Feb. 7, 1961 S. A. TEMPLE ET AL 2,970,314

EXPLOSIVELY ACTUATED NAIL DRIVING TOOL

Original Filed April 9, 1957 4 Sheets-Sheet 1

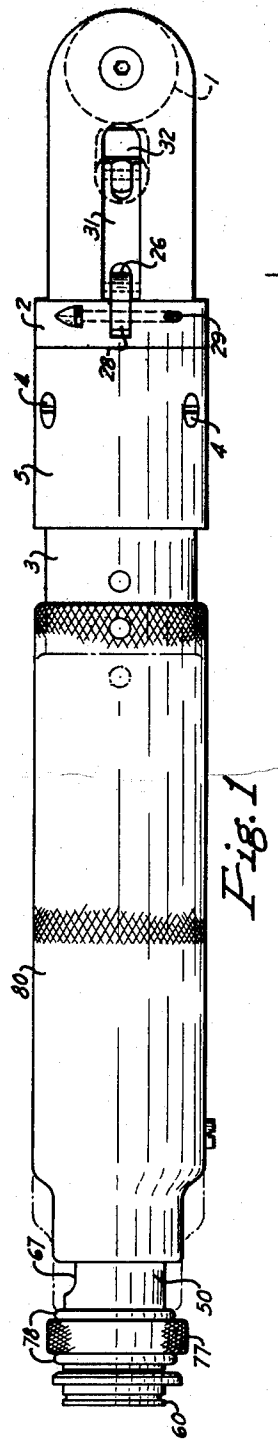


Fig. 1

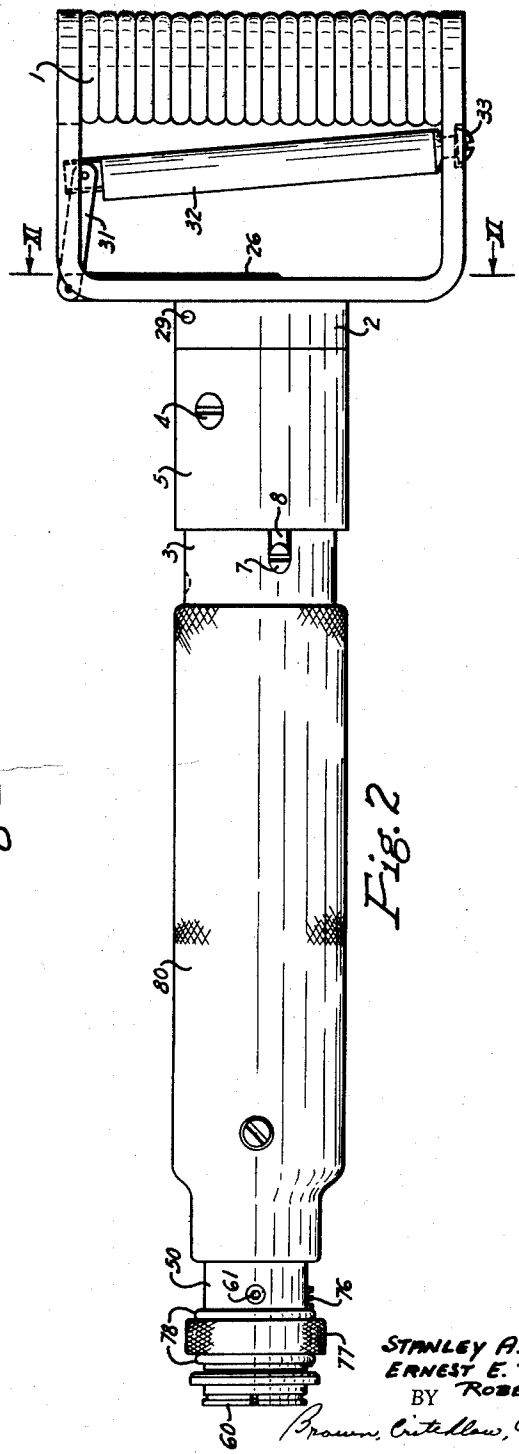


Fig. 2

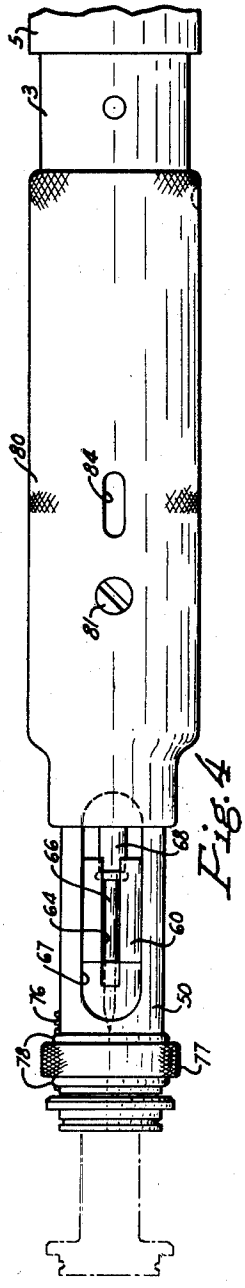


Fig. 4

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EXPLOSIVELY ACTUATED NAIL DRIVING TOOL

Original Filed April 9, 1957 4 Sheets-Sheet 2

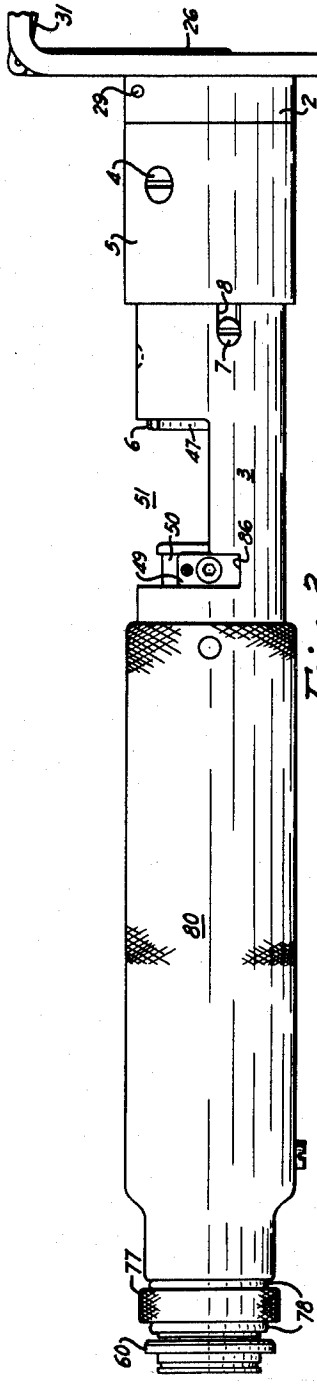


Fig. 3

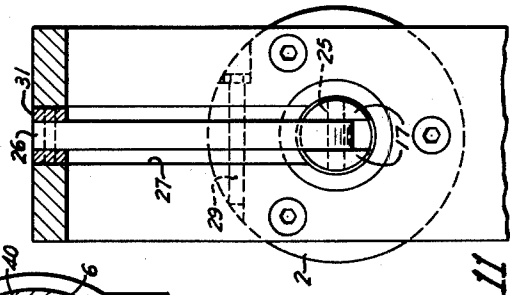


Fig. 11

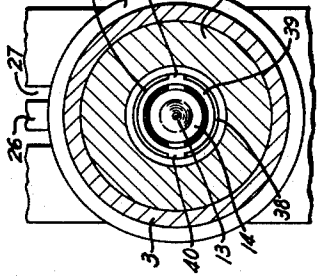


Fig. 12

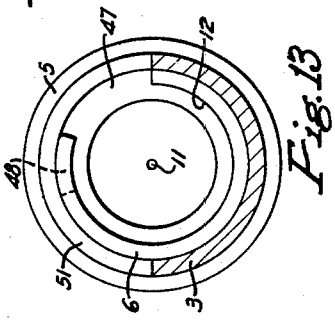


Fig. 13

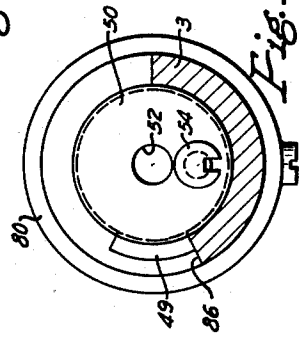


Fig. 14

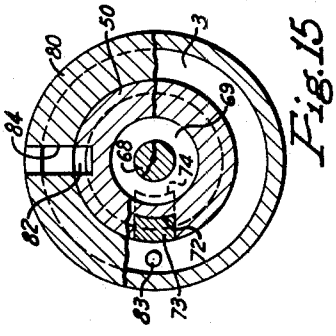


Fig. 15

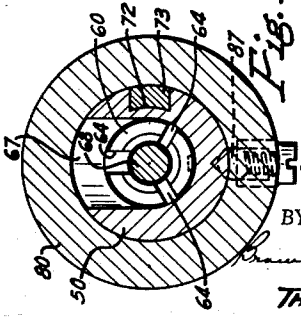


Fig. 16

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EXPLOSIVELY ACTUATED NAIL DRIVING TOOL

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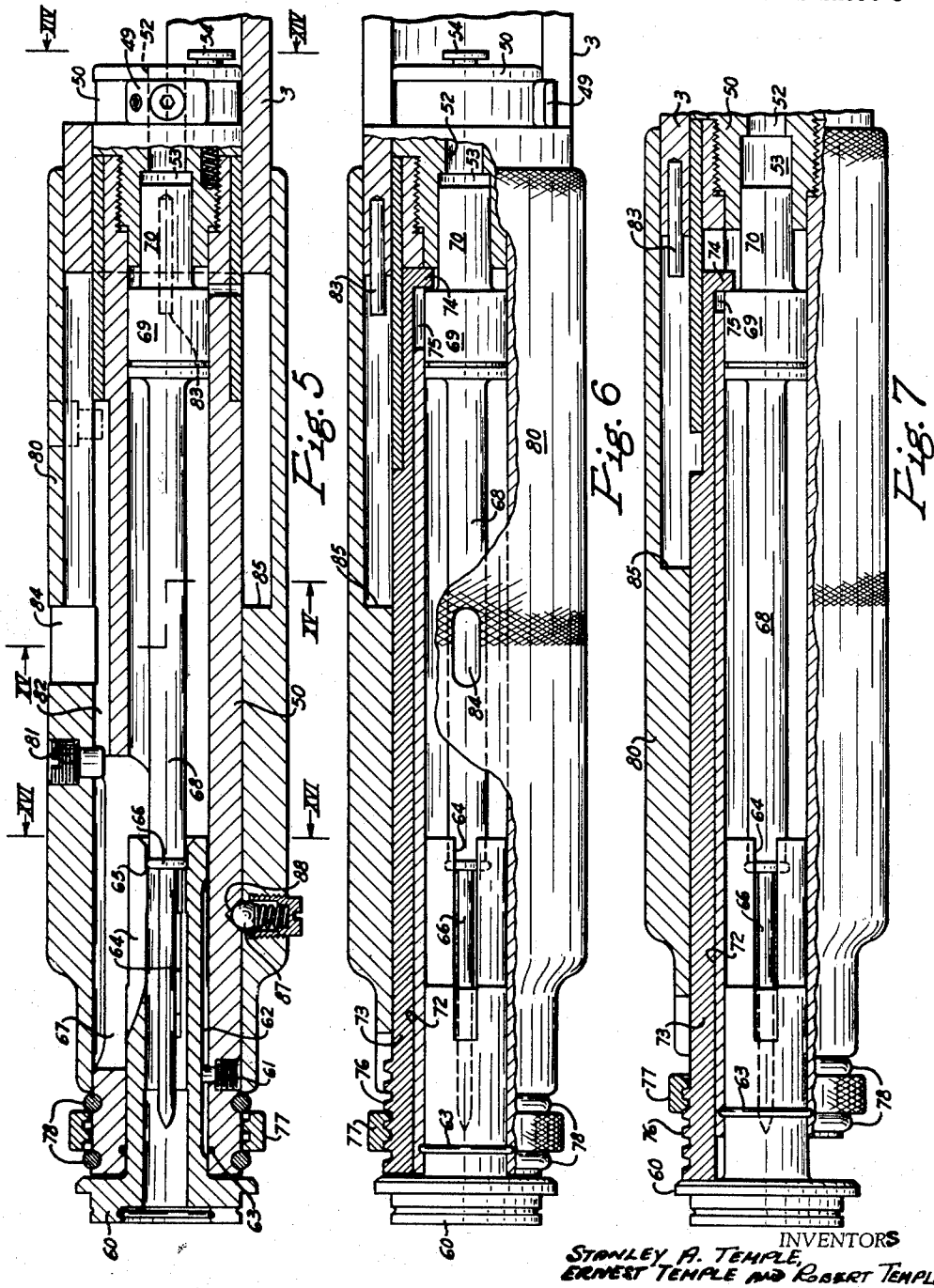


Fig. 5

Fig. 6

Fig. 7

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EXPLOSIVELY ACTUATED NAIL DRIVING TOOL

Original Filed April 9, 1957 4 Sheets-Sheet 4

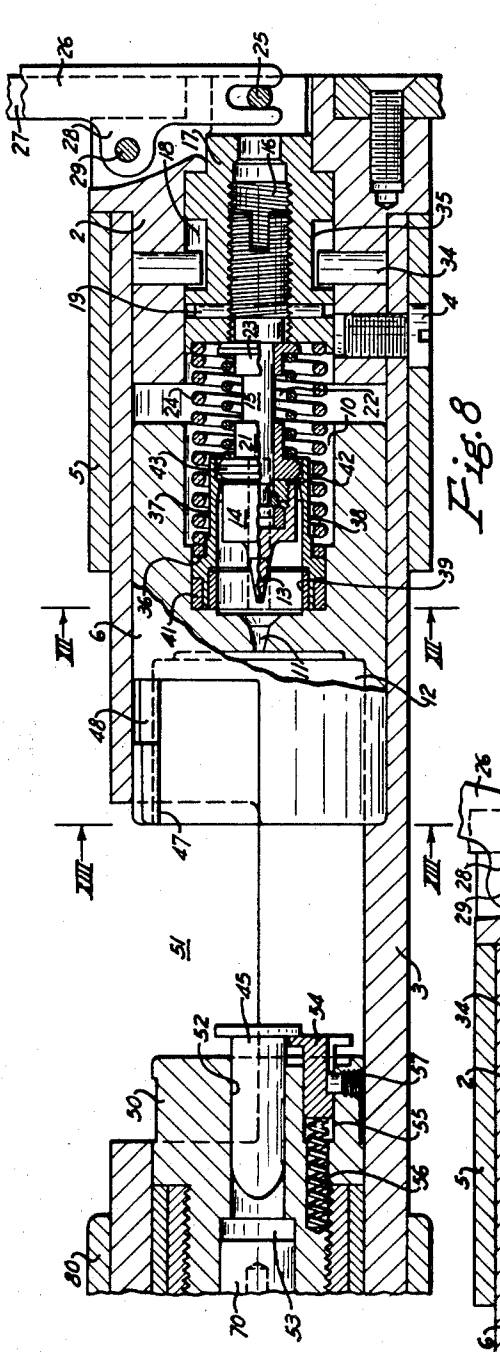


Fig. 8

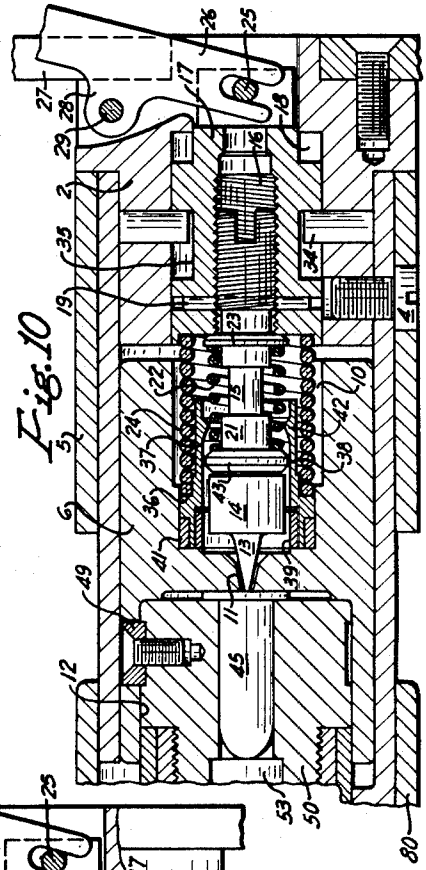


Fig. 10

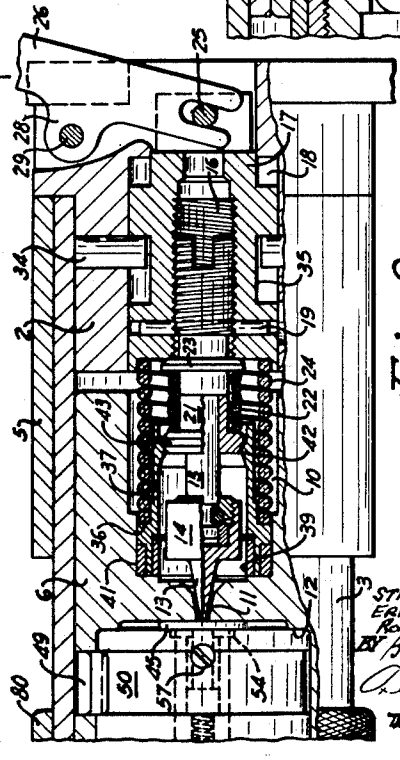


Fig. 9

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2,970,314

EXPLOSIVELY ACTUATED NAIL DRIVING TOOL

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Original application Apr. 9, 1957, Ser. No. 651,718, now Patent No. 2,930,042, dated Mar. 29, 1960. Divided and this application Mar. 26, 1958, Ser. No. 727,019

1 Claim. (Cl. 1—106)

This invention relates to explosively actuated tools for driving fastening members, and more particularly to such a tool designed primarily for driving nails. It is a division of our copending application, Serial No. 651,718, filed April 9, 1957, now Patent No. 2,930,042, granted March 29, 1960.

It is among the objects of this invention to provide an explosively actuated tool which can drive nails, which cannot be operated accidentally, which is easy to load, in which all of the parts are permanently connected together, and in which the act of using the tool renders the safety feature inoperative so that the tool will fire.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

Fig. 1 is a plan view of the tool;

Fig. 2 is a side view thereof;

Fig. 3 is a fragmentary side view showing the tool opened for cartridge loading;

Fig. 4 is a fragmentary plan view showing the tool opened for fastener loading;

Fig. 5 is an enlarged vertical longitudinal fragmentary section of the tool as shown in Fig. 3;

Fig. 6 is a view similar to the preceding figure, but looking down on the tool;

Fig. 7 is a view similar to Fig. 6, but with the piston and chuck adjusted forward;

Fig. 8 is an enlarged vertical longitudinal fragmentary section of the tool as shown in Fig. 3;

Fig. 9 is a similar section, but with the tool in firing position with the firing pin spring fully compressed just before it is released;

Fig. 10 is a view like Fig. 9, showing the firing pin driven ahead into firing position;

Fig. 11 is an enlarged vertical section through the handle taken on the line XI—XI of Fig. 2;

Figs. 12 and 13 are reduced vertical sections taken on the lines XII—XII and XIII—XIII, respectively of Fig. 8; and

Figs. 14, 15 and 16 are vertical sections taken on the lines XIV—XIV, XV—XV and XVI—XVI of Fig. 5.

Referring to Figs. 1 to 3, 8 and 11 of the drawings, the stock of the tool is in the form of a D-handle, provided with a hand grip 1. Opposite the grip, the stock has a forwardly projecting body portion 2 extending into the rear end of a carrier tube 3 that is held in place by three cap screws 4, the heads of which are disposed in holes in a cylindrical collar 5 encircling the rear end of the tube. The cap screws also hold the collar in place. Slidably mounted in the carrier tube directly in front of the stock is a breechblock 6 that is prevented from rotating in the tube by a cap screw 7 projecting from it into a longitudinal slot 8 in the side of the tube. (Figs. 2 and 3.)

As shown in Fig. 8, the rear end of the breechblock is provided with a deep socket 10 that is connected by an axial passage 11 with a larger socket 12 in the front end of the block. A firing pin 13 is disposed in the rear socket in line with passage 11. It projects from the

front end of a cup 14 slidably mounted on the front end of a rod 15, the rear end of which is screwed into a threaded opening 16 extending through a slide 17 that is disposed in an axial bore 18 through the stock body. The rod is held in the correct position in the slide by a pin 19 extending through both of them. The rod and slide form a firing pin support. The firing pin is urged forward on the rod by means of a firing collar 21 slidably mounted on the rod behind it and pressed forward by a coil spring 22 compressed between it and a trip ring 23, which is also slidably mounted on the rod.

The inoperative or safety position of the firing pin is one in which the pin, although held in its foremost position on the rod by spring 22, is still maintained retracted far enough by the rod to prevent it from projecting through breechblock passage 11 even if the breechblock is accidentally pushed back in the carrier tube as far as it will go. This safety position of the firing pin is shown in Fig. 8, which shows slide 17 in its rear position, where it normally is held by a coil spring 24 compressed between it and the breechblock that simultaneously is held in its front position. In order to move the firing pin forward into firing position, the slide has to be moved forward in the stock. For this purpose the rear end of the slide is bifurcated and provided with a cross pin 25 straddled by the forked lower end of a lever 26. The lever extends upwardly through a slot 27 in the stock and has an intermediate forwardly projecting lug 28 that is pivotally mounted on a pin 29 in the upper part of the stock body. As shown in Fig. 2, the upper end of the lever is pivotally connected by a link 31 to the upper end of a gripping lever 32, the lower end of which is pivotally connected to the bottom of the handle by a screw 33 extending through an enlarged opening in the handle. The gripping lever is inclined upward and forward away from the handle grip 1. Consequently, when the gripping lever is squeezed by the fingers toward the grip behind it, the lower end of slide lever 26 is swung forward to push the slide ahead in the stock, as shown in Fig. 9. Forward movement of the slide is limited by radial pins 34 projecting from the stock body into an annular recess 35 around the outside of the slide. The moment the operator releases gripping lever 32, the slide is pushed back to its original position in the stock by means of coil spring 24.

The front end of spring 24 bears against a shoulder 36 encircling the front end portion of a firing spring compressor that is formed in four parts. Two of the parts form segments 37 and 38 of a hollow cylinder, with their side edges spaced apart and with their front ends engaging the front wall of the rear breechblock socket. The front ends of these members are recessed and fit around a retaining ring 39, which has rearwardly extending ears 40 (Fig. 12) that project between the side edges of the segmental members. The front ends of these members are encircled by a spring clip 41. Near their rear ends, the insides of the segmental members are provided with arcuate shoulders 42 that are tapered in cross section. These shoulders are adapted to be engaged by a tapered shoulder 43 on the firing collar when it is moved forward in the breechblock.

Further forward movement of the rod 15 through the firing collar will cause the firing spring to be compressed, as shown in Fig. 9 where the spring is shown fully compressed because the stock and carrier tube have been pushed forward relative to the breechblock to a point just short of firing. The trip ring 23 is in contact with the firing collar, and the firing pin lightly engages a blank cartridge 45 in front of it. Now, when the stock is pushed ahead only a slight amount, the trip ring 23

will force the firing collar 21 to expand the spring compressor and slide past its shoulders 42, which is permitted by the fact that the segmental members 37 and 38 are anchored only at their front ends and only by a spring clip that permits their rear ends to be forced apart. The released firing collar is then driven by the firing spring 22 forward with considerable force against the firing pin cup 14, as shown in Fig. 10, which thereby is driven forward on the rod to cause the firing pin to penetrate and detonate the percussion cap in the rear end of the cartridge.

The side wall of the front socket 12 in the breechblock is cut away to form a large notch 47, as shown in Figs. 8 and 13, and the same wall at one edge of this notch is provided with a circumferential slot 48 for receiving a boss 49 screwed onto the side of the rear end of a barrel 50 slidably and rotatably mounted in carrier tube 3. A bayonet joint is thus formed between the barrel and breechblock, which can be disconnected by rotating the barrel to swing the boss out of the slot so that the rear end of the barrel can be moved forward out of the socket. The upper half of the carrier tube 3 is cut away for a short distance in front of the breechblock to form an opening 51 giving access to the rear end of the barrel when it is in its forward position. The front wall of this opening is engaged by boss 49 to limit the distance the barrel can be moved forward, as shown in Fig. 3.

The rear end of the axial bore through the barrel is reduced in diameter to form a chamber 52 for receiving the blank cartridge previously mentioned, as shown in Figs. 5, 8 and 10. A short length of the bore directly in front of this chamber has a diameter intermediate that of the chamber and the rest of the bore to form a combustion chamber 53. The rear end of the barrel may be provided at one side of the cartridge chamber with a cartridge extractor 54 (Figs. 8 and 14) slidably mounted in a small bore 55 extending forward into the barrel. The extractor is urged rearwardly by a coil spring 56 compressed between its inner end and the inner end of the bore, but outward movement is limited by a set screw 57.

Slidably mounted in the front end of the barrel is a tubular chuck 60 for receiving a fastener that is to be driven by this tool. Although the tool can be used for driving studs and other types of fasteners, it is designed primarily for driving nails. The front end of the chuck is enlarged to limit the distance it can be pushed into the barrel. It cannot be removed entirely from the barrel because a set crew 61 in the side of the barrel projects into a longitudinal groove 62 in the side of the chuck. As shown in Figs. 5 to 7, the chuck is frictionally engaged by a spring ring 63 mounted in a groove in the inside of the barrel, so that the chuck will stay in any position in which it is placed relative to the barrel. The rear half of the chuck is separated into three segments by longitudinally extending slots 64. Near its rear end, the inside of the chuck is provided with a shoulder 65, the rear face of which is adapted to be engaged by the head of a nail 66, that extends forward through the chuck. The segments of the chuck will spread apart enough to allow the head to pass the shoulder when the tool is fired.

When it is desired to insert a nail in the chuck, the chuck is pulled out of the barrel as far as it will come (the broken line position of Fig. 4), and then the nail can be inserted in its rear end through a rather wide slot 67 in the side wall of the barrel. The upper slot 64 in the chuck is wide enough to allow the nail to enter the chuck at an angle. The chuck is then pushed back into the barrel, when the head of the nail will engage the front end of a plunger to hold the head against chuck shoulder 65 with the point of the nail centered in the chuck. The front part of the plunger is a piston rod 68, the rear end of which is joined to a piston 69 that has a reduced rear extension 70 fitting in the combustion chamber. In its high pressure or rear position shown in Figs. 5 and 6, the rear end of the piston extension is spaced only a short distance from the rear end of the combustion chamber. When the cartridge is fired, the gases expanding in this chamber will drive the piston ahead, and the piston rod will drive the nail through the chuck and into the member against which the front end of the chuck is held. The piston will be stopped by the chuck if it is not stopped sooner by the nail coming to rest. The outer end of the chuck is designed for holding a shield, if desired.

Another feature of this invention is that the size of the combustion chamber can be varied in order to control the force with which the nail is driven. Accordingly, as shown in Figs. 6, 7, 15 and 16, the outside of the barrel is provided with a groove 72 extending lengthwise of it for most of its length, and in this groove a small bar 73 is slidably mounted. The front end of the bar substantially engages the enlarged front end of the chuck. The rear end of the bar has a stop 74 that projects into the barrel through a slot 75 at the rear end of the groove. The stop projects behind the shoulder formed between piston 69 and its extension, and thereby limits rearward movement of the piston in the barrel. The outer surface of the front end of the bar is provided with several screw thread segments 76, a couple of which are engaged by the threads inside of a ring 77 rotatably mounted on the barrel. The ring may be prevented from moving lengthwise of the barrel by clamping rings 78 encircling the barrel at opposite ends of the ring.

When the threaded ring is turned, it will cause the bar to move lengthwise of the barrel groove. When the bar stop 74 is pulled ahead, it will push the plunger forward to increase the effective length of the combustion chamber behind the piston extension. At the same time, the front end of the advancing bar will push the chuck ahead, whereby the rear end of the chuck always remains the same distance from the piston behind it after the chuck has been loaded with a nail. It will be seen that when the bar is in its forward position, the size of the combustion chamber will be at its maximum, and the nail will be driven with the least force possible for the particular cartridge being used.

In order to cover the slot 67 in the side of the front end of the barrel while the tool is being fired, and also to cover the access opening 51 in the side of carrier tube 3 at the same time, a sleeve 80 is slidably mounted on the tube and barrel and is rotatably mounted on the tube. It is prevented from rotating on the barrel by means of a cap screw 81 that projects from the wall of the sleeve into a longitudinal groove 82 in the outside of the barrel, as shown in Fig. 5.

While the barrel is locked in the breechblock and the tool is being used, the sleeve is in its rearmost position, shown in Figs. 1 and 2. While in this position, the sleeve cannot be turned in order to unlock the barrel from the breechblock, because a positioning pin 83 projects forward from the front end of the wall of the carrier tube 3 and into a rearwardly opening recess 84 in the internal shoulder 85 that limits rearward movement of the sleeve. The recess is formed conveniently by cutting a radial slot in the wall of the sleeve. Before the barrel can be unlocked, the sleeve has to be slid forward a short distance to the dotted line position shown in Fig. 1, to release the recess from the positioning pin. Then the sleeve can be turned, which will rotate the barrel and unlock the bayonet joint. The sleeve is then pushed forward again, but this time it moves the barrel forward with it until the bayonet boss 49 strikes the front end of opening 51 in the carrier tube, as shown in Fig. 3. The sleeve then is turned farther to cause the boss to enter a circumferential notch 86 at the front end of the tube opening. The total rotation of the tube is 90°.

After a spent cartridge has been removed from the rear

end of the barrel, the sleeve is pulled backward on the barrel and tube to uncover the slot 67 in the front end of the barrel so that a nail can be inserted in the chuck, as shown in Fig. 4. Boss 49 in notch 86 will prevent the barrel from moving back with the sleeve. The sleeve is then slid forward again to its front position, in which a spring-pressed ball 87 projects from the sleeve into a tapered hole 88 in the side of the barrel (Fig. 5), and the barrel is loaded with a cartridge. The sleeve is then rotated to turn the barrel far enough to remove the boss from the tube notch, and then the sleeve is pulled backward on the tube again. Due to engagement of ball 87 with barrel hole 88, the barrel is pulled back with the sleeve and the rear end of the barrel enters the frount socket in the breechblock. The sleeve is then turned to move the boss into bayonet slot 48, after which the sleeve is pulled the rest of the way back to cause the positioning pin 83 to enter the sleeve recess 84. The tool is then ready to use again. It has the appearance of the one shown in Figs. 1 and 2.

In operation, after the tool has been loaded the front end of the tubular chuck 60 is placed flat against the object into which a nail is to be driven. The hand grip 1 then is pushed forward while the gripping lever 32 is squeezed against the handle to cause the lower end of slide lever 26 to push the slide 17 forward in the stock. This will move shoulder 43 up close to shoulders 42 on the inside of the segmental members 37 and 38. As the stock is pushed further forward, movement of the rod 15 through the firing collar 21 will cause the firing spring 22 to be compressed, as shown in Fig. 9. In that figure the spring is shown fully compressed because the stock and carrier tube 3 have been pushed forward relative to the breechblock 6 to a point just short of firing. The trip ring 23 is in contact with the firing collar, and the firing pin lightly engages a blank cartridge 45 in front of it. Now, when the stock is pushed ahead slightly, the trip ring 23 will force the firing collar shoulder 43 to expand the spring compressor and slide past its shoulders 42, which is permitted by the fact that the segmental members 37 and 38 are anchored only at their front ends and only by a spring clip 41 that permits their rear ends to be forced apart. The released firing collar 21 is then driven forward by the firing pin 22 with considerable force against the firing cup 14, as shown by Fig. 10, which thereby is driven forward on the rod to cause the firing pin to detonate the percussion cap in the rear end of the cartridge.

The tool disclosed herein is very safe to use. It can be quickly loaded with both a cartridge and a nail without removing any of the parts. Longitudinal and a quarter turn movement is all that is necessary for opening or closing the tool. The safety prevents accidental discharge of the tool, because as long as lever 26 is in its normal position the firing pin is held too far back to strike the cartridge even if the barrel is pushed back in the stock accidentally, such as by dropping the tool on its muzzle. The safety is released automatically when the handle and lever 32 are gripped in the hand to use the tool. Even if lever 26 is held in operative position by tying lever 32 back against the handle, the tool will not be discharged accidentally by dropping on its muzzle because, as shown in Fig. 10, fully compressed coil spring 24 will prevent breechblock 6 and the firing pin from being pushed back far enough for cup 14 to strike the front end of firing rod 15. The plunger adjustment makes it possible to vary the force exerted against nails, without changing the powder charge used in the cartridges. Therefore, one type of cartridge can be used for all work, without danger of overdriving or underdriving the nails. This tool is especially designed for driving nails, which, of course, are driven into wood and therefore require less driving force than studs that are driven into concrete or metal. Accordingly, the nails are driven by the plunger pushing against them, rather than by a free piston that would be propelled through the barrel at high velocity until it struck the nails.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I 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.

I claim:

An explosively actuated driving tool comprising a stock, a tube projecting rigidly from the front of the stock, a breechblock slidably mounted in the tube and provided with an axial passage therethrough, a spring urging the breechblock forward in the tube, a barrel connected with the front end of the breechblock and projecting from the tube, the stock being movable forward toward the breechblock against the resistance of said spring when the barrel is held stationary and being provided with an opening in line with said axial passage, a firing pin support slidably mounted in said opening and projecting from its front end, a firing pin slidably mounted on the front end of said support and projecting forward therefrom, said pin being adapted to be driven forward in said passage to detonate an explosive cartridge, said pin support 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, a collar slidably mounted on said pin support behind the pin and engageable with the pin, a coil spring behind the collar urging it forward with the stock toward the barrel, means supported by the breechblock for arresting forward movement of said collar while the stock is being moved forward toward the barrel to compress said coil spring a predetermined amount, means releasing said arresting means from said collar when forword movement of said stock is continued after the coil spring has been compressed said predetermined amount, a lever pivotally connected with the stock, means operatively connecting one end of the lever to the rear end of said pin support for sliding it forward in said opening a predetermined distance, and means operatively connected to the opposite end of said lever and adapted to be actuated manually for swinging said one end of the lever forward so that said pin can project through said passage when the stock has been moved toward the breechblock and said collar has been released, the maximum distance that the stock can be moved away from the breechblock being less than the distance axially of the tool between said released arresting means and released collar while said pin support and stock are in their forward positions, whereby said lever must be released before the tool can be cocked again.

References Cited in the file of this patent

UNITED STATES PATENTS

2,213,435	Temple	Sept. 3, 1940
2,622,243	Temple et al.	Dec. 23, 1952