the lever in a clockwise direction. Movement of the cocking lever 79 is prevented, however, by an extension or flange 81 on the external surface of the sleeve 39 which cannot move due to sleeve sear 71.

As the feed lever moves a cartridge into the firing chamber, the pin and slot connection 73 and the particular pivot connection of the link 69 to the lever 57 result in a time delay in releasing the sleeve sear 71. Therefore, just as the cartridge 25 reaches the round stop 77, the sleeve sear 71 is released and the cocking lever 79 and a buffer 89, which is biased by a spring 91, drive the sleeve 39 toward the position illustrated in phantom in FIG. 4. The movement of the cocking lever also causes the feed lever 57 to move in the clockwise direction, and if the feed slide 55 has not moved outwardly far enough to clear the sleeve as it passes, a chamfered surface 83 on the periphery of the sleeve cooperates with a similarly chamfered surface 85 on the slide so that the movement of the sleeve will drive the slide away from the firing chamber.

A second tab or extension 87 on the periphery of the sleeve will contact the cocking hammer 79, driving it still further about the pivot 61 so that the feed lever 57 will return to the position shown and sear 65 will lock it in the ready position.

When the firing pin is actuated to ignite the cartridge in the firing chamber, all of the powder 29 will undergo combustion and the projectile 27 will be driven through the bore 13. Forces created by this combustion will act in both parallel and radial directions relative to the chamber axis. Forces acting in the axial direction will tend to drive the forward and rear chamber walls apart but this reaction will be prevented by straps 20. The radially directed forces will pass through the openings 45 and 47 as well as the straps 20 so that they are all absorbed by the sleeve which translates them into hoop stresses within its cylindrical body.

The force of the firearm recoil transmitted to the sleeve through the barrel will serve to drive the sleeve 39 back toward the position shown in FIG. 4 where it is stopped by the sleeve buffer 89 and spring 91.

The cycle of operation has now been completed and the next round 25 will be fed into the firing chamber

when the firing mechanism **67** is actuated. In this manner, the cartridges are not fed into the firing chamber until the firing mechanism is actuated, thereby reducing the possibility of premature ignition or cook-off of powder **29**. It will also be obvious that when the feed slide is actuated by movement of the feed lever, it acts against the cartridge **25** in a straight line motion and proper dimensioning of the feed port will cause the cartridge to be controlled by the upper and lower surfaces of the firing chamber at the same time that it is being positively moved by the slide.

If a cartridge in the firing chamber should prove to be defective and fail to fire, the feed system is reactuated and the incoming cartridge will serve to drive the reject through the ejection opening. When this occurs, the cartridge stop **77** may be withdrawn and moved by any suitable structure (not shown) to allow passage and ejection.

This disclosure thus illustrates a preferred embodiment of new and improved concepts in the firearm art which yield true advances in the art. Many modifications and alterations of that embodiment, as well as other embodiments, which are within the scope of the present invention, will be obvious to those skilled in the art. For example, the chamber may be adapted to fire many other types of cartridges, a large number of feed systems may be used in place of the one shown, a different mechanism may be used to actuate the sleeve, etc.

Therefore, applicant does not intend that this invention be limited to the structure described, but rather what is claimed as the invention is:

1. In a firearm having a barrel attached to a breech section, the improvement comprising
- a firing chamber in said breech section comprising
  - a slot extending through said breech section in symmetrical relationship with the axis thereof,
- straps on opposed sides of said slot and forming walls thereof,
- said straps being integral with the portions of said breech section at the opposite axial ends of said slot and providing structural support therebetween, and
- means for closing said firing chamber and enclosing said straps comprising
  - sleeve means which are axially movable relative to said breech section.

2. The firearm of claim **1** wherein
- said straps provide substantially all of the structural support which holds the portions of said breech section at the opposite ends of the slot together.

3. The firearm of claim **1** including
- means for sealing said sleeve means to said breech section when it closes said firing chamber.

4. The firearm of claim **1** including
- means for moving said sleeve from
  - a first position in which said firing chamber is open to
  - a second position in which said firing chamber is closed.

5. The firearm of claim **4** including
- means for retaining said sleeve in said first position against the force exerted by said moving means.

6. The firearm of claim **4** including
- means for feeding a cartridge into said firing chamber,
- means for actuating said feeding means, and
- means actuated by said feeding means for causing said moving means to move said sleeve to said second position.

7. The firearm of claim **6** including
- means on said sleeve for positioning said feeding means for actuation by said actuating means.

8. The firearm of claim **7** wherein
- said positioning means includes
  - at least one chamfered surface thereon, said firearm also including
- at least one chamfered surface on said feeding means located thereon so as to be complementary to and cooperate with said at least one chamfered surface on said positioning means.

9. The firearm of claim **8** wherein
- said positioning means includes
  - at least one flange on said sleeve for movement into abutment with said moving means when said sleeve is moved between said first and second positions.

10. A firearm comprising
- a breech section including
  - means defining a firing chamber extending along a predetermined axis comprising
    - a forward member substantially perpendicular to the axis,
    - a rear member substantially perpendicular to the axis,
    - a pair of opposed straps located on opposite sides of the axis and extending between and connecting said forward and rear members, and
- means for peripherally enclosing said firing chamber for temporary sealing thereof and for absorbing radially directed forces generated therein during firing.

11. A firearm breech section comprising
- a firing chamber having
  - a cartridge feed opening and
  - an ejection opening therein and defined by
  - a forward member,
  - a rear member,
  - means for preventing relative axial movement of said forward and rear members, and
  - means enclosing said firing chamber, said feed and ejection openings, and said preventing means for absorbing all radially directed forces generated within said firing chamber and converting them into hoop stresses.

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