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[54] **SELF-LOADING FIREARMS**

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[51] **Int. Cl.**.....**F41c 19/00**, F41c 11/00

[58] **Field of Search**.....42/69 B, 16

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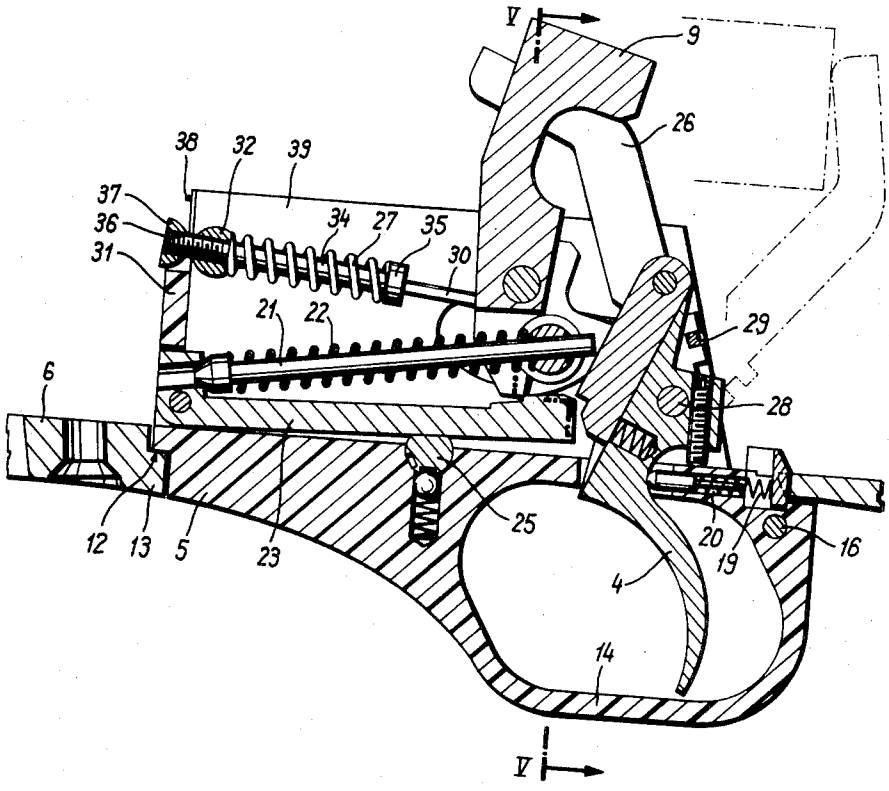
[57] **ABSTRACT**

A self-loading firearm having a bolt slidably mounted in the longitudinal direction of the barrel and a recoil spring loading the bolt. The recoil spring is located outside of the path of the bolt and is connected with the bolt by means of at least one movable intermediate member.

17 Claims, 5 Drawing Figures



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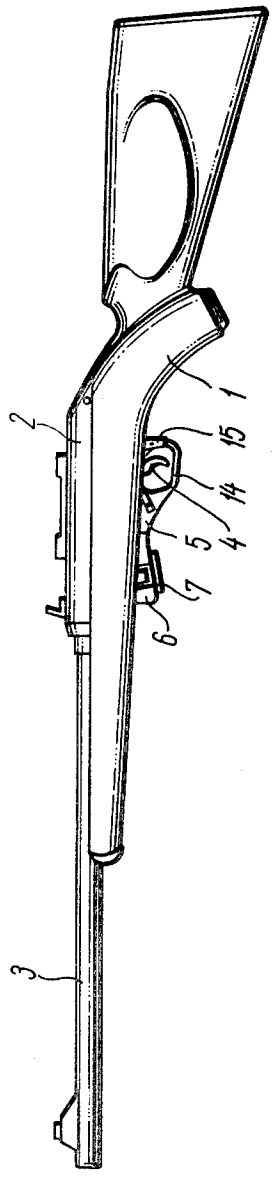

Fig. 1

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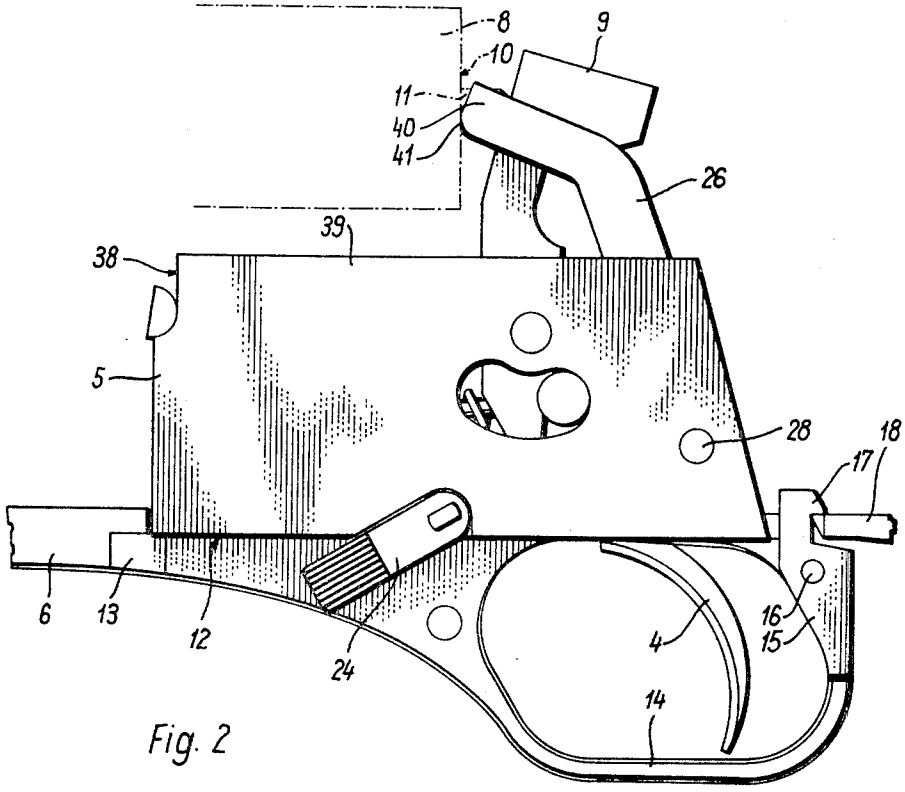

Fig. 2

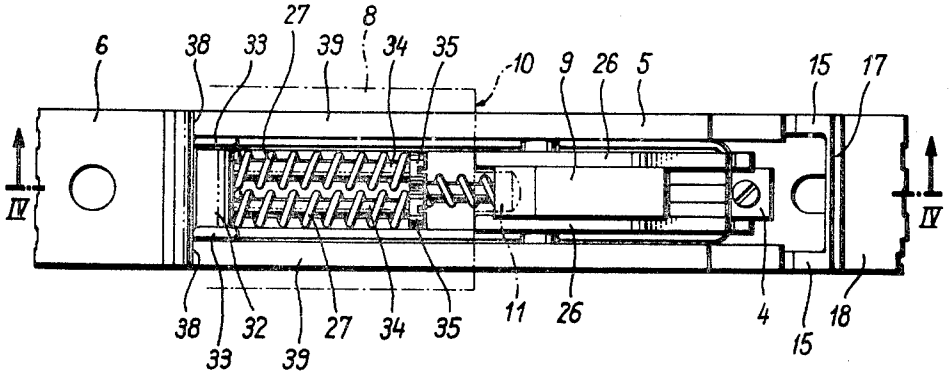

Fig. 3

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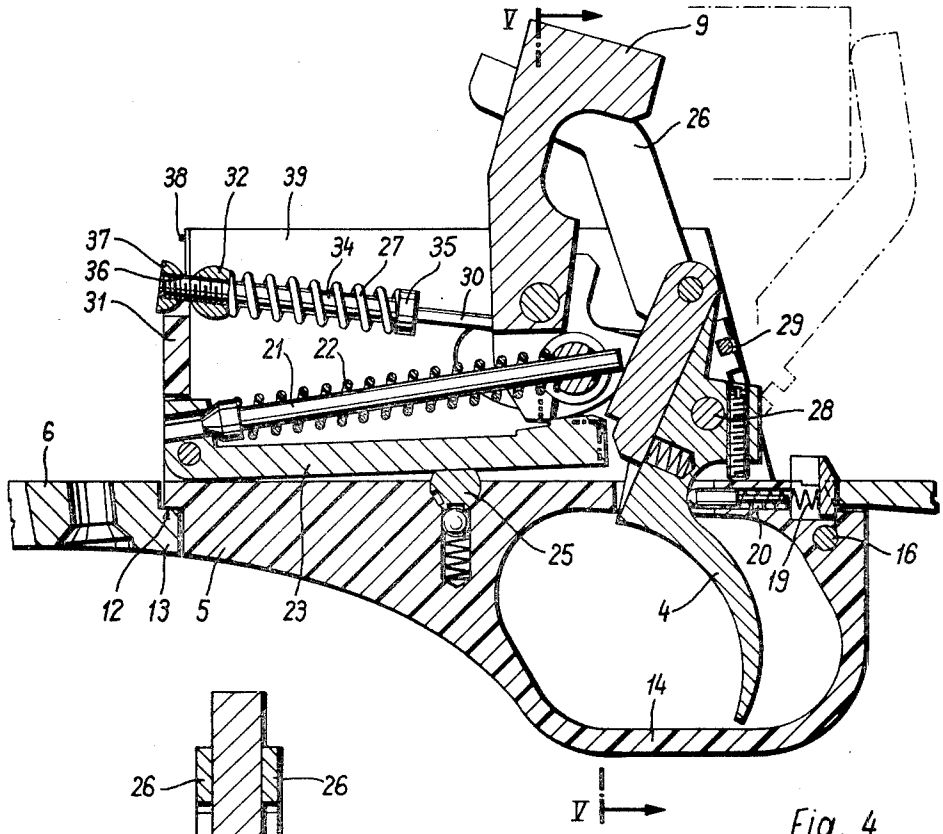

Fig. 4

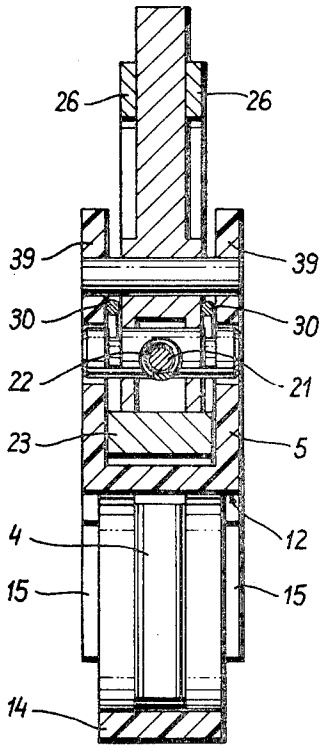

Fig. 5

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SELF-LOADING FIREARMS

The present invention relates to a self-loading firearm, particularly a small-caliber rifle, with a bolt slidably mounted in the longitudinal direction of the barrel and with a recoil spring loading the bolt.

In all prior art self-loading firearms, the recoil spring is a compression spring which directly contacts a part of the bolt and is accordingly located in the path of the bolt. In many instances, the recoil spring is located behind the bolt in the extension of the barrel and therefore results in an extension of the distance between the rear end of the receiver and the rear end of the barrel. The space required for this results in either an extension of the firearm and an increase in weight, which cannot be accepted in many cases, or a reduction in the overall length available for the barrel. A shortened barrel can easily result in reduced accuracy.

In another prior art firearm, the recoil springs are located in a special tube, whose axis is displaced with respect to the axis of the barrel, and the bolt is provided with a shoulder extending into this recoil spring tube. A disadvantage of this arrangement is the increase in the volume and weight of the receiver.

In prior art pistols the recoil spring is arranged concentrically or in front of the actual bolt, parallel to the barrel, because there is a bolt carrier overlapping the barrel. A solution of this type is possible only in pistols and not in long-barrel firearms, since this type of bolt carrier would be too heavy in this case and would represent a significant source of danger. In rifles and shotguns, an enclosed receiver is strived for, on whose outside surface there are no moving parts while shooting. A requirement of this type must be made, particularly for fully automatic, i.e. sustained fire, self-loading firearms.

It is the object of the present invention to avoid the disadvantages of the prior art, self-loading firearms, resulting from the arrangement of the recoil springs. In accordance with the present invention, this objective is accomplished in that the recoil spring is located outside the path of the bolt and is connected with the bolt by means of at least one moving intermediate member.

This invention enables the recoil spring to be arranged at a location in the firearm at which there is sufficient space available for this, without the recoil spring influencing the overall length or overall volume of the firearm. A special advantage is that the recoil spring can have a different direction of action than the direction of travel of the bolt and that a number of possibilities therefore result for the installation of the recoil spring. In accomplishing this it is also possible, with the assistance of the intended intermediate members, to achieve a reduction, so that the stroke of the recoil spring can be kept significantly shorter than the stroke of the bolt. This offers the possibility of extremely compact arrangements, which as such also require much less space than the prior art recoil spring arrangements.

An additional advantage of the use of moving intermediate members is also that these intermediate members and the recoil spring system can also be employed to catch the bolt, i.e. that a buffer facility does not need to be arranged in the extension of the bolt or for parts rigidly connected with the bolt, so that this also offers numerous possibilities for shortening the overall length of this type of firearm.

In a preferred embodiment of the invention, the recoil spring and the intermediate member are located in the trigger assembly housing. In this case the recoil spring, which usually requires much additional space, is located within the trigger assembly housing, which is present in any event and which is designed for mounting movable members anyway and thus does not require any additional space. This arrangement is especially advantageous if the trigger assembly housing can be detached from the firearm as a standard unit, as the recoil spring and the intermediate member are, as is the trigger mechanism, available for maintenance after removal or after the trigger assembly housing is simply pivoted down. The operative connection between the recoil spring and the bolt is then also separated without additional measures, so that after the receiver has been opened, the bolt can be readily removed from the firearm without having to bother with the more or less relieved recoil spring. Thus, it is easily possible to close the rear end of the receiver in a simple manner with a detachable closure, after whose removal the bolt can be extracted from the receiver from the rear. It is possible to attach this type of simple closure since this closure does not need to act as a buffer to catch the bolt but this can be accomplished by the intermediate member and the recoil spring. After the bolt has been removed, the rear end of the barrel is freely accessible for cleaning the firearm, which will present a considerable advantage.

The intermediate member can be formed in an especially simple manner by a lever, which can be pivoted around an axis at right angles to the path of the bolt and one end of which rests against a surface of the bolt primarily at right angles to the path of the bolt. A good transfer of the force of the recoil spring to the bolt results if the end of the lever engaging the bolt extends essentially parallel to the path of the bolt in the forewardmost position of the bolt and generally at right angles to the path of the bolt in the rearmost position of the bolt. In this manner, the lever always engages the corresponding bolt surface in a specific manner and slides only to a limited degree on the surface of the bolt. For this purpose, it is also practical if the contact surface on the bolt for the lever has at least almost symmetrical positions with respect to a plane through the lever axis and at right angles to the path of the bolt in the extreme positions of the bolt, and if the end of the lever engaging the bolt is angled in the direction of closing. The rear face of the bolt is particularly suited as a contact surface for the lever. It is then not necessary to provide any special contact surfaces, so that the bolt is not additionally complicated through the use of this invention.

It is readily possible to employ this invention with self-loading firearms with hammer blow ignition and to also employ a pivoted lever as an intermediate member in this case and to mount this lever in the trigger assembly housing. In an embodiment of the invention, the lever is located parallel to the hammer in this case, and has a fork-shaped end whose sections enclose between them the hammer and the end of the firing pin protruding from the rear face of the bolt. With a firearm of this type, it is of course possible to also locate the intermediate lever and the recoil spring on the side of the firearm opposite that of the trigger assembly housing

with the hammer. In many cases, however, it will be more advantageous, as mentioned above, to locate the lever and the recoil spring in the trigger assembly housing. To simplify the arrangement it is then also possible, for example, to mount the lever on the same axis as an additional member of the trigger mechanism, for example the trigger itself.

In the firearm in accordance with the invention, it is also possible for the recoil spring to be a helical spring. Especially simple interaction with the intermediate member results when this helical spring extends parallel to a pull rod, which contacts the intermediate member and engages this pull rod, as this produces an especially favorable transfer of power to the intermediate member. It is possible to achieve an especially uniform engagement of the helical spring if such a pull rod is bracket-shaped and if the helical spring is located between the shanks of the bracket and engages a yoke connecting the ends of the shanks of the bracket, while the bridge of the bracket engages the intermediate member. A pull rod of this type also enables a lever, having a fork-shaped end, to be designed in two sections connected with each other by a bridge, formed by the cross member of the bracket-shaped pull rod.

An especially simple embodiment of the invention results when a compression spring is employed as a recoil spring and this compression spring is located on a rod, passing through the yoke and having a stop for the compression spring on the end located between the shanks of the bracket, while its other end is anchored in a rigid bearing preferably located in a supporting relationship within the trigger assembly housing. It is then also possible to locate two or more recoil springs parallel to each other if an extremely high closing force is to be achieved in a small space.

Additional details and developments of the invention are contained in the following description in which the invention is described in more detail and explained on the basis of the example depicted in the drawing. The characteristics contained in the description and the drawing can, in other embodiments of the invention, be employed individually or jointly in any desired number of combinations. In the drawings

FIG. 1 shows a side view of the rifle in accordance with the invention,

FIG. 2 shows a side view of the trigger assembly housing of the rifle according to FIG. 1 with sections of supporting members, adjacent to the front and rear of the trigger assembly housing and mounted in the rifle stock, in enlarged scale,

FIG. 3 shows a top view of the configuration according to FIG. 2,

FIG. 4 shows a cross-section of the trigger assembly housing along line IV—IV in FIG. 3 and

FIG. 5 shows a cross-section through the configuration according to FIG. 4 along the line V—V.

The self-loading firearm depicted as an example in the drawing is a small caliber rifle, which could be employed particularly as a closed season rifle. It has the usual stock 1, in which the receiver 2 with the barrel 3 inserted therein is fixed. Located on the bottom of the stock 1 is the trigger 4 which is mounted in a trigger assembly housing 5 inserted into the stock from below. Inserted into the stock 1 from below in front of the trigger assembly housing 5 is a magazine well 6, in which is located a magazine, of which only the floor plate 7 is visible in FIG. 1. This is a self-loading rifle, having a slidably mounted bolt, preferably an inertia bolt, located within the receiver 2 in the longitudinal direction of the barrel 3 in a manner not described in more detail. In the prior art, this bolt serves to close the chamber of the barrel, to ignite the cartridge located in the chamber with the assistance of the firing pin located in the bolt, to extract and to eject the empty cartridge case after the shot is fired and to remove a new cartridge from the magazine and feed this cartridge into the chamber of the barrel.

While the rearward travel of the bolt, required to extract and eject the cartridge case, is provided by the effect of the recoil and/or the pressure of the powder gas, the force for the forward travel of the bolt and feed of a new cartridge is supplied by a recoil spring. In the depicted rifle, the cartridge is ignited with the assistance of a hammer 9, which is cocked with the assistance of the bolt 8 and which can be released again by operating the trigger 4. The hammer 9 then strikes the end 11 of the firing pin mounted in the bolt 8 and extending beyond the rear face 10 of the bolt.

In the example depicted in the drawing, the trigger assembly housing 5 forms a standard unit which can be inserted into the stock 1 of the firearm from below and which is mounted there in an easily detachable manner. For this purpose, the trigger assembly housing 5 has a shoulder 12 at the level of the lower edge of the stock, with which the front end of the trigger assembly housing overlaps a projection 13, which overlaps for this purpose the rear end of the magazine well bolted to the stock 1. At the rear end of the trigger assembly housing, the section of the trigger assembly housing 5 projecting from the stock 1 of the rifle and set off by the shoulder 12 changes into a trigger guard 14, surrounding the trigger 4. Located on both sides of the rear section of this trigger guard are two locking catches 15, pivot mounted around a pin 16 passing laterally through the trigger guard and connected with each other by means of a cross member 17 at their ends, which extend into the stock 1. This cross member 17 forms a nose, which is located at the rear of the trigger assembly housing 5 and which overlaps a locking plate 18 mounted in the stock of the rifle. The locking catches 15 are loaded by a compression spring 19, which is located in a hole 20 in the trigger assembly housing 5, extending at right angles to the cross member 17 of the locking catches 15, and which is in a supporting relationship with the cross member 17 of the locking catches. The compression spring 19 also serves to load the trigger 4.

In addition to the hammer 9, a hammer spring 22 located on a connecting rod 21, a trigger lever 23 serving to catch and release the hammer, a safety pin 25 with a wing 24 located below the trigger lever and the actual trigger 4 serving to operate the trigger lever 23 and thus release the hammer 9, a lever 26 is also located in the trigger assembly housing 5 and acts upon the rear face 10 of the bolt 8 and is loaded by two recoil springs 27, located parallel to one another and also located in the trigger assembly housing 5.

The lever 26 is formed by two sections which are mounted on both sides of the trigger 4 on the same pin 28 as this trigger. These two sections of the lever 26 are

connected to each other by a bridge **29** formed by the cross piece of a bracket, whose shanks **30** extend past the outside of the parts of the lever **26** until close to the front wall **31** of the trigger assembly housing **5**. The free ends of the shanks **30** are connected to each other by a yoke **32**, which is formed by a pin with sections of decreasing diameter at its ends and whose ends engage in corresponding hooks **33** on the shanks **30** of the bracket. This yoke **32** has two lateral holes which contain the guide rods **34** for the recoil springs **27**. These guide rods **34** are formed by cap screws around which are located on the section extending from the head **35** to the yoke **32** the recoil springs **27** in a compression spring configuration. Their ends, located in the holes in the yoke **32** and provided with a thread **36**, are screwed into a support **37** formed by a semi-circular rod, whose ends are in a supporting relationship with the end faces **38** of the side walls **39** above the front wall **31** of the trigger assembly housing **5**. The sections of the guide rods **34** surrounded by the recoil springs **27** extend parallel to the shanks **30** of the bracket and are located between these shanks, so that the recoil springs **27** attempt to press the yoke **32**, having a flattened area facing the recoil springs, towards the support **37**. In this manner, a force is exerted upon the two sections of the lever **26** via the shanks **30** and the bridge **29** of the bracket and tends to pivot the lever **26** in FIG. **2** and **4** counterclockwise; i.e. to press the ends of the lever **26** against the rear face **10** of the bolt **8** and thus maintain the bolt in its closed position. Since the bridge **29** is located close to the pin **28** serving as a bearing for the lever **26**, the recoil springs **27** must only travel a distance which is much shorter than the path of the bolt **8**. It is therefore possible to keep the recoil springs **27** short enough so that they easily have room in a small trigger assembly housing.

As mentioned above, the ends of the lever **26** rest against the rear face **10** of the bolt **8** and in this manner transmit the force of the recoil springs **27** to the bolt **8**. The two-section configuration of the lever **26** makes it possible to not only locate the lever **26** on the same pin as the trigger **4** in a simple manner, but also to rest the lever against the rear face **10** of the bolt **8**, from which the end **11** of the firing pin projects to enable the hammer blow ignition. The two sections of the lever **26** rest against the rear face **10** of the bolt on both sides of the end of the firing pin **11** and also surround the hammer **9** so that this hammer can operate without interference from the lever **26**.

The pin **28** for mounting the trigger and the lever **26** is located near the rear end of the trigger assembly housing **5** so that almost the entire length of the trigger assembly housing is available for locating the recoil springs **27**. In this manner the space, which is free anyway and which is required anyway for the hammer spring **22**, in front of the hammer **9** is utilized. The recoil springs **27** extend essentially parallel to the hammer spring in the otherwise unused space above the hammer spring.

Furthermore, the arrangement is designed in such a manner that a plane, at right angles to the path of the bolt and through the pin **28** which also serves to mount the lever **26**, is located approximately in the center between the positions in which the rear face **10** of the bolt **8** is located in its two extreme positions, indicated by the dotted line in FIG. **2**. By angling the front end **40** of the lever **26**, it is then possible to ensure that with the bolt in the forward position this end extends essentially parallel to the path of the bolt and with the bolt in its rearmost position it extends generally at right angles to the path of the bolt. This ensures that this end of the lever **26** always has a specific contact on the rear face **10** of the bolt **8**. In the example depicted, the point **41** of the lever **26** which rests against the bolt is rounded in order to reduce wear on the end **40** of the lever as well as on the rear face **10** of the bolt **8** as much as possible when the end of the lever slides along the surface of the bolt during bolt travel.

Although only one embodiment of the invention has been illustrated and described herein, it will be evident to those skilled in the art that various modifications may be made in the details of construction without departing from the principles herein set forth. Thus, the invention can be employed with hammer ignition firearms as well as with firearms containing a firing pin which is cocked and released with the assistance of the trigger mechanism. It would also be conceivable to provide similar arrangements in light automatic firearms, such as submachine guns, or normal pistols in which the recoil springs and the required intermediate members would then be located in the firearm's grip. It is also conceivable to employ several intermediate members instead of only one lever. In the embodiment depicted as an example, the pull rod can even be viewed as a second intermediate member. However it would also be conceivable to employ intermediate members deviating from the lever arrangements, for example a pinion engaging toothing on the bottom of the bolt and loaded by a very strong coil spring or helical springs contacting close to the circumference. Depending upon the relationship between stroke length and gear diameter, the gear could make either several revolutions or only a fraction of a revolution. In this case, it would suffice to employ toothed segments.

In the embodiment depicted as an example, the lever **26** serves as a buffer for the recoiling bolt and in its rearmost position rests against a stop in the receiver, not described in more detail and located approximately at the level of the upper edge of the trigger assembly housing. The elasticity of the lever prevents the bolt from being caught too hard. It is evident that instead of this, special buffers could also be provided against which the lever or other intermediate members participating in the bolt travel could also strike. These buffers could also then be arranged in locations which are not in the path of the bolt.

Having thus fully described out invention, what we claim as new and wish to secure by Letters Patent is

1. A self-loading firearm having a bolt located slidably in the longitudinal direction of a barrel of the firearm and a recoil spring loading the bolt, characterized in that a trigger assembly housing (**5**) extends into and is mounted in the firearm, the recoil spring (**27**) being located outside of the path of the bolt and being connected with the bolt (**8**) by means of at least one movable intermediate member (**26**), a trigger mechanism as well as the recoil spring (**27**) and the intermediate member (**26**) being located in the trigger assembly housing (**5**).

2. A firearm in accordance with claim 1, characterized in that the intermediate member (26) is formed by a lever which is pivotable about an axis (28) located at right angles to the path of the bolt, and whose end (40) contacts a surface (10) of the bolt (8) generally at right angles to the path of the bolt.

3. A firearm in accordance with claim 2, characterized in that the end (40) of the lever (26) engaging the bolt (8) extends essentially parallel to the path of the bolt in the frontmost position of the bolt and essentially at right angles to the path of the bolt in the rearmost position of the bolt.

4. A firearm in accordance with claim 3, characterized in that the contact surface (10) for the lever (26) on the bolt (8) has, in the extreme positions of the bolt, almost symmetrical positions to a plane through the lever axis (28) and at right angles to the path of the bolt and that the end (40) of the lever (26) contacting the bolt (8) is angled in the direction of closure.

5. A firearm in accordance with claim 4, characterized in that the lever (26) rests against the rear face (10) of the bolt (8).

6. A self-loading firearm having a bolt located slidably in the longitudinal direction of a barrel of the firearm and a recoil spring loading the bolt, characterized in that the recoil spring (27) is located outside of the path of the bolt and is connected with the bolt (8) by means of at least one movable intermediate member (26), the recoil spring (27) and the intermediate member (26) being located in a trigger assembly housing (5) arranged in the firearm, the intermediate member (26) being formed by a lever which is pivotable about an axis (28) located at right angles to the path of the bolt, and whose end (40) contacts a surface (10) of the bolt (8) generally at right angles to the path of the bolt, the lever (26) resting against the rear face (10) of the bolt (8), a hammer (9) for hammer blow ignition, the lever (26) being arranged parallel to the hammer (9) and having a fork-type end, whose sections enclose between them the hammer (9) and the end of a firing pin (11) projecting out of the rear face (10) of the bolt (8).

7. A firearm in accordance with claim 6, characterized in that the lever (26) is comprised of two sections, arranged on both sides of the hammer (9) and connected with each other by a bridge (29) engaged by the recoil spring.

8. A firearm in accordance with claim 7, characterized in that the lever axis is formed by an axle and that the lever (26) and an additional member (4) of the trigger mechanism is mounted on the axle.

9. A firearm in accordance with claim 8, characterized in that the additional member is a trigger (4) of the trigger mechanism.

10. A firearm in accordance with claim 6, characterized in that the lever (26) is offset to one side and that the recoil spring (27) engages the lever close to the pivot axis (28) of the lever.

11. A firearm in accordance with claim 6, characterized in that the recoil spring (27) is a helical spring, which extends parallel to a pull rod (30) engaging the intermediate member (26) and engages the pull rod.

12. A firearm in accordance with claim 11, characterized in that the pull rod is bracket-shaped with shanks connected by a bridge and the helical spring (27) is located between the shanks of the bracket (30) and engages a yoke (32) connecting the ends of the bracket shanks, the bridge (29) of the bracket engaging the intermediate member (26).

13. A firearm in accordance with claim 12, characterized in that as the recoil spring (27) is a compression spring and that the compression spring is located on a rod (34) passing through the yoke (32) and having a stop (35) for the compression spring (27) on the end located between the shanks (30) of the bracket, while its other end is anchored in a rigid support (37), supported on the trigger assembly housing (5).

14. A firearm in accordance with claim 13, characterized in that the rod (34) is a screw, provided with a head (35) and screwed into the support (37).

15. A firearm in accordance with claim 11, characterized in that at least two recoil springs (27) are arranged parallel to each other.

16. A firearm in accordance with claim 6, characterized in that the recoil spring (27) extends generally parallel to a spring (22) for loading the hammer (9).

17. A firearm in accordance with claim 7, characterized in that the bridge (29) connecting both sections of the lever (26) is formed by the cross member of the bracket-shaped pull rod.

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