

April 11, 1950

L. A. ANDERSON ET AL
BOLT MECHANISM

2,503,575

Original Filed Feb. 26, 1945

3 Sheets-Sheet 1

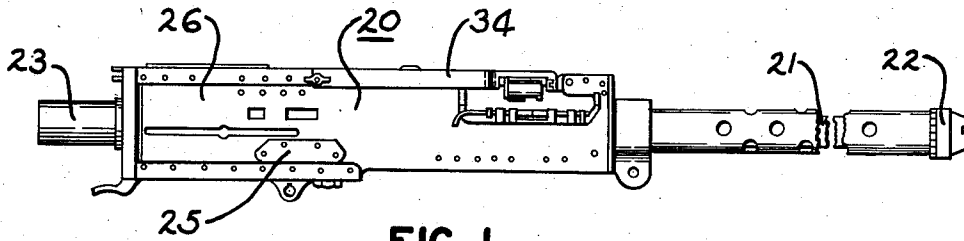


FIG. 1

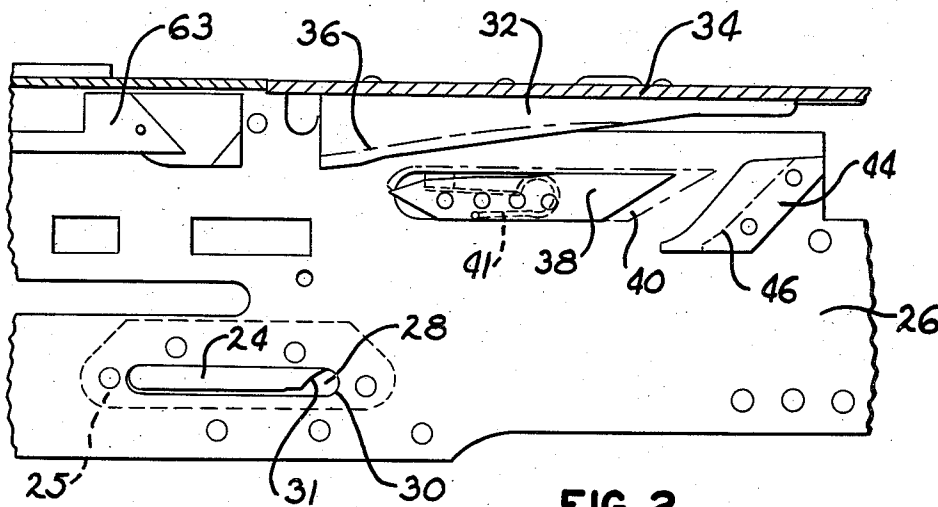


FIG. 2

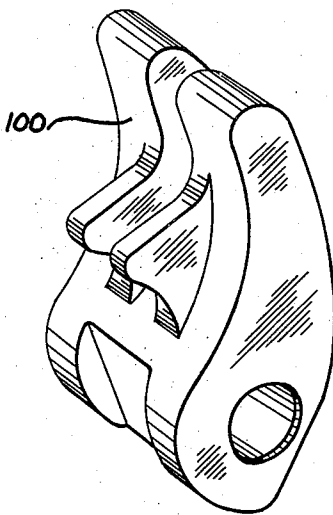


FIG. 3

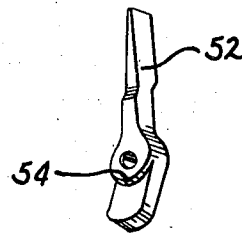


FIG. II

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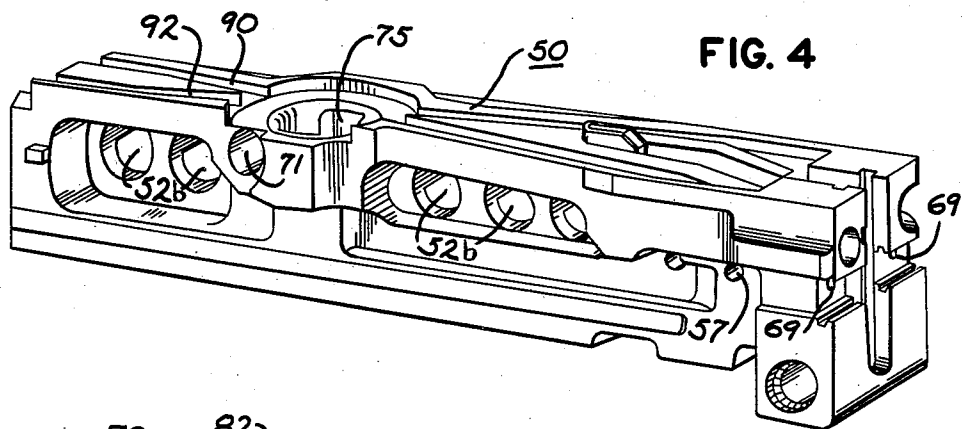


FIG. 4

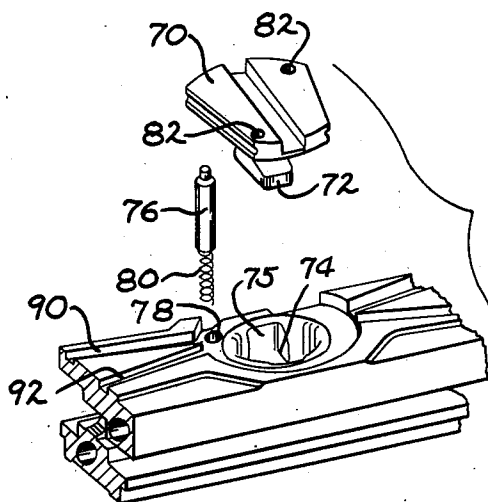


FIG. 5

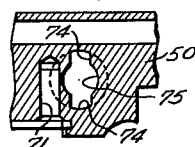


FIG. 12

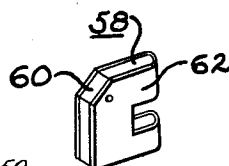


FIG. 7

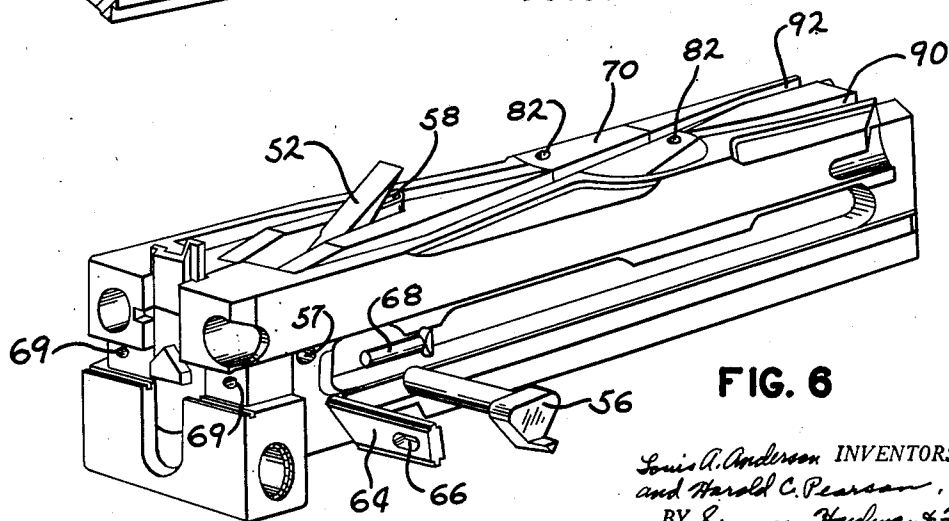


FIG. 6

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3 Sheets-Sheet 3

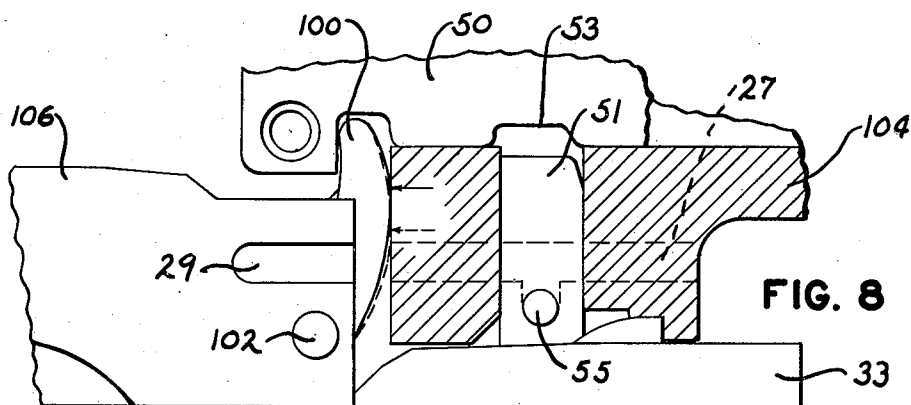


FIG. 8

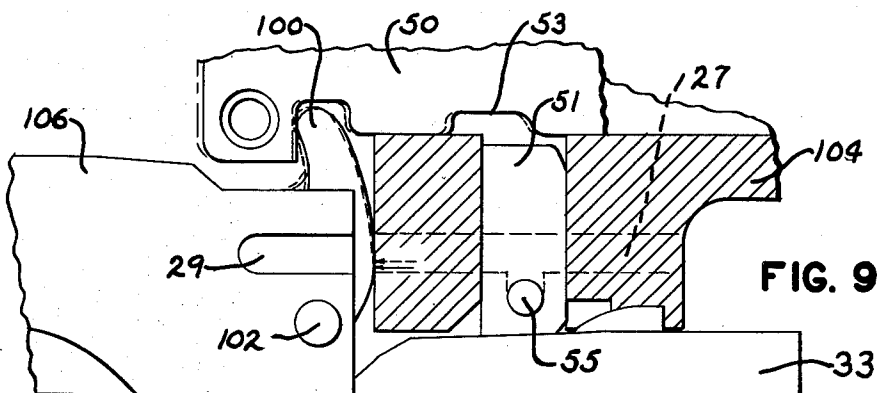


FIG. 9

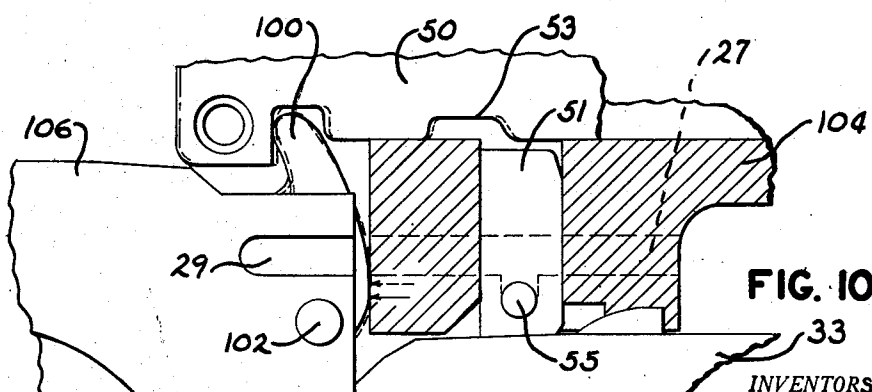


FIG. 10

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UNITED STATES PATENT OFFICE

2,503,575

BOLT MECHANISM

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Original application February 26, 1945, Serial No.
579,736. Divided and this application March
13, 1946, Serial No. 653,978

1 Claim. (Cl. 42—16)

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This invention relates to ordnance and more particularly to an improved high-speed machine gun.

This application is a division of our copending application Serial No. 579,736, filed February 26, 1945.

The desirability and necessity for increasing the rate of fire of the caliber .50 M2 Browning machine gun became more important as the speed of opposing planes became greater and the consequent "on target" time became less. The problem of increasing the rate of fire of the M2 gun during wartime was made doubly hard by the requirement that the majority of the parts of the new gun were to be identical with those used on the M2 model or were to be made from the same forgings or raw stock. This being the case, any increase in the rate of fire could not be accompanied by any material increase in size of the parts to withstand the increased strain.

It is an object of this invention to increase the rate of fire of a .50 caliber M2 machine gun by approximately 50% and to prevent breakage of parts by improving the action of the moving parts rather than by increasing the size of the parts.

It is another object of this invention to improve the construction and operation of the switch mechanism.

Another object of this invention is to improve the bolt and its action. More specifically, it is an object of this invention to reduce the weight of the bolt and at the same time strengthen the bolt by rearranging the switch mechanism relative to the extractor stud.

Still another object of this invention is to provide a very simple and inexpensive cocking lever stop for preventing breakage of the cocking lever due to the violent accelerations imparted to the light-weight bolt.

A further object of this invention is to improve the construction and arrangement of the sear slide.

A still further object of this invention is to so coordinate the design of the bolt buffer, the bolt and the bolt accelerator as to reduce the wear and tear on the parts.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 of the drawings is an elevational view of the new high-speed .50 caliber machine gun;

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Fig. 2 is a fragmentary view showing the improvements which have been made in the construction and arrangement of the extractor cam mechanism and the breech lock depressor;

Fig. 3 is an enlarged pictorial view of the accelerator used;

Fig. 4 is a pictorial view of the bolt showing the cocking lever stop mounted in place;

Fig. 5 is an exploded view showing the improved switch arrangement;

Fig. 6 is a pictorial view showing the switch in place and showing an improved arrangement for holding the sear slide in assembled relationship;

Fig. 7 is a pictorial view of the cocking lever stop;

Figs. 8, 9, and 10 are diagrammatic full scale views comparing the action of the new light-weight bolt and the accelerator used in the new high speed gun with the bolt and accelerator used in the standard caliber .50 M2 machine gun;

Fig. 11 is a pictorial view of the cocking lever; and

Fig. 12 is a fragmentary horizontal sectional view extending through the bearing 71 and the hole 75 of the bolt 50.

Referring now to Fig. 1 of the drawings wherein I have shown a high-speed .50 caliber machine gun embodying my invention, reference numerals 20, 21, 22, and 23 designate generally the receiver housing, the barrel, the recoil booster and the bolt buffer respectively. The recoil booster may be of any conventional type and serves the usual purpose of momentarily confining the blast pressure after the projectile leaves the nozzle so as to increase the recoil force on the muzzle face of the barrel, thus helping to cause a faster recoil cycle. Inasmuch as the details of the recoil booster form no part of this invention, the specific construction of the recoil booster need not be described herein as recoil boosters are now well known.

The general over-all dimensions of the main part of the gun have not been materially changed and the same is true of the general organization and functioning of the gun. The main changes have been made in the shape, weight and method of mounting the various parts within the receiver housing. In order to eliminate needless details only those elements which have been materially changed will be described in detail. The construction and operation of the other parts of the gun are essentially the same as in the M2 model gun and are too well known to require further description.

In order to provide smoother action of the parts and in order to strengthen the gun in general, the breech bolt lock depressors 24 have been fastened rigidly to and project inwardly from the side plates 26 of the receiver housing 20 as shown in Fig. 2. A pronounced increase in the rate of fire results from this change. The exact location of each depressor is established by a sizeable tongue 28 which mates in a milled slot 30 in the side plate. For purposes of illustration, I have shown the breech lock depressor 24 (see Figs. 2 and 12) projecting inwardly from the tongue 28 which in turn is secured to a side plate 25 riveted to the outer surface of the side wall 26 of the receiver 20. The depressors 24 project inwardly into and register with the slots 29 and 27 (see Figs. 8-10) provided in the side walls of the barrel buffer body 106 and the barrel extension 104, respectively. The breech bolt lock depressors used in the M2 gun were mounted in slots in the sides of the oil buffer body with the result that the oil buffer body together with the barrel extension tended to move vertically within the receiver housing during recoil and thereby caused binding of the parts whereas with the new construction the fixed breech lock depressors eliminate all vertical movement of these parts and thereby eliminate the binding action. The new construction also eliminates the objectionable wear at the meeting surfaces of the buffer body and breech lock cam 33. As in the M2 gun, the barrel, the breech bolt 50 and the barrel extension 104 move to the rear during recoil. The breech bolt 50 is locked in place relative to the barrel extension 104 by a conventional breech lock 51 carried by the barrel extension 104 and movable into the recess 53 in the bottom of the bolt 50. As the barrel extension and associated parts move to the rear, the ends of the breech lock pin 55 engage the cam surfaces 31 provided on the breech lock depressors so as to depress the breech lock.

Another important change in the breech lock depressors consists in the shape of the camming surface 31 on the depressors. In the prior art depressor the camming surface was a straight surface whereas in the new construction the camming surface comprises a concave curved surface which materially reduces the shock during the unlocking operation by virtue of the more gradual acceleration of the breech lock.

Referring now to Fig. 2 of the drawings, it will be noted that the shape of the extractor cam 32 which is secured to the cover 34 has been changed so as to have a steeper and longer camming surface. The dot-dash line 36 indicates the shape of the cover extractor cam used in the standard .50 M2 machine gun. By virtue of the change in contour of the extractor cam the downward displacement of an incoming cartridge from the feedway to the level of the barrel chamber is accomplished in a more uniform, smooth manner. This improved motion results from a steeper cover extractor cam having a longer camming surface and from a flatter slope on the underside of the side plate switch 38. The construction of the side plate switch 38 used on the slower speed caliber .50 M2 machine gun has been shown by the dot-dash line 40. In addition to making a slight change in the side plate switch, a heavier side plate switch spring 41 is used so as to cause the side plate switch to snap up more rapidly.

The extractor cam element 44 has been made larger so as to raise the extractor assembly

(not shown) earlier in the counter-recoil stroke in order that the ejector will clear the front of the barrel extension. Furthermore, the shape of the cam surface has been altered so as to provide a more gradual slope at the base of the extractor cam. The more gradual slope reduces the shock on the parts and thereby makes it possible to fire the gun more rapidly without further strengthening the parts to take care of the increased velocity involved. The shape of the cam surface used on the M2 gun has been shown by the dot-dash line 46.

Referring now to Figs. 4, 5, 6, and 7 wherein there are shown various views of the new "light weight" bolt and parts associated with the bolt, reference numeral 50 has been used to designate generally the new light weight bolt which has been cut away at various places so as to reduce the weight of the bolt without objectionably weakening the vital parts of the bolt. Thus, holes 52b have been drilled through the bolt so as to remove some of the extra material which is not required for strength. The new "light weight" bolt weighs approximately $3\frac{1}{4}$ lbs. whereas the M2 bolt weighs over $4\frac{1}{2}$ lbs. By virtue of the changes made in various parts of the gun including the change made in the weight of the bolt, the velocity of the bolt has been increased considerably with the result that the wear and tear on the cocking lever 52 has been materially increased.

A number of changes have been made in order to prevent breakage of the cocking lever 52. One of the main changes made in the cocking lever has been to provide thicker cross sections and to eliminate sharp corners (see Fig. 11). Furthermore, a shoulder 54 has been provided on the hub of the lever 52 which engages the conventional firing pin extension (not shown) so as to insure that the hole in the lever will always line up vertically with the hole 57 which receives the cocking lever pin 56. In addition to improving the design of the cocking lever, a cocking lever stop 58 is provided as shown in Figs. 6 and 7 and consists of a fiber block 60 riveted into a thin steel housing 62 which is mounted within the cocking lever slot directly in front of the cocking lever. The cocking lever 52 is actuated by the top plate bracket 63 in the usual manner which needs no further description.

The mechanism for holding the sear slide 64 in place has also been improved upon. The sear slide 64 is provided with a slotted portion 66 which cooperates with the sear slide stop pin 68 so as to be held in place by the pin 68. The pin 68 fits within one of the holes 69 in the bolt and is held in place by the cocking lever pin 56. Thus, in order to remove the sear slide it is first necessary to remove the cocking lever pin 56 and then to remove the sear slide stop pin 68 which normally prevents removal of the sear slide 64. Fig. 6 shows the slide 64, pin 68, and pin 56 ready for assembly. The gun may be fired from either side by shifting the sear slide 64, sear slide stop pin 68, and cocking lever pin 56 from one side of the bolt to the other.

Another important change which has resulted in strengthening the bolt is the change in the bolt switch. In the M2 machine gun, the hole for the bolt switch stud intersects a portion of the hole in which the extractor stud is journaled with the result that the extractor stud does not have the benefit of a full bearing surface. In the arrangement shown in Fig. 5, the portion of the bolt 50 immediately surrounding the bolt switch 70

has been designed to provide a completely supported bearing 71 for the extractor stud which is separate and independent of the bearing or aperture for the bolt switch 70. The bolt switch 70 is provided with a depending stud which in turn is provided with an integral interlocking projecting tongue or lug arrangement 72 which interlocks with the underside of an integral locking lug arrangement 74 provided by the slotted hole 75 in the upper face of the bolt 50. The hole 75 has its slots on opposite sides to receive the bayonet tongues 72 extending in the direction of the groove in the switch 70 as shown in Fig. 5, so that the tongues engage the diametrically opposite lugs of the lug arrangement 74 when turned so that the groove in the switch 70 aligns itself with either groove 90 to 92. In other words, the elements 72 and 74 serve as a bayonet connection for holding the switch 70 in place within the hole 75. The switch 70 is held in either one of its rotated positions by means of a locking pin 76 slidably supported within the recess 78 which is arranged as shown. A spring 80 biases the pin 76 upwardly into locking engagement with the switch. The switch is provided with a pair of holes 82 which cooperate with the upper end of the pin 76 so as to hold the switch in either one of its desired positions. The top surface of the bolt is provided with two diagonal ways or grooves 90 and 92 which act as cams for actuating the usual belt feed mechanism (not shown).

Contributing further to increasing the bolt velocity is a change which has been made in the curvature of the accelerator 100. In Figs. 8, 9, and 10 there is shown, somewhat diagrammatically, the difference in construction and operation between the accelerator used on the standard M2 machine gun and the new accelerator used in the gun disclosed herein. In Figs. 8, 9, and 10, the shape of the M2 accelerator has been indicated by the dotted lines whereas the shape of the new accelerator has been shown in solid lines. Because of the change in the curvature of the accelerator, more of the recoil energy of the barrel and barrel extension is imparted to the bolt so as to accelerate the bolt faster. Furthermore, the strain on the accelerator has been reduced due to the fact that the rate of acceleration at the beginning is less and the rate of acceleration is gradually increased as the bolt moves towards the rear. Thus referring to Fig. 8 of the drawings wherein the dotted line arrow indicates the point of contact of the old type of accelerator with the barrel extension 104 at the beginning of the acceleration and the full line arrow designates the corresponding point of contact of the new accelerator, it is apparent that the fulcrum point of the new accelerator on the barrel extension 104 is farther from the pivotal point 102 at the beginning of contact with the result that the initial impact between the accelerator and the bolt has been reduced by the new accelerator design. However, as the bolt moves back and the barrel extension 104 moves closer to the buffer 106, (see Figs. 9 and 10 for further comparisons), the point of contact rapidly moves down until it coincides

with and finally passes the corresponding point of contact when using the M2 accelerator with the result that the final rate of acceleration is greater with the new accelerator. Thus by virtue of the light weight bolt used and the new accelerator design used, the rate of acceleration is less to begin with but increases gradually until finally the bolt actually attains a higher velocity with the new type of accelerator than it would have attained with the old type of accelerator. Figs. 9 and 10 show in solid lines two progressive positions of the bolt 50 when used with the new type of accelerator and show in dot-dash lines the corresponding positions of the bolt when using the old type of accelerator.

The details of the barrel buffer 106 have been shown and are claimed in the co-pending application S. N. 500,161, filed August 26, 1943, now Patent 2,422,767, issued June 24, 1947. As set forth fully in said co-pending application, the barrel buffer is of the pneumatic type so as to eliminate the numerous disadvantages resulting from the use of oil and so as to further increase the speed of the bolt during the counter-recoil stroke.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claim which follows.

What is claimed is as follows:

In a rapid fire machine gun, a reciprocating breech bolt having a pair of intersecting ways provided in its upper surface, said bolt having a bearing aperture in its upper surface for receiving a switch stud, a switch removably secured within said bearing aperture, said switch being disposed substantially at the intersection of said ways, said switch and said bolt each being provided with integral complementary interlocking bayonet type lugs for holding said switch vertically in place relative to said bolt, and a switch positioning pin carried by said bolt, said switch having a pair of pin engaging recesses for selective cooperation with said pin, and spring means for urging said pin into engagement with one or the other of said positioning recesses, said recesses and said lugs being oriented so that the lugs are in interlocking engagement when any of the recessed are in alignment with said pin.

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