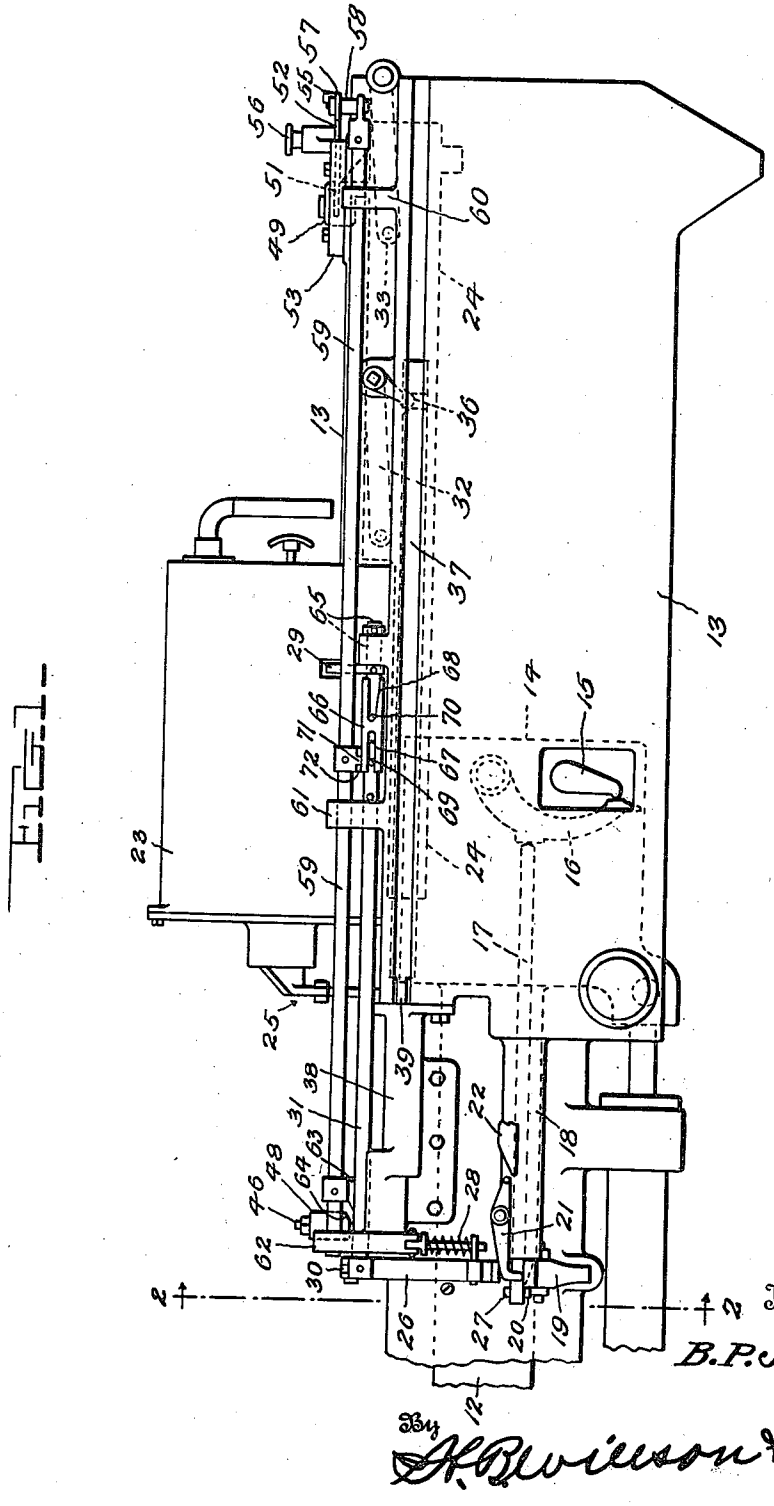
June 23, 1942. B. P. JOYCE 2,287,104

GUN LOCKING MECHANISM

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GUN LOCKING MECHANISM

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FIG. 1

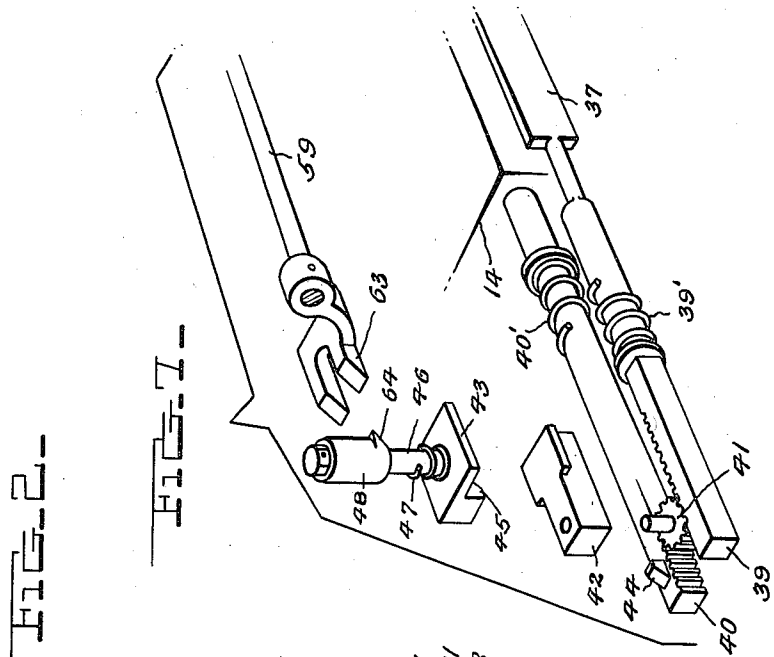
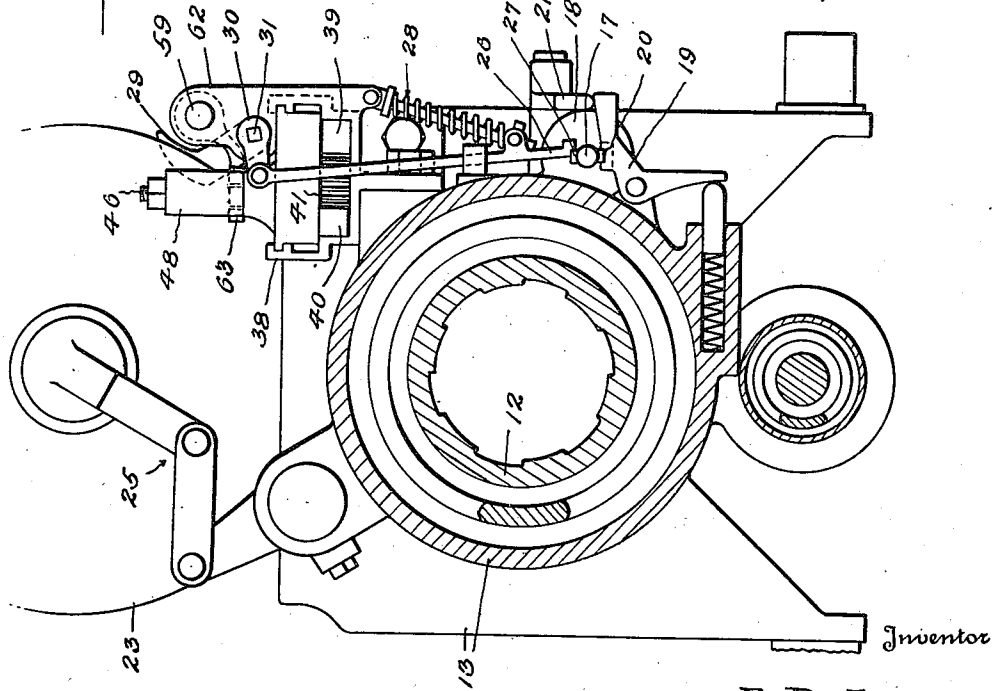


FIG. 2



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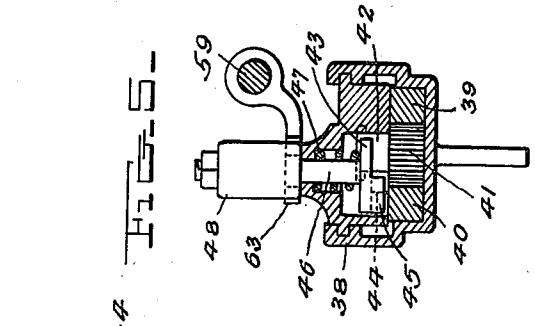
By H. B. Willson & Co.

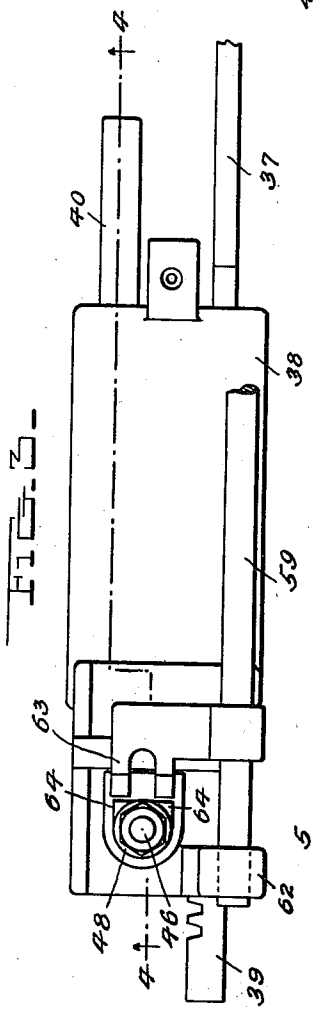
Attorneys

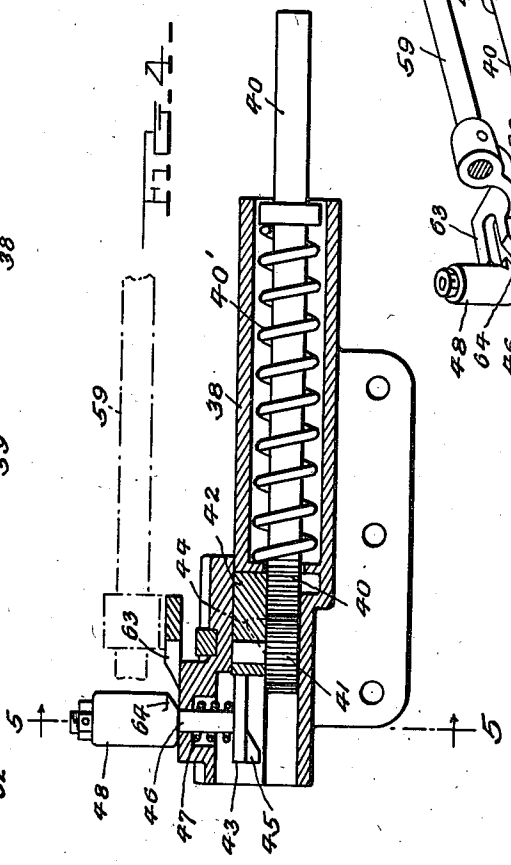
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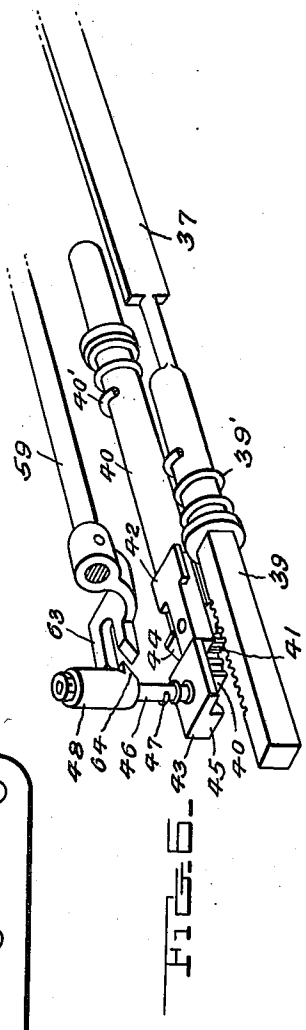
GUN LOCKING MECHANISM

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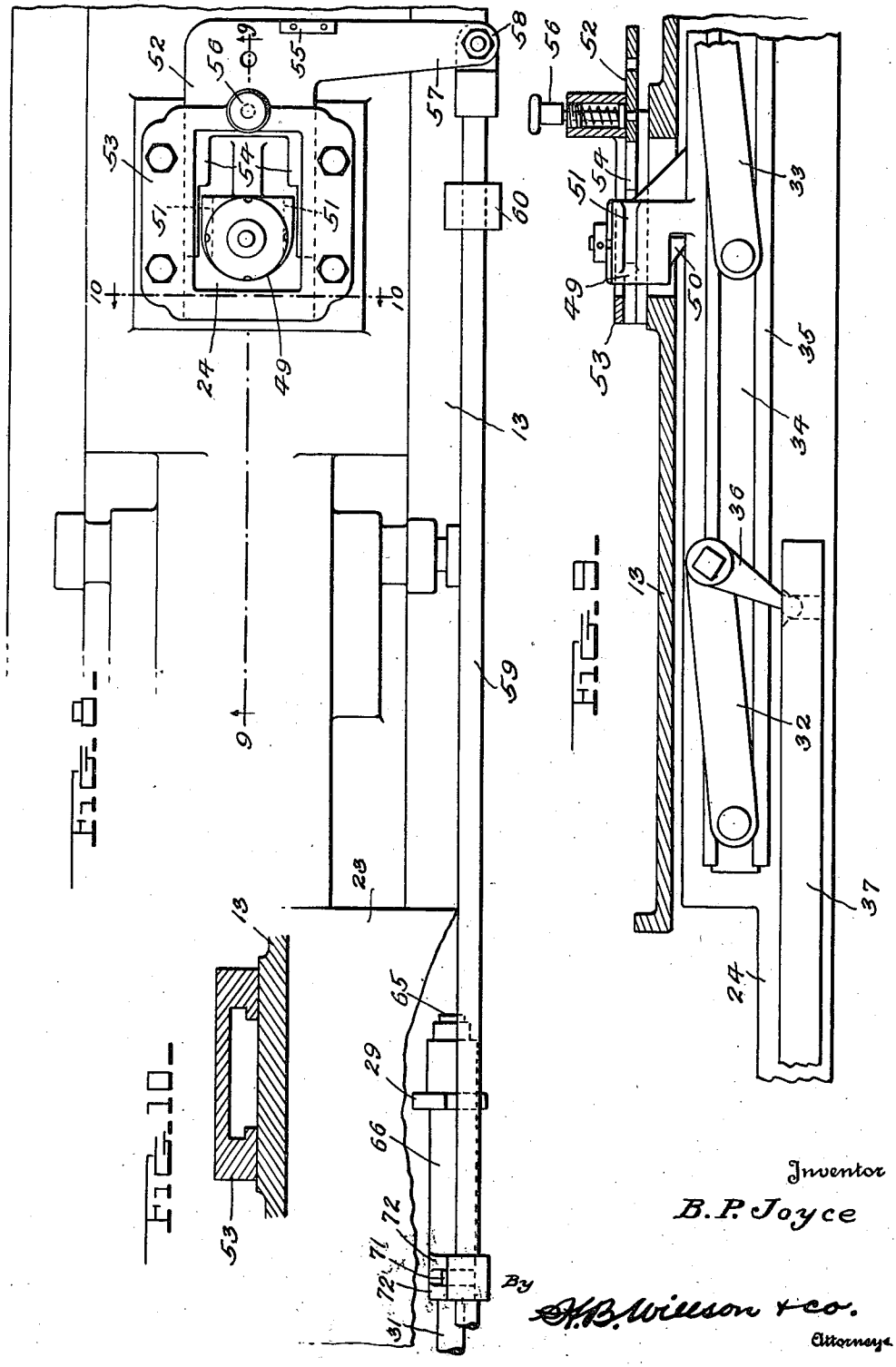
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GUN LOCKING MECHANISM

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GUN LOCKING MECHANISM

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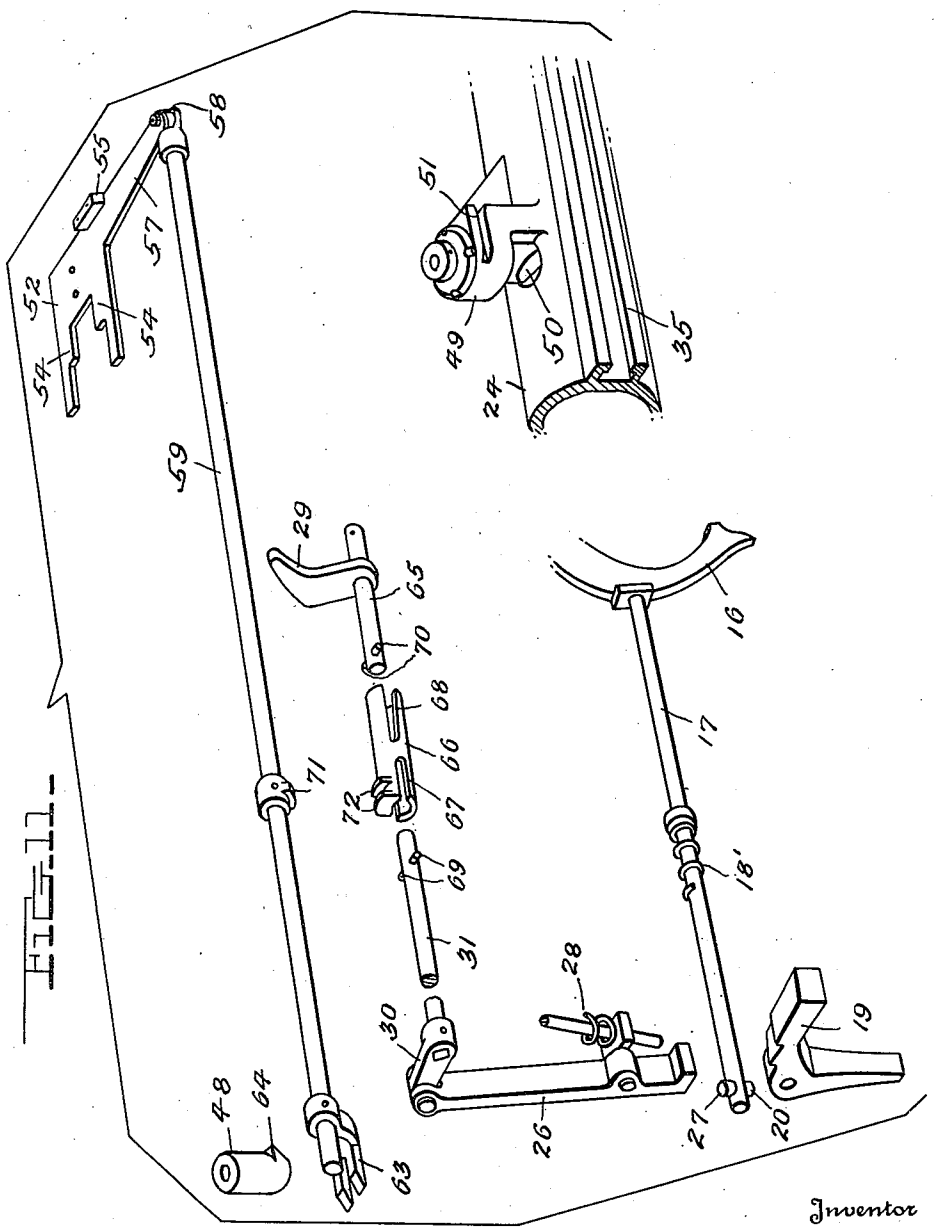


FIG. 11.

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UNITED STATES PATENT OFFICE

2,287,104

GUN LOCKING MECHANISM

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Application August 9, 1941, Serial No. 406,179

10 Claims. (Cl. 89—1)

The invention relates to improvements in guns of the general type in which the gun proper is mounted for recoil and counter-recoil on a gun cradle, and in which the rounds are moved from a magazine to loading position by means of a tray actuated by the recoil and counter-recoil of the gun on the cradle. Such a gun is shown in my U. S. Patents 2,122,423 of July 5, 1938; 2,142,132 of January 3, 1939, and 2,186,026 of January 9, 1940.

In adapting the gun for use on tanks or other mobile gun carriers which necessarily travel over rough grounds, barriers, etc., it has become highly advisable, when the gun is idle and its mobile carrier traveling, to prevent any severe shocks which cause forward and rearward movements of the gun on the cradle, from moving the loading tray from its normal position, and the foremost object of the present invention is to make novel provision under the control of the gunner for locking said loading tray in said normal position whenever desired. In this connection, a further object is to provide novel means to prevent operation of the tray-actuating mechanism under the influence of any movements of the gun on the cradle during any period in which the tray is locked by the above-mentioned locking means, instead of allowing said tray-actuating mechanism to exert any force on the tray, thus preventing injury of said tray, said tray-actuating mechanism and said locking means.

A still further object is to provide novel means for locking the gun-firing mechanism against possible accidental operation during any period in which the loading tray is locked in its normal position by the aforesaid locking means.

With the foregoing in view, the invention resides in the novel subject matter hereinafter described and claimed, description being accomplished by reference to the accompanying drawings. In these drawings, a gun of the general type disclosed in the above-mentioned patents has been illustrated, but for clarity of disclosure, numerous parts extraneous to the improved features and cooperating elements, have been omitted.

Figure 1 is a side elevation.

Figure 2 is an enlarged vertical transverse section on line 2—2 of Figure 1.

Figure 3 is a top plan view showing part of the actuating mechanism for the loading tray, and the slidable member which causes said mechanism to merely idle under the influence of any gun movements, when the tray is locked in its normal position by the aforesaid locking means.

Figure 4 is a longitudinal sectional view on line 4—4 of Figure 3.

Figure 5 is a vertical transverse section on line 5—5 of Figure 4.

Figure 6 is a perspective view illustrating the movable parts of Figures 3, 4 and 5, removed from the casing and in cooperative relation with each other.

Figure 7 is a disassembled perspective view of the parts illustrated in Figure 6.

Figure 8 is a top plan view showing more particularly the tray-locking means but also showing (at the left) part of the means which locks the gun-firing mechanism against operation when the tray is locked.

Figure 9 is a longitudinal sectional view on line 9—9 of Figure 8.

Figure 10 is a detail transverse section on line 10—10 of Figure 8.

Figure 11 is a disassembled perspective view showing the improvements and a number of elements directly cooperating therewith.

A general description of the old parts with which the improvements cooperate will first be given.

The gun 12 is mounted for recoil and counter-recoil on a cradle 13 and the breech portion 14 of said gun (Figs. 1 and 7) carries a trigger arm 15 (Fig. 1) and a pivoted arm 16 (Figs. 1 and 11) abutting said arm 15. When the gun 12 is in battery position, the arm 16 abuts the rear end of a firing rod 17 (Figs. 1, 2 and 11) slidably mounted in a guide 18 on the cradle 13, and this rod is urged rearwardly by a spring 18' in said guide (Fig. 11). A spring-pressed latch 19 (Figs. 1, 2 and 11) is pivoted on the cradle 13 to engage a stud 20 on the rod 17 to hold said rod in a forward cocked position, and a releasing lever 21 (Figs. 1 and 2) is provided to release said latch. The element 22 in Fig. 1 is simply a fragment of a cam forming part of fire-control means operable by the gunner to operate the lever 21 to release the latch 19, and when the latch is released, spring 18' forces the firing rod 17 rearwardly causing the arm 16 to operate the trigger arm 15 and fire the gun.

A magazine 23 (Figs. 1, 2 and 8) is mounted on the cradle 13 to contain clips of rounds, and a normally raised loading tray 24 (Figs. 1, 9 and 11) is mounted in the cradle 13 to receive the rounds one at a time from said magazine and lower them to loading position to be forced into the gun by a tray-carried plunger (not shown). Part of the mechanism for feeding the rounds

from the magazine is shown at 25 in Figs. 1 and 2.

A vertical lock 26 (Figs. 1, 2 and 11) is provided above the front end of the firing rod 17 to drop behind a stud 27 on said firing rod when the last round has been fed from the magazine 23 into the loading tray 24, preventing firing of this round after it is loaded into the gun, until another clip of rounds has been placed in the magazine. A spring device 28 (Figs. 1, 2 and 11) urges the lock 26 downwardly but a feeler 29 (Figs. 1, 2, 8 and 11) is held by the rounds in the magazine 23 and prevents said lock 26 from descending and locking the firing rod 17 until the last round has left said magazine. In my patents above mentioned, the lock corresponding to lock 26 descended and locked the firing rod only when the last round left the magazine but certain improvements are provided (hereinafter described) to cause this lock to function also when the loading tray 24 is locked in its normal raised position by other improvements, also described later. This lock is suspended from an arm 30 (Figs. 1, 2 and 11) on a lock shaft 31 as in the above mentioned patents but this shaft does not directly carry the feeler as previously.

Front and rear parallel arms which raise and lower the loading tray 24 are shown at 32 and 33 in Figs. 1 and 9, said arms being pivoted on the cradle 13 at their upper ends and pivoted to slide bars 34 (Fig. 9) at their lower ends, said slide bars being slidable in guide tracks 35 on the sides of the tray. A crank arm 36 (Figs. 1 and 9) serves to swing the front arms 32 downwardly and lower the tray 24 when said crank arm 36 is pushed rearwardly from the position shown and also serves to again raise said tray when said crank arm is again swung forwardly. A longitudinal slide bar 37 mounted on the cradle 13 (Figs. 1, 3, 6, 7 and 9) is provided to actuate the crank arm 36 as required, said bar 37 extending into a casing 38 secured to the cradle 13 in advance of the magazine 23 (Figs. 1, 2, 3, 4 and 5). This casing 38 contains a number of parts now to be described.

Reference is now made more particularly to Figs. 4 to 7. There are two slidable racks 39 and 40 in the casing 38, rack 39 being secured to the front end of the slide bar 37, and rack 40 being provided with a rear terminal which abuts the front of the breech portion 14 (Figs. 1 and 7) of the gun 12. One spring 39' urges rack 39 and slide bar 37 forwardly and another spring 40' presses rearwardly on rack 40. Between and in mesh with both racks 39 and 40 is a pinion 41 which is carried by a slide 42. A latch 43 is provided to lock the slide 42 in a rearward position and a cam 44 is carried by rack 40 for lifting said latch to release said slide, said cam being cooperable with a lug 45 on said slide. A stem 46 projects upwardly from latch 43 and is surrounded by a spring 47 which lowers said latch, the upper end of said stem having a head 48 above the casing 38.

When the gun 12 is in normal or battery position, the breech portion 14 of said gun holds the rack 40 forwardly as in Fig. 7 and the cam 44 then holds the latch 43 in raised position so that slide 42 is free. At the same time, the rack 39 is in its rearward position (Fig. 7) and the loading tray 24 occupies its normal raised position (Figs. 1 and 9). When the gun is fired and recoils, spring 40' pushes rack 40 rearwardly (Figs. 3, 4 and 6) causing pinion 41 to roll rearwardly on rack 39. The slide 42 moves rearwardly with the pinion 41 and the latch 43 drops in front of said slide (Figs. 4, 5 and 6). As counter-recoil occurs, the breech portion 14 of the gun 12 pushes rack 40 forwardly causing it to drive pinion 41 and causing said pinion to rearwardly slide rack 39 and slide bar 37 to effect lowering of the loading tray 24. When this is effected, cam 44 lifts latch 43. By this time, the round has been forced from the tray into the gun and the tray is returned to normal under the influence of spring 39' and other means not shown.

It will be seen that latch 43 must lower and hold slide 42 in order that the tray-actuating mechanism can lower the tray. Thus, if said latch should be held in raised position, said tray-actuating mechanism would be inoperative and should any forward and rearward movements of the gun occur with respect to the cradle, with said latch held up, the rack 40, pinion 41 and slide 42 would simply idle instead of exerting any moving force on the tray 24. One of my improvements, therefore, resides, in a specific sense, in the provision of a chock for holding latch 43 raised when the gun carrier (tank, truck or the like) is traveling, with liability of the gun moving appreciably on the cradle under the influence of shocks caused by travel over rough ground, barriers, etc. Another improvement resides in novel provision for locking the loading tray against movement during rough traveling of the gun carrier, and I also provide for locking the firing mechanism against accidental firing when the loading tray is locked, all of which will now be specifically described, with the understanding, however, that variations may be made.

Projecting upwardly from the rear portion of the loading tray, is a lug 49 (Figs. 1, 8, 9 and 11) which may well be the same lug which carries the latch 50 for holding the loading plunger (not shown) in retracted position. Opposite sides of this lug are formed with grooves 51 for cooperation with a horizontal locking plate 52 to lock the tray 24 in its normal raised position when desired. The locking plate 52 is slidably mounted in a guide frame 53 secured to the top of the cradle 13 behind the magazine 23, and said locking plate 52 is bifurcated to straddle the lug 49. When the plate 52 is slid forwardly from the normal position shown in Figs. 8 and 9, the portions 54 of the furcations of said plate enter the grooves 51 of the lug 49 and lock the tray in its normal raised position. A handle 55 is provided for operating the plate 52 and a latch 56 is employed to hold it in either applied or released position. A lateral arm 57 on the plate 52 is connected at 58 with the rear end of a rod 59 (Figs. 1, 2, 3 to 6 and 11) which rod extends longitudinally of the cradle 13 and is slidably mounted in guide lugs 60, 61 and 62, the lugs 61 and 62 also serving to mount the above described lock shaft 31. The front end of the rod 59 carries a bifurcated chock 63 (Figs. 1, 2, 3 to 7 and 11) to straddle the above described stem 46 of the pinion slide latch 43, the furcations of said chock then underlying downwardly facing shoulders 64 on the head 48 of said stem 46, to hold said latch against descent. The chock 63 enters under the head 48 when the lock plate 52 is moved forwardly to lock the tray 24, and it will be recalled that the tray-actuating mechanism can exert no moving force on the tray as long as the latch 43 is held against descent. Thus, as long as the plate 52 is locking the tray 24, the tray-actuating means can exert no force on the tray, with danger of injury to

parts, even though the rack 40 will be moved forwardly and rearwardly during any movements which the gun 12 may have on the cradle 13 when traveling over rough ground, barriers, etc.

Coming now to the locking means for the firing mechanism, attention is invited more particularly to Figs. 1, 8 and 11. In these views, it will be observed that the feeler 29 is secured to a short feeler shaft 65 alined with the lock shaft 31 and that a coupling means is provided between these two shafts. This coupling means includes a sleeve 66 slidable on both shafts, the front end of said sleeve being provided with longitudinal slots 67 having parallel side walls, and the rear end of said sleeve being formed with longitudinal slots 68 having side walls which diverge rearwardly. The slots 67 receive studs 69 on the lock shaft 31 and the slots 68 receive studs 70 on the feeler shaft 65. The sleeve 66 normally occupies a rearward position and unitarily connects the two shafts 31 and 65, placing the lock 26 under the control of the feeler 29, with the result that said feeler will hold said lock released until the last round has left the magazine 23, unless the sleeve 66 be slid forwardly. When such forward sliding of the sleeve is effected, however, the studs 70 are received in the wide ends of the slots 68 and said sleeve and the lock shaft 31 may then turn with respect to the feeler shaft 65, allowing the spring device 28 to lower the lock 26 behind the stud 27 of the firing rod 17, thus locking the firing mechanism against operation.

A connection is provided between the sleeve 66 and the above described rod 59 for sliding said sleeve forwardly when said rod is slid forwardly. Thus, when the locking plate 52 is slid forwardly to lock the tray 24, the rod 59 moves the chock 63 into position under the head 48 to place the tray-actuating mechanism in inoperative condition, and said rod 59 also slides the sleeve 66 forwardly to cause locking of the firing mechanism. Also, rearward sliding of locking plate 52 restores chock 63 and sleeve 66 to their normal rearward positions.

The connection between rod 59 and sleeve 66 preferably consists of a collar-carried rib 71 on said rod received between two ribs 72 on said sleeve as seen in Figs. 1, 8 and 11.

From the foregoing, it will be seen that novel and advantageous provision has been made for carrying out the objects of the invention. While preferred structural details have been shown and specifically described, attention is invited to the fact that the disclosure is illustrative rather than limiting.

I claim:

1. In a gun mounted for recoil and counterrecoil upon a cradle, said cradle being provided with a loading tray for said gun and with actuating mechanism for said tray operated by movement of the gun on the cradle; movable locking means operatively associated with said loading tray for locking it against movement when desired, additional movable means operatively associated with said tray-actuating mechanism for preventing operation thereof while said tray is locked by said locking means, and means operatively connecting the two aforesaid means for joint movement to effective position and for joint movement to ineffective position.

2. In a gun mounted for recoil and counterrecoil upon a cradle, said cradle being provided with a loading tray for said gun; movable locking means operatively associated with said tray for locking it against movement when desired, additional movable locking means operatively associated with the firing mechanism of the gun for locking it against operation while said tray is locked by the first mentioned locking means, and means operatively connecting the two aforesaid locking means for joint movement to effective position and for joint movement to ineffective position.

3. In a gun mounted for recoil and counterrecoil upon a cradle, said cradle being provided with a loading tray for said gun, said cradle being also provided with actuating mechanism for said tray operated by movement of the gun on the cradle; movable means operatively associated with said tray-actuating mechanism for preventing operation thereof when desired, movable locking means operatively associated with the firing mechanism of the gun for locking it against operation while the aforesaid means prevents operation of said tray-actuating mechanism, and means operatively connecting the two aforesaid means for joint movement to effective position and for joint movement to ineffective position.

4. In a gun mounted for recoil and counterrecoil upon a cradle, said cradle being provided with a loading tray for said gun and with actuating mechanism for said tray operated by movement of the gun on the cradle; movable locking means operatively associated with said loading tray for locking it against operation when desired, a second movable means operatively associated with said tray-actuating mechanism for preventing operation thereof while said tray is locked by said locking means, additional movable locking means operatively associated with the firing mechanism of the gun for locking it against operation while said tray is locked by the first mentioned locking means, and a fourth means operatively connecting the three aforesaid means for joint movement to effective position and for joint movement to ineffective position.

5. In a gun mounted for recoil and counterrecoil upon a cradle, the rear portion of said cradle being provided with a loading tray for said gun depressible from a normal round-receiving position, said cradle being provided with actuating mechanism for said tray operated by movement of the gun on the cradle and including a normally raised member which must descend before said mechanism can exert depressing force upon said tray, said normally raised member being spaced forwardly from said tray; a manually slidable rod mounted longitudinally on said cradle, coacting locking elements on said tray and the rear end of said rod for locking said tray in said normal position when said rod is slid to a predetermined position, and a chock on the front end of said rod for holding said normally raised member against descent when said rod occupies said predetermined position, said normally raised member having a downwardly facing shoulder cooperable with said chock.

8. In a gun mounted for recoil and counterrecoil upon a cradle, said cradle being provided with a loading tray for said gun depressible from a normal raised position; a lug secured to and projecting upwardly from said tray, said lug having grooves in opposite sides, a bifurcated lock member whose furcations are spaced to straddle said lug and enter said grooves, and means slidably mounting said lock member on said cradle in such position that its furcations may be slid

into said grooves when said tray occupies said normal raised position.

7. A gun mounted upon a cradle for recoil and counter-recoil, said cradle being provided with a loading tray for said gun and with actuating mechanism for said tray operated by movement of the gun on the cradle, said actuating mechanism including a normally raised member which must descend before said mechanism can exert any tray-moving force on said tray; a bifurcated chock the furcations of which are spaced to straddle said normally raised member and prevent descent thereof when desired, and means slidably mounting said chock on said cradle, said normally raised member having downwardly facing shoulders under which said furcations of said chock are insertible.

8. In a gun having a magazine, a firing mechanism, a self-applied lock for locking said firing mechanism in cocked position, and a round-held feeler associated with said magazine; connecting means operatively connecting said lock with said feeler to ordinarily hold said lock released until the last round has left the magazine, said connecting means including a shiftable member movable from a normal position in which it places said lock under the control of said feeler, to an abnormal position in which it frees said lock from the control of said feeler, permitting said lock to operate and lock said firing mechanism.

9. In a gun having a magazine, a firing mechanism, a self-applied lock for locking said firing mechanism in cocked position, and a round-held feeler associated with said magazine; connecting means operatively connecting said lock with said feeler to ordinarily hold said lock released until the last round has left the magazine, said connecting means including a feeler shaft and a lock shaft operatively connected with the feeler and the lock respectively, and coupling means between the two shafts; said coupling means having a shiftable coupling member slidable on said shafts from a normal position in which it unitarily connects said shafts with each other to place said lock under the control of said feeler, to an abnormal position in which it allows said lock shaft to turn in lock-applying direction with respect to said feeler shaft, thereby freeing the lock from the control of the feeler and allowing said lock to lock said firing mechanism.

10. A structure as specified in claim 9; said gun having a round-feeding mechanism; means for preventing operation of said round-feeding mechanism when desired, including a rod parallel with said lock shaft and feeler shaft, said rod being slidable in one direction as said preventing means is being applied and in the other direction as said preventing means is being released, and means operatively connecting said rod with said shiftable coupling member for sliding the latter to said abnormal position when said rod is slid in said one direction and for returning said coupling member to said normal position when said rod is slid in said other direction.

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