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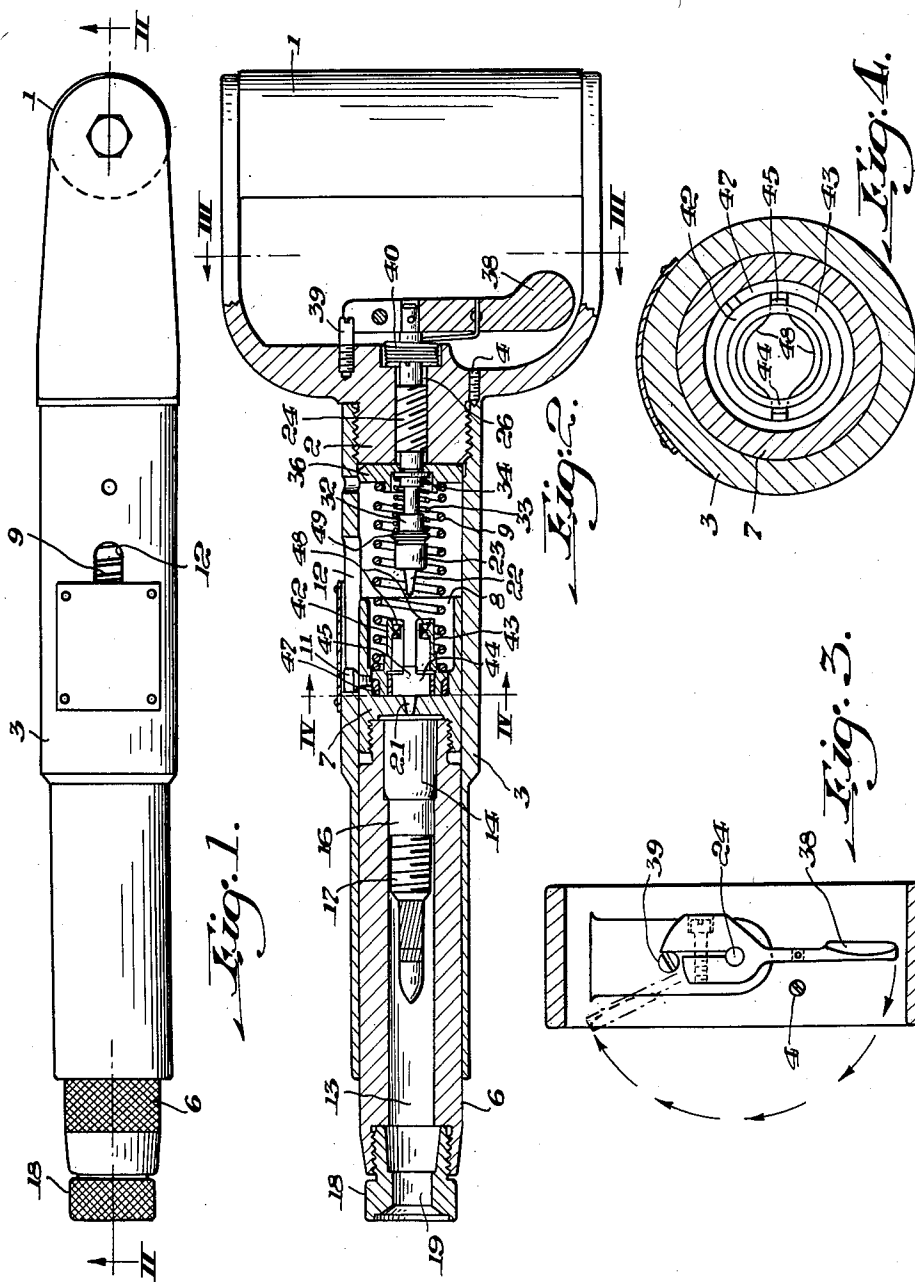
R. TEMPLE ET AL

2,622,243

SPRING FIRED EXPLOSIVELY ACTUATED TOOL

Filed April 5, 1950

3 Sheets-Sheet 1



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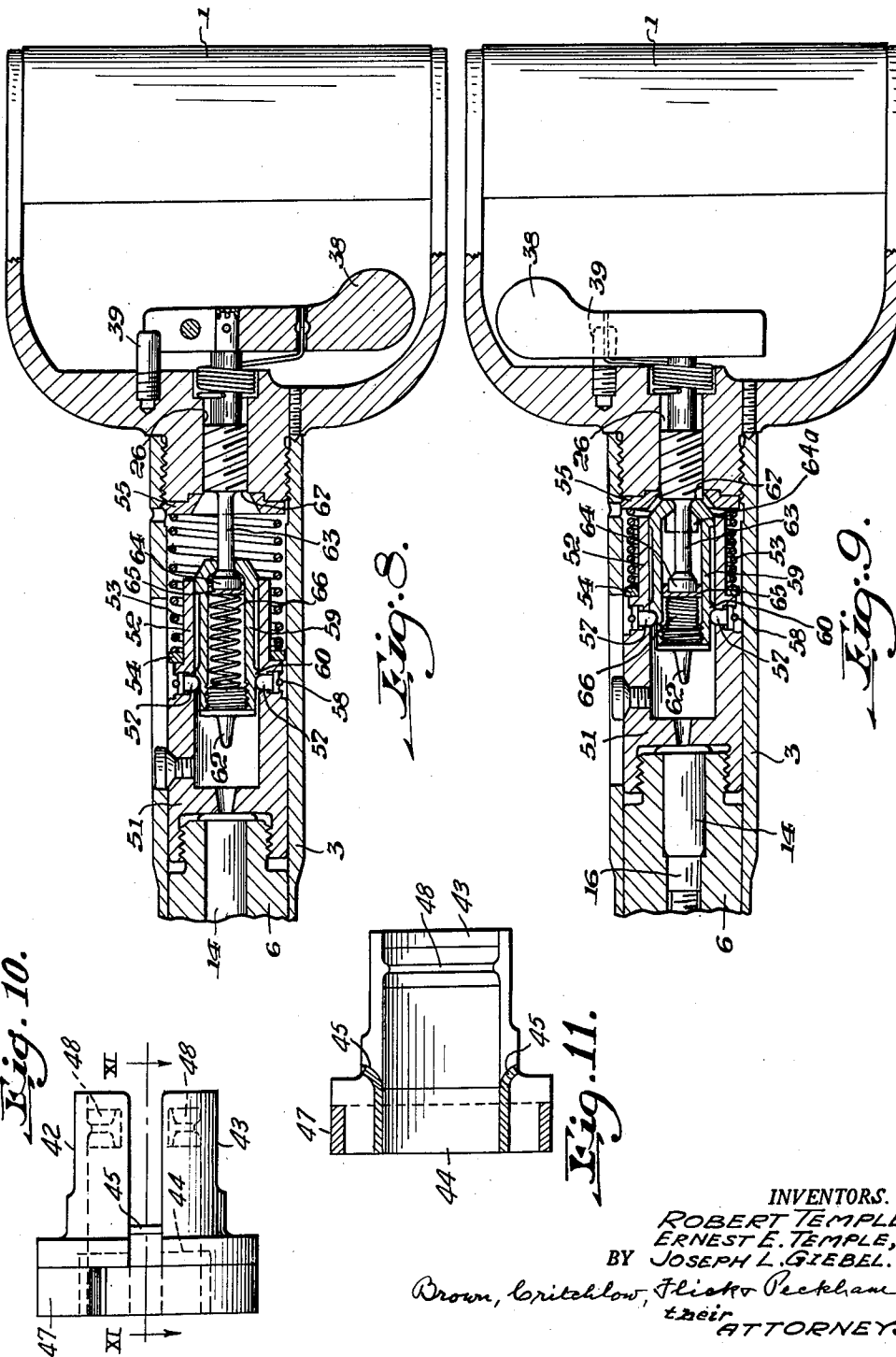
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UNITED STATES PATENT OFFICE

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SPRING FIRED EXPLOSIVELY ACTUATED
TOOL

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11 Claims. (Cl. 1—47)

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This invention relates to explosively actuated tools that may be used for driving studs and the like, and more particularly to such tools provided with safety mechanism to prevent accidental discharge.

In my Patent No. 2,479,431 a driving tool is shown in which the explosive cartridge that furnishes the driving power is detonated by pushing the tool forward around the barrel to press a firing pin against the cartridge. The firing pin normally is retracted so that if the barrel is pushed back into the tool accidentally, as might happen if the tool were dropped and landed on either end, the cartridge will not strike the firing pin. The firing pin has to be advanced manually before the cartridge can be detonated, whereby a safety mechanism is provided. It has been found that in some cases the users of that patented tool push the firing pin against the cartridge so slowly that the pin merely indents the percussion cap without detonating it. The cartridge then becomes a dud and has to be replaced.

It is among the objects of this invention to provide an explosively actuated driving tool of the sliding barrel type disclosed in my patent, in which the firing pin will always be driven against the cartridge at high speed regardless of how slowly the tool is pushed forward around the barrel, but in which the driving means for the firing pin cannot act while the safety mechanism is in effect.

In accordance with this invention a breechblock is slidably mounted in a barrel guard which is in the form of a sleeve projecting from the front of a stock that can be held in the hand. The breechblock, which has an axial passage through it, is urged forward in the sleeve by a spring. Connected with the front end of the breechblock is a barrel which projects from the guard. A rod projects axially from the front end of the stock in line with the breechblock passage, and a firing pin is slidably connected to the front end of the rod and projects forward from it. The pin is adapted to be driven forward in the breechblock passage to detonate an explosive cartridge held against the front of the block. The pin is urged forward relative to the rod by means of a coil spring. The tool is provided with means movable rearward in the sleeve by means of the breechblock for compressing the coil spring a predetermined amount. Means also is provided for releasing the coil spring when the spring-compressing means is moved farther back after compression of the spring has been stopped.

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This allows the coil spring to expand and snap forward. Preferably, the spring-compressing means includes radially expansible means carried by the breechblock and engaging a shoulder over which the expansible means slips when rearward movement of the shoulder is stopped. When the tool is provided with the safety mechanism disclosed in my above-mentioned patent, the firing pin rod is threaded in the stock and normally is retracted therein to keep the pin from projecting through the breechblock passage in case the block is accidentally pushed rearward in the sleeve by the barrel to firing position. A turning member is connected to the rod for turning it manually in one direction so as to screw it forward in the stock opening a predetermined distance sufficient to project the pin through the passage when the breechblock is in firing position. When the turning member is released, the rod is automatically turned in the opposite direction to return it to its retracted position. The stop, which limits compression of the coil spring, may be retracted with the rod so that the compressed coil spring will not be released if the rod has not been advanced into firing position.

The invention is illustrated in the accompanying drawings, in which Fig. 1 is a plan view of the tool; Fig. 2 is a central longitudinal section thereof, taken on the line II—II of Fig. 1; Fig. 3 is a transverse section taken on the line III—III of Fig. 2; Fig. 4 is an enlarged cross section taken on the line IV—IV of Fig. 2; Fig. 5 is a view similar to Fig. 2, showing the firing pin spring fully compressed just before it is released; Fig. 6 is a view like Fig. 5, showing the firing pin driven ahead into firing position; Fig. 7 is an enlarged fragmentary longitudinal section through the firing pin assembly shown in Fig. 2; Fig. 8 is a fragmentary longitudinal section through a modification of this invention; Fig. 9 is a fragmentary longitudinal section showing the firing pin spring fully compressed just before it is released; Fig. 10 is an enlarged side view of the firing spring compressor shown in the first embodiment of the invention; and Fig. 11 is a longitudinal section through the spring compressor taken on the line XI—XI of Fig. 10.

Referring to Figs. 1 to 4 of the drawings, the stock is in the form of a D-handle provided with a hand grip 1. Opposite the grip the stock has a forwardly projecting portion 2 extending into the rear end of a sleeve 3 that is held in place by a screw 4 and that forms a guard for a barrel 5. The barrel is slidably mounted in the sleeve

and has its rear end screwed into a sliding breechblock 7 that has a deep socket 8 in its rear end for receiving a coil spring 9 that urges the block away from the stock. Forward movement of the breechblock is limited by a cap screw 11 projecting from the top of the block into a slot 12 extending lengthwise of the sleeve.

The rear end of the axial bore 13 through the barrel is adapted to receive a cartridge 14, the rim of which is clamped between the rear end of the barrel and the breechblock. Preferably, the front end of the cartridge is crimped over the rear portion of a piston member 16 that is frictionally connected to the rear end of a stud 17 for supporting the stud centrally in the barrel. The stud is shaped for the purpose for which it is intended, the one shown having a threaded rear end. The front end of the barrel is formed by a muzzle block 18 provided with a bore 19 that is slightly smaller than the one through the rest of the barrel so that piston 16 will be stopped by the block as the stud leaves the barrel. Barrels with different size bores for studs of different diameters are interchangeable with the one shown. When a barrel is being screwed into or out of the breechblock, the latter is prevented by cap screw 11 from rotating.

The breechblock 7 is provided with an axial passage 21, through which a firing pin 22 can be projected for detonating cartridge 14. The firing pin discharges the cartridge when the barrel guard 3 is pushed forward a predetermined distance around the barrel. However, simply pushing the barrel back into the guard (or pushing the guard down over the barrel) will not detonate the cartridge, because it first is necessary to move the firing pin forward from an inoperative or safety position to an operative position. Accordingly, as shown in Fig. 7, the firing pin 22 extends from the front end of a socket 23 that receives the front end of a rod 24 screwed into a threaded opening 26 extending through the stock portion 2 in line with breechblock passage 21. The rod projects from both ends of the stock opening. A short distance from its front end the rod is provided with an annular recess 27 of a length that will permit the pin socket 23 to be slid back and forth on the rod the desired amount. The portion of the rod in front of the recess slides in a spacing ring 28, and the recessed portion of the rod is encircled by a split lock ring 29. The lock ring is clamped against the spacing ring by a coupling screw 31. This construction permits the pin socket to be moved back and forth on the rod a short distance without ever separating from it.

The firing pin is urged forward relative to the rod by means of a collar 32 slidably mounted on the rod and pressed forward by a coil spring 33 compressed between it and a trip ring 34 which also is slidably mounted on the rod. The trip ring normally engages a stop washer 36 engaging the front end of the stock. Slidably mounted in this washer behind the trip ring is a shoulder 37 with which the rod is provided and which will engage the trip ring 34 and move it forward in the washer when the rod is screwed forward in the stock.

The inoperative or safety position of the firing pin is one in which the pin, although pushed forward on the rod by spring 33, is held retracted far enough by the rod to prevent it from projecting past the front end of breechblock passage 21 even if the barrel is pushed back in the guard sleeve as far as it will go. This safety position of the firing pin is shown in Fig. 2. In

order to move the firing pin forward into firing position, a lever or arm 38 is rigidly mounted on the projecting rear end of rod 24. By swinging the arm to turn the rod the latter will be screwed forward through the stock far enough for the pin to project a short distance past the front end of the breechblock passage when the barrel guard is pushed forward. The position to which the arm can be swung manually is shown in broken lines in Fig. 3, and in full lines in Figs. 5 and 6. A stop member 39 is fastened permanently in the stock in the path of both ends of the arm to limit the distance that the arm can be turned in either direction to only that necessary for moving the pin into and out of firing position. The moment the operator releases the arm, the pin is automatically returned to its retracted inoperative position by means of a spring 40 coiled around the rear end of the rod in front of the arm. One end of the spring is anchored in a slot in the stock, while the other end projects into a hole in the arm. This torsional spring is put under such tension when the arm is swung manually to firing position that it will automatically swing the arm back to its original position, shown in full lines in Figs. 2 and 3, when released.

Mounted in breechblock socket 8 is a firing spring compressor formed in four parts, as shown in Figs. 2, 4, 10 and 11. Two of the parts 42 and 43 form segments of a hollow cylinder, with their side edges spaced apart. The front ends of these members are recessed and fit around a retaining ring 44 which has rearwardly extending ears 45 that project between the side edges of the segmental members. The front ends of the segmental members are encircled by a spring clip 47. Near their rear ends the insides of the segmental members are provided with arcuate shoulders 48 which are tapered in cross section. These shoulders are adapted to engage a tapered shoulder 49 on firing collar 32 when it is moved forward toward the barrel. Further forward movement of the rod 24 through the firing collar 32 will cause the firing spring 33 to be compressed, as shown in Fig. 5. As long as the firing rod is in retracted safety position the engaging shoulders 48 and 49 will merely compress the firing spring until the rear end of the breechblock is struck by stop washer 36.

On the other hand, if, as shown in Fig. 5, the firing rod is screwed forward by turning arm 38, the shoulder 37 on the rod will move trip ring 34 forward so that the ring will strike the firing collar 32 before the stop washer 36 strikes the breechblock. Just as the firing spring is compressed its full amount, the firing pin, which has entered breechblock passage 21, engages the rear end of the cartridge. It does not detonate the cartridge at this time, however, because it does not engage it with any force. Instead, after the trip ring 34 engages firing collar 32, the rod 24 moves forward relative to the stationary pin 22. This forward movement of the firing rod in the firing pin socket 23 causes the shoulder 49 on the firing collar to expand the spring compressor and slide past its shoulders 48, which is permitted by the fact that the segmental members 42 and 43 are anchored only at their front ends and only by spring clip 47 which permits their rear ends to be forced apart. When the spring compressor is expanded in this way, the firing collar is released and will be driven by the firing spring 32 forward with considerable force against the firing pin socket 23, which thereby is driven forward on rod 24 to cause the firing pin

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to penetrate and detonate the percussion cap in the rear end of the cartridge, as shown in Fig. 6.

This tool is used as follows. After the barrel of the tool has been loaded with a stud and cartridge and has been screwed into the breechblock, the front end of the barrel is placed against the object into which the stud is to be driven. One hand can grip the barrel guard 3 while the other hand grips the hand grip 1. A thumb or finger of the latter hand then is used to swing arm 38 clockwise as far as it will go. This screws firing rod 24 ahead into operative position. The handle then is pushed forward, either fast or slowly, to push the guard sleeve over the barrel as far as it will go. During this operation the firing mechanism first takes the position shown in Fig. 5 and then the position shown in Fig. 6. When the cartridge is discharged, the piston 16 and stud are driven forward in the barrel, but the piston is stopped by muzzle cap 19 while the stud continues to move forward into the object against which the barrel muzzle has been placed. Arm 38 then can be released, and the torsion spring 49 will return it to its original position in which the firing pin 22 will be retracted far enough so that it cannot detonate the next cartridge until the arm again is swung by the operator clockwise against stop 39. In this way a safety is provided for the tool which prevents it from being discharged accidentally. As soon as the tool is removed from the work, spring 9 will force the breechblock and barrel forward in the guard sleeve again. This spring is strong enough to pull compressor shoulders 48 over firing collar shoulder 49 so that the firing spring compressor can return to the position shown in Fig. 2.

In the modification shown in Figs. 8 and 9, the rear end of the breechblock 51 is provided with a longer tubular extension 52 than in Fig. 2. A coil spring 53 encircles the extension and is compressed between a washer 54 mounted thereon and a stop washer 55 engaging the front of the stock 2. In front of washer 54 the tubular extension of the breechblock is provided with a plurality of circumferentially spaced radial holes in which plugs 57 are slidably mounted. These plugs are urged inward by a surrounding spring retaining ring 58. Their rounded inner ends normally engage the outer surface of a tubular socket member 59 in front of an annular shoulder 60 with which the socket is provided. Screwed into the front end of the socket member is a firing pin 62, while the smaller rear end of the socket is slidably mounted on a reduced portion of a firing rod 63 threaded in an axial opening 26 in the stock. The front end of the rod has a head 64 to prevent the socket member from escaping from it. The socket member and firing rod are assembled by slipping the rod and its head 64 sideways into the socket through a slot 64a in its side wall, and then a cap 65 is placed over the head to prevent it from sliding out through the slot. A coil spring 66 inside the socket is compressed between the firing pin and the cap 65 to normally hold the pin and socket member in advanced position on the rod.

When guard sleeve 3 is pushed forward around barrel 6, socket member 59 is held stationary by the engagement of its shoulder 63 with plugs 57, but firing rod 63 moves forward in the socket member and thereby compresses firing spring 66 in the socket. If the firing rod is in retracted position, as shown in Fig. 8, the rear ends of the socket and breechblock will strike stop washer

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55 at the same time and nothing will happen. On the other hand, if the firing rod has been screwed ahead in the stock by turning arm 38 to the position shown in Fig. 9, a shoulder 67 on the rod will strike the rear end of the socket member 59 before the stop washer engages the breechblock extension. Continued rearward movement of the breechblock (or forward movement of the stock) will cause the socket shoulder 60 to force plugs 57 outward until the shoulder can slip forward past them. The firing spring then will drive the socket member and firing pin forward, and the pin will detonate the cartridge 14. When the barrel and arm 38 are released, the outer spring 53 will push the breechblock forward with sufficient force to push the plugs forward over shoulder 60 to their normal position in front of it.

With either of these tools, the speed or force with which the barrel and guard sleeve are telescoped is immaterial, because it is the firing spring that drives the firing pin into the cartridge. That spring is made strong enough to guarantee detonation every time.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring, a rod carried by the stock and projecting axially from the front end of it in line with said breechblock passage, a firing pin slidably connected to the front end of the rod and projecting forward therefrom, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, means including a coil spring behind the pin urging the pin forward relative to the rod, the rear end of the coil spring being movable forward with the stock toward the barrel, means supported by the breechblock for arresting forward movement of the front end of the coil spring while the stock is being moved forward toward the barrel to compress said coil spring a predetermined amount, and means releasing the front end of the coil spring when forward movement of said stock is continued after the coil spring has been compressed said predetermined amount.

2. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring, a rod carried by the stock and projecting axially from the front end of it in line with said breechblock passage, a firing pin slid-

7. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring, a rod carried by the stock and projecting axially from the front end of it in line with said breechblock passage, a firing pin slidably connected to the front end of the rod and projecting forward therefrom, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, a collar slidably mounted on the rod behind the pin, a coil spring encircling the rod and urging the collar forward to push the pin forward on the rod, a plurality of transversely arcuate members supported by the breechblock, a retaining element encircling the front ends of said members, the rear ends of said members being provided with radial projections on their inner surfaces for engagement by the front of the collar when the stock is moved forward to compress the coil spring, and a trip member movable forward with the stock for striking the collar while said stock continues to move forward, said members being adapted to be moved outward by the collar when it is struck by said forwardly moving trip member, whereby the collar will slip forward past said projections and be driven forward on the rod by means of the coil spring.

8. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring, a rod carried by the stock and projecting axially from the front end of it in line with said breechblock passage, a socket member slidably mounted on the rod and projecting forward from it, a firing pin carried by the front end of the socket member, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, a coil spring in the socket compressed between the firing pin and the rod, a radial projection on the outer surface of the socket member, means supported by the breechblock for engaging said projection to hold said member stationary while said rod is moved forward by the stock toward the barrel to compress the coil spring in the socket, and a stop movable forward with the rod to engage the socket member, said holding means being yieldable radially so as to permit the stop to push the socket member past said means after the stop strikes the socket member, whereby the coil spring will expand and drive the socket member and firing pin forward.

9. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting

from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring, a rod carried by the stock and projecting axially from the front end of it in line with said breechblock passage, a socket member slidably mounted on the rod and projecting forward from it, a firing pin carried by the front end of the socket member, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, a coil spring in the socket compressed between the firing pin and the rod, a shoulder encircling the socket member, the breechblock being provided with a rearwardly extending tubular extension provided with radial holes through it, plugs slidably mounted in said holes and projecting from their inner ends in front of said shoulder, whereby when the sleeve is pushed forward around the breechblock the plugs will hold the socket member stationary and the coil spring will be compressed in the socket, a stop movable forward with the stock to engage the socket member while said stock continues to move forward, and resilient means urging the plugs inward and adapted to yield to permit the plugs to be moved outward by said shoulder when the socket member is struck by said forwardly moving stop, whereby the shoulder will slip forward past the plugs and allow the socket member and firing pin to be driven forward by the expanding coil spring.

10. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring and being provided with a threaded opening in line with said passage, a rod threaded in said opening and projecting from its front end, a firing pin slidably connected to the front end of the rod and projecting forward therefrom, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, said rod normally being retracted in said opening to keep said pin from projecting through said passage in case the stock and breechblock are accidentally moved toward each other toward firing position, a collar slidably mounted on the rod behind the pin, a coil spring encircling the rod and urging the collar forward to push the pin forward on the rod, means supported by the breechblock adapted to be engaged by said collar to hold the collar stationary while the stock is moved forward toward the barrel to compress the coil spring, a turning member for said rod adapted to be turned manually in one direction for screwing the rod forward in said threaded opening a predetermined distance so that said pin can project through said passage when the breechblock is in firing position, a trip member movable forward by the rod to engage the stationary collar, said means being yieldable radially so as to permit said collar to pass said means after said trip member strikes the collar, and means operative automatically when said turning member is released for turning said rod in the opposite direction to return it to its retracted position.

11. An explosively actuated driving tool comprising a stock, a sleeve projecting rigidly from the front of the stock, a breechblock slidably

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mounted in the sleeve and provided with an axial passage therethrough, a spring between the stock and breechblock urging the breechblock forward in the sleeve, a barrel connected with the front end of the breechblock and projecting from the sleeve, the stock being movable forward toward the barrel manually against the resistance of said spring and being provided with a threaded opening in line with said passage, a rod threaded in said opening and projecting from its front end, a socket member slidably mounted on the rod and projecting forward from it, a firing pin carried by the front end of the socket member, a coil spring in the socket compressed between the firing pin and the rod, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, said rod normally being retracted in said opening to keep said pin from projecting through said passage in case the stock and breechblock are accidentally moved toward each other toward firing position, a radial projection on the outer surface of the socket member, means supported by the breechblock for en-

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gaging said projection to hold said member stationary while said rod is moved forward by the stock toward the barrel to compress the coil spring in the socket, a turning member for said rod adapted to be turned manually in one direction for screwing the rod forward in said threaded opening a predetermined distance so that said pin can project through said passage when the breechblock is in firing position, the rod being provided with an abutment movable forward with the rod to engage the socket member, said means being yieldable radially so as to permit said projection to pass said means after the socket member is struck by said abutment, and means operative automatically when said turning member is released for turning said rod in the opposite direction to return it to its retracted position.

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No references cited.