

April 10, 1956

D. T. PHILLIPS ET AL

2,740,965

STUD DRIVING TOOL

Filed Feb. 29, 1952

5 Sheets-Sheet 1

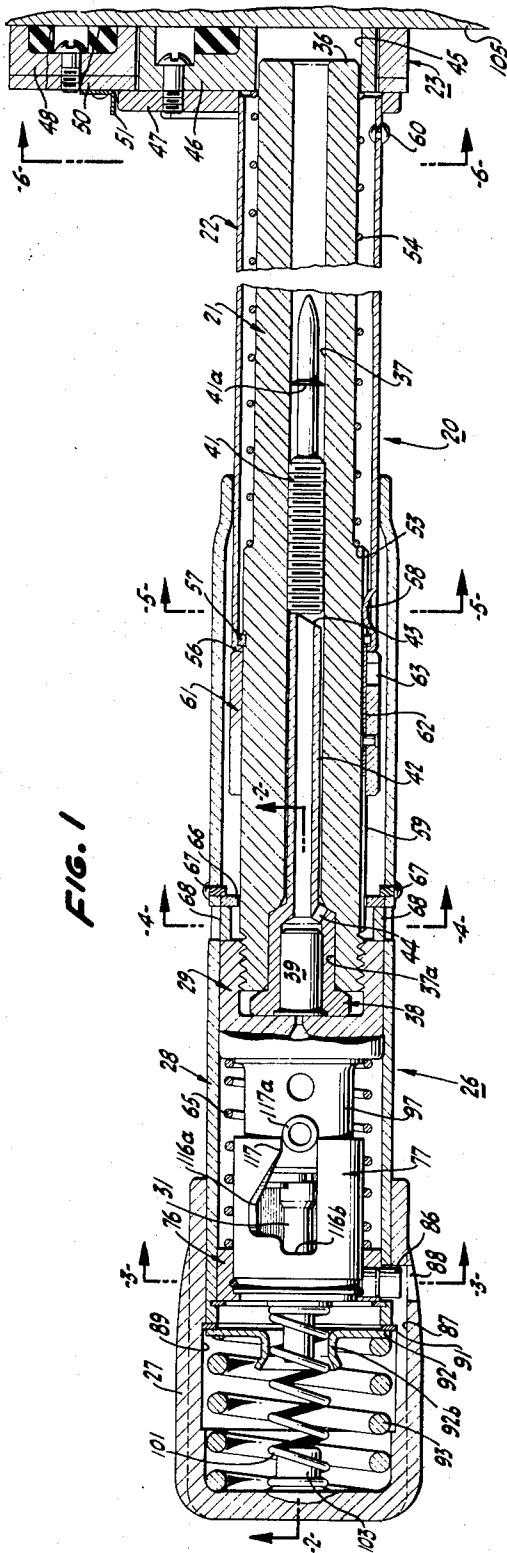


FIG. 1

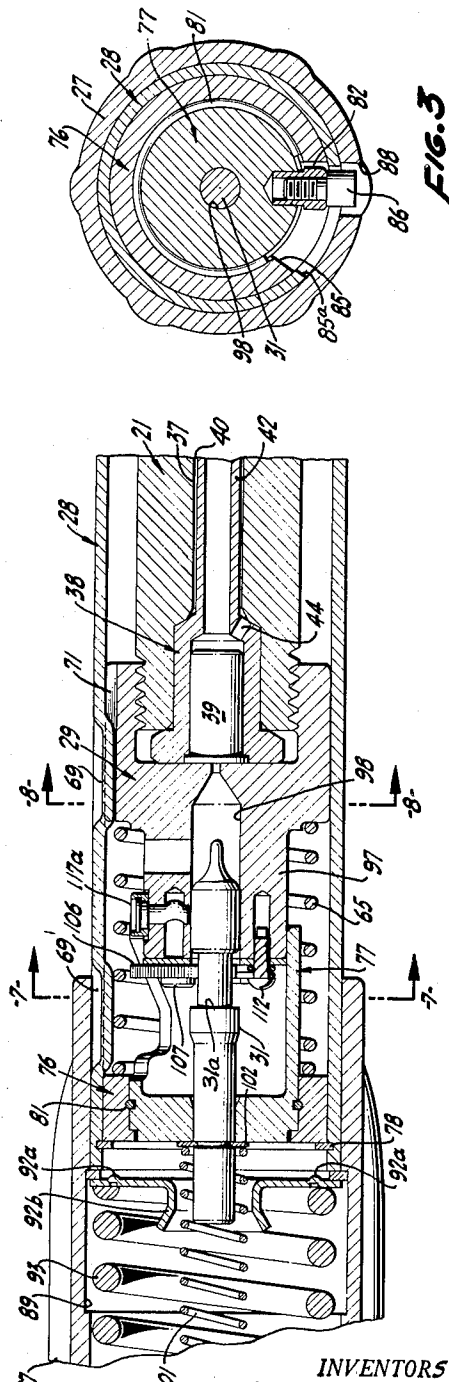


FIG. 2

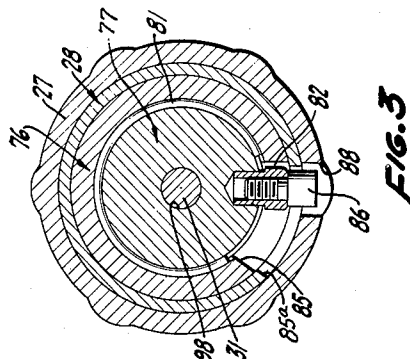


FIG. 3

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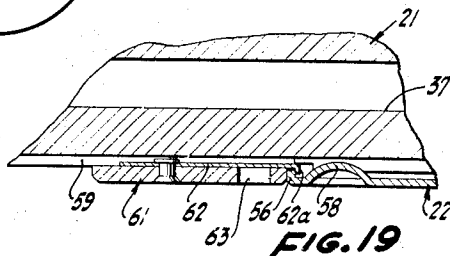
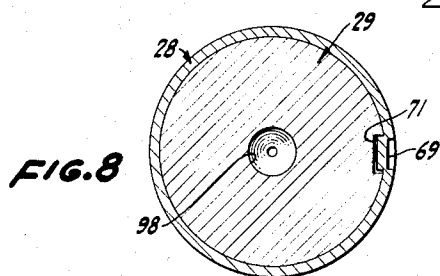
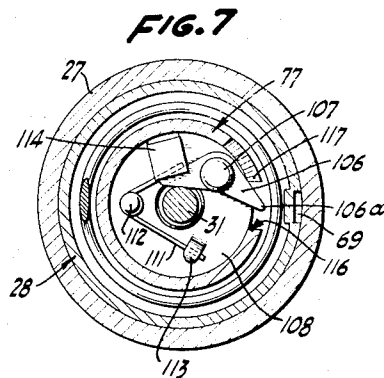
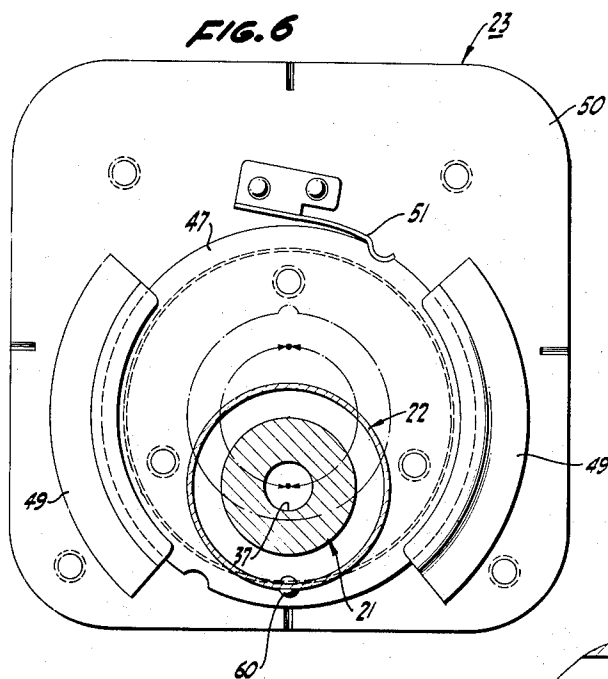
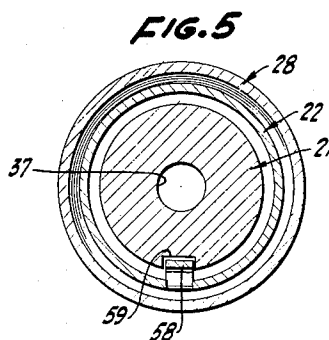
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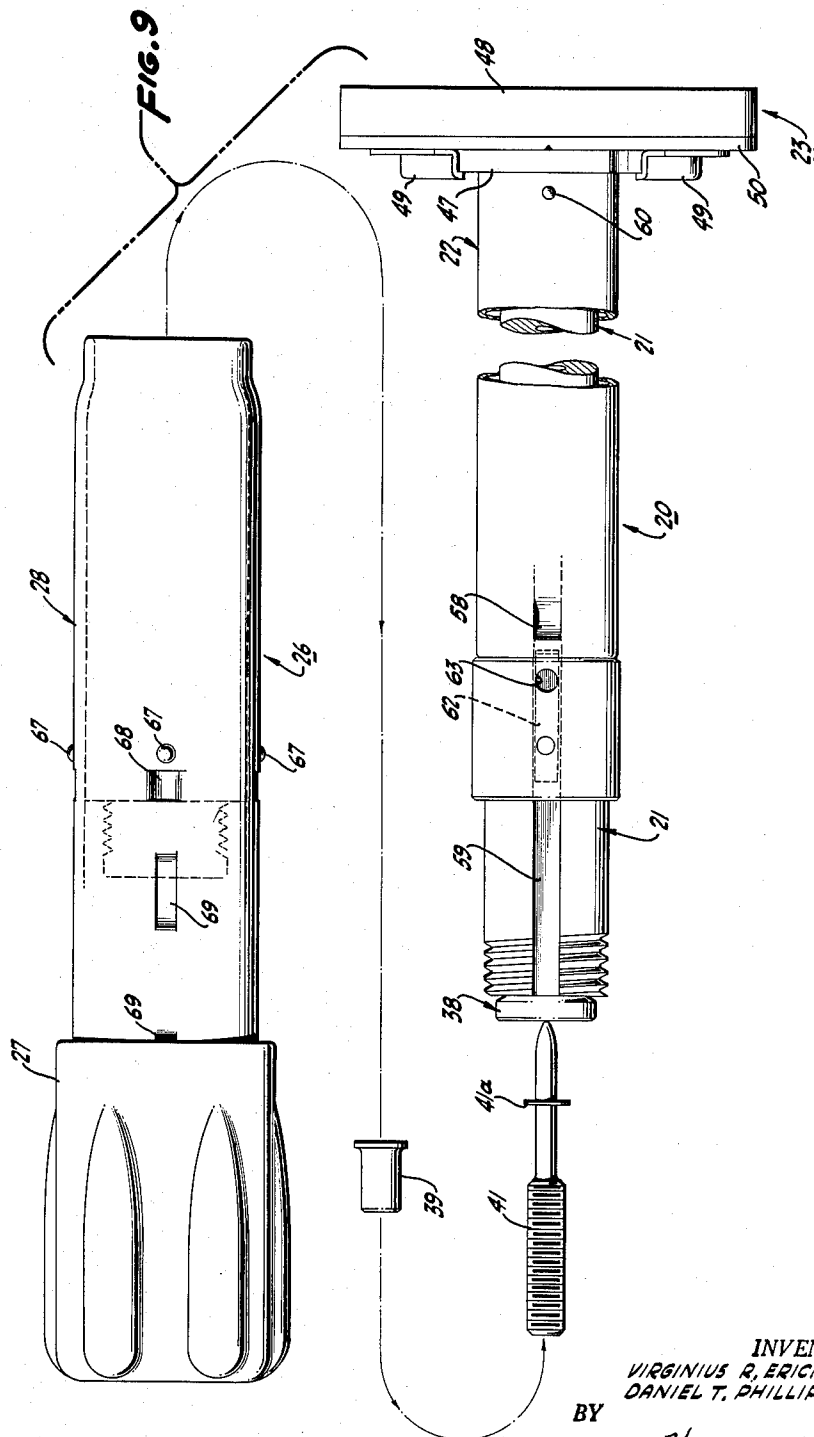
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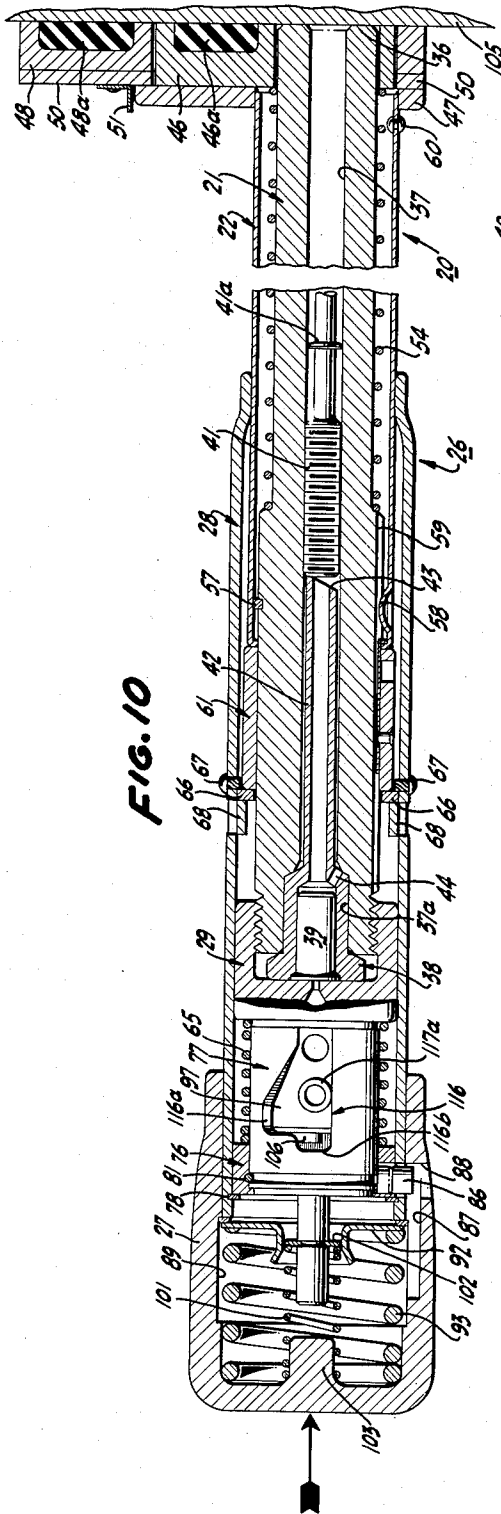


FIG. 10

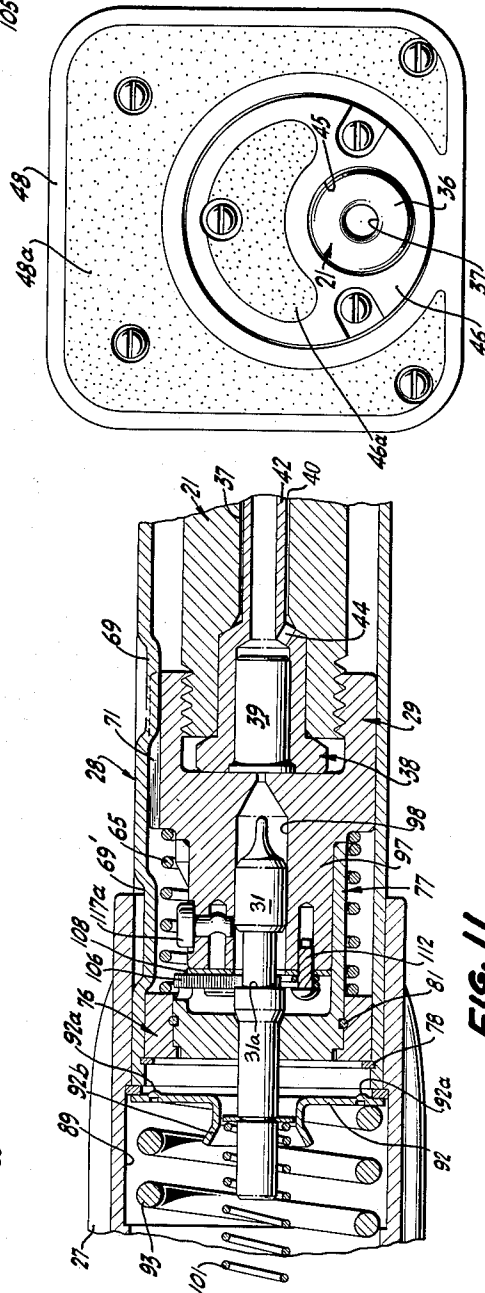


FIG. 11

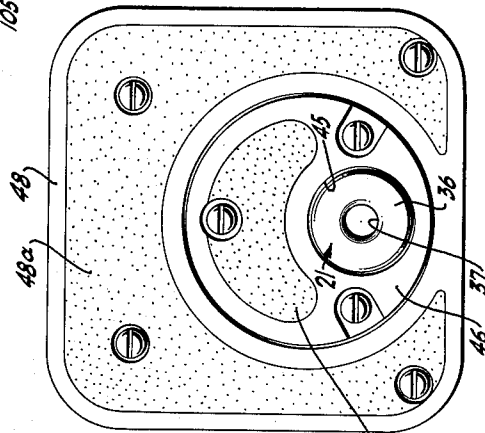


FIG. 12

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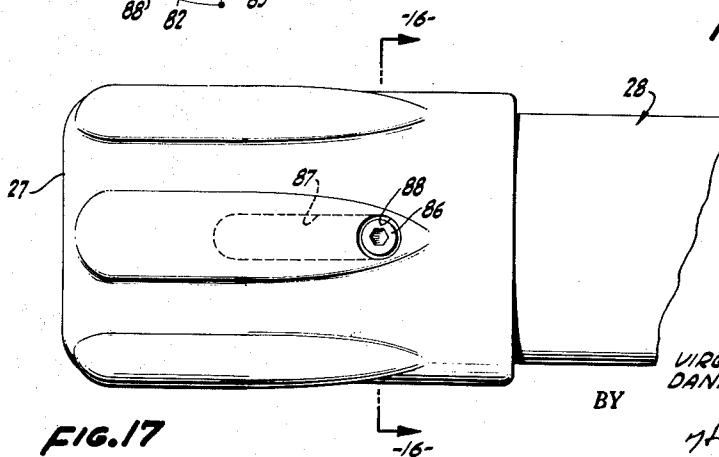
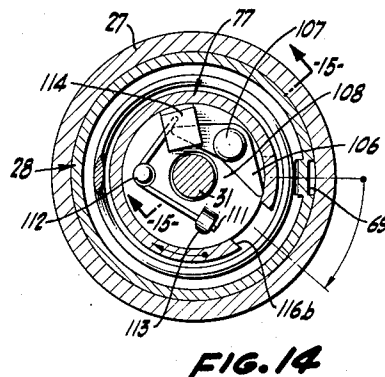
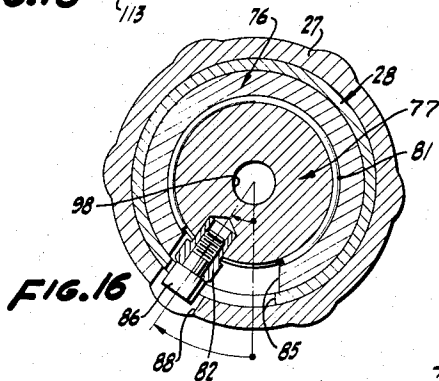
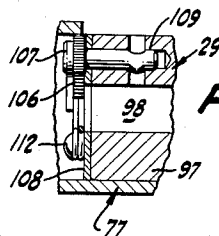
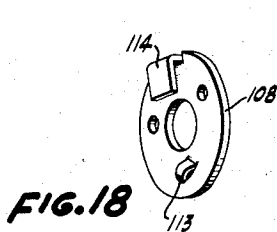
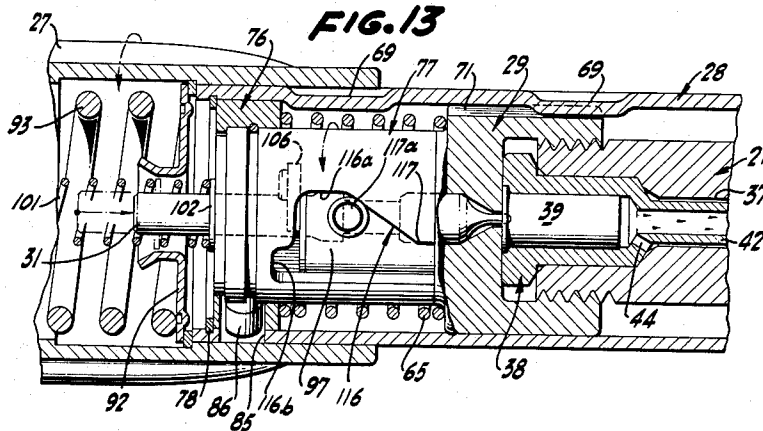
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STUD DRIVING TOOL

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Application February 29, 1952, Serial No. 274,172

3 Claims. (Cl. 1—106)

The present invention is concerned with the explosively actuated stud driving tools and relates more particularly to an improved construction thereof which reduces the size of the tool for a given caliber of an explosive shell and provides for a reduced cost of manufacture.

The above and other objects of the invention are attained as described in connection with a preferred embodiment of the invention, in which:

Figure 1 is a longitudinal sectional view through the tool.

Figure 2 is a fragmentary sectional view on an enlarged scale taken in a plane indicated by the line 2—2 in Figure 1.

Figure 3 is a transverse sectional view taken in the plane indicated by the line 3—3 in Figure 1.

Figure 4 is a transverse sectional view taken in a plane indicated by the line 4—4 in Figure 1.

Figure 5 is a transverse sectional view taken as indicated by the line 5—5 in Figure 1.

Figure 6 is a sectional elevational view taken as indicated by the line 6—6 in Figure 1.

Figure 7 is a transverse sectional view taken as indicated by the line 7—7 in Figure 2.

Figure 8 is a transverse sectional view taken as indicated by the line 8—8 in Figure 2.

Figure 9 is a composite elevational view showing the two halves of the tool separated.

Figure 10 is a longitudinal sectional view similar to Figure 1 but illustrating the tool at one stage of the firing operation in which the front and rear halves have been telescoped together as the first step in conditioning the tool for firing.

Figure 11 is a sectional view similar to Figure 2 but showing the tool in the same condition as illustrated in Figure 10.

Figure 12 is an elevational view of the surface engaging face of the safety pad.

Figure 13 is a sectional view similar to Figures 2 and 11 but showing the parts of the tool as positioned at the moment of firing.

Figure 14 is a transverse sectional view similar to Figure 7 but showing the firing pin released from its latch.

Figure 15 is a fragmentary detail section taken on the line 15—15 in Figure 14 with the firing pin omitted from the view.

Figure 16 is a sectional view taken in a plane indicated by the line 16—16 in Figure 17.

Figure 17 is an elevational view of the handle with certain details shown in dotted lines.

Figure 18 is a perspective detail view of the trigger disk.

Figure 19 is an enlarged portion of Figure 1 illustrating the relation of the sleeve extension and its latch spring.

In general the tool shown in the instant application is of the type described and claimed in the co-pending applications of Smith and Daugherty, Serial No. 124,078, filed November 28, 1949, and Erickson and Bullwinkle,

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Serial No. 130,318, filed December 2, 1949, and issued as U. S. Letters Patent No. 2,679,645, on June 1, 1954, and Serial No. 135,744, filed December 29, 1949.

Referring to Figures 1 and 9, the tool comprises two detachably connected parts including a front or barrel half 20 having a barrel 21, a safety pad mounting sleeve 22 and a safety pad 23 carried thereby, and a rear half 26 including handle 27, a housing 28 and a firing pin carrier 29 in which a firing pin 31 is mounted. In Figure 1 the two halves are shown in the assembled condition and in the position of the parts which will be referred to as the normal or expanded position.

Referring to the front or barrel half of the tool as shown in Figures 1 and 9 the barrel 21 includes a muzzle end 36 and a central longitudinal bore 37 of conventional construction which terminates in an enlarged bore 37a to receive a removable breech plug or power insert 38. The breech plug serves as a mounting for a cartridge 39 while the bore 37 of the barrel serves as a mounting for a stud 41 having a frictional retainer 41a. The plug 38 is provided with a tubular extension 42 extending into the bore 37 of the barrel and having a beveled end 43 which serves to push the stud 41 to a desired position in the barrel. Clearance space is provided between the outer surface of the extension 42 and the barrel and one or more apertures 44 extend through the plug 38 to an annular clearance space 40 at a location beyond the end of the cartridge 39. The apertures 44 and the clearance space 40 provide passage means to the exterior of the plug extension 42 to provide for flow of the explosive gases to equalize pressure and prevent splitting of the extension. The beveled end 43 provides passage means at the outer end for the same purpose. The breech end of the barrel is externally threaded to be attached to the firing pin carrier 29 at its recessed front end.

The muzzle end 36 of the barrel is disposed within an aperture 45 of the safety pad structure 23. The structure 23 comprises a central circular recessed pad portion 46 (Figures 1, 6 and 12) bolted to a similar frame plate 47 which is secured as by brazing about the front end of safety pad sleeve 22. The aperture 45 is in off center position with respect to the pad portion 46. Journalled about the eccentric center pad portion 46 is an outer recessed pad portion 48 and outer frame plate 50 journalled eccentrically about pad portion 46 by swivel guides 49 overlying the plate 47. The pad portion 46 and 48 carry suitable rubber inserts 46a and 48a bonded within their respective recesses. The detachable mounting of the pad portions 46 and 48 provides for replacement of these parts, when required, due to damage resulting from firing of the tool. The outer frame plate 50 carries a spring latch 51 for engaging suitable notches in the plate 47.

The above structure provides for adjustment of the barrel with respect to the safety pad as disclosed in said application, Serial No. 130,818.

The safety pad structure including the sleeve 22 is carried by the barrel and spring urged outwardly with respect thereto, selective means being provided to enable extension of the barrel for installing studs in recesses. As seen in Figure 1, the barrel is reduced in diameter adjacent the muzzle end to provide a seat or shoulder 53 for a safety pad spring 54, which seats at its other end against the member 46 of the safety pad structure thus spring urging the safety pad and its sleeve 22 outwardly. The limit or normal position as shown in Figure 1 determined by engagement of the flanged end 56 of the sleeve 22 with a conventional split retainer ring 57 carried by a groove in the barrel. Also an inwardly formed lug or key 58 of the sleeve 22 engages in a longitudinal groove 59 of the barrel to hold the parts against relative rotation.

Means is provided to prevent removal of the safety

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pad structure from the barrel. Such means comprises a rivet 60 (Figure 1) in the sleeve 22 whose inside head will engage the shoulder 53 of the barrel as a stop upon movement of the sleeve 22 rearwardly along the barrel. By virtue of the two limit stops comprising the flange end 56 of the sleeve 22 and the rivet 60, attempted removal of the safety pad structure when the barrel is disassembled from the remainder of the tool is prevented.

Detachably connected to the safety pad sleeve 22 is a sleeve extension 61 carrying a longitudinally leaf spring 62 (Figures 1 and 19) which seats within the groove 59 of the barrel and has a latch end or lip 62a which engages behind the inturned flange 56 of the sleeve 22 and holds the sleeve extension against it. The sleeve extension 61 also serves to prevent misalignment of sleeve 22 and prevents firing of the tool unless perpendicular to the work surface as the sleeve extension 61 will bind and prevent sliding movement of the safety pad sleeve 22 when the tool is not held perpendicular to the work surface. The extension 61 is apertured at 63 to provide access to the spring 62 so that the spring can be flexed to disengage its lip from the safety pad sleeve in the event it is wished to disassemble the sleeve extension 61 and use the tool without it. When the sleeve extension is omitted, the safety pad structure is allowed to recede further with respect to the barrel before initiating a firing sequence, thereby allowing firing into recesses.

The rear half of the tool includes the handle 27, the housing 28, and the firing pin carrier 29, and certain firing control parts referred to hereinafter. The carrier 29 (Figures 1 and 2) is urged forwardly by a spring 65, which seats at its other end against a retainer ring 76 referred to hereinafter. The housing 28 (Figures 1 and 4) carries a stop ring 66 for the carrier which is secured in place between four drive screws 67 and four inwardly struck lugs 68 of the housing 28. The housing is also formed with two inwardly struck guide lugs or keys 69 and 69', (Figures 2 and 8) the right hand one 69 of which engages in a longitudinal groove 71 in the firing pin carrier 29. The firing pin carrier 29 is thus connected slidably and non-rotatably to the housing 28. The lug 69' at the left in Figure 2 and also shown in Figure 7 serves as a guide in installing the control cam 77. At its rear face the retainer ring 76 is held in place about a split stop ring 78 seated in a suitable groove in the housing 28.

The control cam or member 77 (Figures 1 and 2) has its forward cylindrical end engaging over the reduced end 97 of the firing pin carrier 29 and is connected at its rearward end to its retainer ring 76 and the housing 28. This retainer ring 76 (Figures 2 and 3) is locked against axial displacement with respect to control cam 77 by an annular wire 81 seating in mating grooves of the ring 76 and the cam 77. An internally threaded sleeve 82 (Figures 1, 3 and 16) is silver soldered in place in the control cam 77 and carries a cap screw 86. The head of the screw 86 and the sleeve 82 engage in respective circumferential slots 85 and 85a in the periphery of the retainer ring 76 and the housing 28. The handle 27 engages over the end of the housing 28 and is held in place by the head of the screw 86 engaging in a longitudinal slot 87 (Figures 1 and 17) in the handle. An aperture 88 at one end of the slot provides for insertion or removal of the screw 86.

The handle 27 (Figures 1 and 2) is provided with an internal annular groove 89 in which an expanding type split retaining ring 91 seats. This ring is abutted by a keeper plate 92 (Figures 1 and 2) having four struck out portions 92a to maintain its central position and having an internal sleeve portion 92b flared at the end for a purpose later described. A recoil spring 93 is seated within the handle and seats against the keeper plate 92.

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The rearward portion 97 (Figures 1 and 2) of the firing pin carrier is reduced and is centrally apertured at 98 to receive the firing pin 31 which has a firing pin spring 101 seated between a stop ring 102 on the firing pin and a lug 103 on the handle. The sleeve portion 92b of the plate 92 serves as a guide for this spring.

Means is provided for latching the firing pin against firing movement and this means comprises a trigger 106 (Figures 2 and 7) pivoted on a stud 107 mounted in the firing pin carrier and also serving to retain a trigger disk 108 (Figures 2, 7 and 18) in place. The stud 107 (Figure 15) is deformed into a threaded hole 109 and thereby retained in place. The trigger 106 (Figure 7) is spring urged to active position by a torsion spring 111 mounted about a drive screw 112 and having it ends retained in place by respective ears 113 and 114 of the trigger disk. As seen in Figure 7 an arm 106a of the trigger disk is disposed in a slot 116 of the control cam 77 adjacent a cam surface 117 thereof. The slot 116a serves with a cam roller 117a on the firing pin carrier 29 to control or provide for relative rotation between these parts.

In the use of the tool, with the barrel half and the handle half separated as shown in Figure 9, the stud is first inserted into the bore 37 of the barrel 21 and then the breech plug inserted 38 with a cartridge 39 therein is inserted in place, the tubular extension 38a of the insert forcing the stud 41 ahead of it to the desired location along the barrel. The tool is then reassembled in the condition shown in Figure 1 and the safety pad is placed against the surface 105 into which the stud is to be driven. The operator then pushes against the handle 27 and the first thing that occurs is the compression of spring 54, the safety pad spring, until the barrel itself engages the surface 105 at its muzzle (see Figure 10). Thereafter continued pressure on the handle 27 will cause this handle, the housing 28, and the control cam 77 to telescope or slide longitudinally with respect to the assembly comprising the firing pin carrier 29 and the barrel 21 (see Figure 13). Strong recoil spring 93 is not compressed to an appreciable extent by this pressure, the entire movement being taken up by the firing pin carrier spring 65. As the firing pin carrier spring 65 is being compressed, the firing pin spring 101 is also compressed, the firing pin being held by its latch 106 (Figure 7). This relative rearward movement of the firing pin carrier with respect to the firing pin places the parts in the position shown in Figure 10 where the roller 117 on the firing pin carrier has moved from a narrow portion of the slot 116 into alignment with the enlarged portion 116a thereof thus permitting relative turning between the firing pin carrier and the control cam. This same movement carries the trigger latch 106 into the narrow portion 116b of the cam slot 116 of control cam 77 where such relative rotation can serve to release the firing pin from its latch.

The operator with a tool conditioned as shown in Figure 10, in which the roller 117a has been moved out of engagement with the narrow portion of the slot 116 and the tail of the ball 106 has been moved into the narrow portion 116b of the cam slot 116, then turns the handle counterclockwise as viewed from the rear end of the tool, and the control cam 77 through the screw 86, is also turned to place the parts in the position thereof shown in Figure 13, in which the ball 106 has been moved from the position shown in Figure 7 to the position thereof shown in Figure 14 whereby the firing pin 31 is released. The extent of turning movement is illustrated in Figure 16. This serves to release the firing pin 31 which under the urgency of its spring 101 will be driven forward to engage and fire the cartridge. As a result the stud is driven into the surface 105. The recoil force from the cartridge is transmitted through the firing pin carrier, the control cam 77 and the housing 28 to the spring 93 which partially absorbs such recoil.

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When the operator releases the handle, the spring 65 becomes effective to restore the parts to the position shown in Figure 1.

If the operator finds it necessary to fire into a recess such as a conduit receptacle, the sleeve extension 61 must be removed before assembling the tool. With the barrel half disassembled as illustrated in Figure 9, the operator inserts a rod or screw driver through the aperture 63 to disengage the latch spring 62 and permit withdrawal of the sleeve extension 61 rearwardly over the barrel. This does not effect the operation in firing the tool except to permit greater compression of the safety pad spring 54 to allow the barrel to extend beyond the safety pad until it contacts the bottom wall of the recessed structure.

While we have shown and described a preferred embodiment of the invention, it is apparent that the invention can be embodied in other forms so that its scope should be limited only by the scope of the claims appended hereto.

We claim:

1. In an explosively actuated stud driving tool having a forward end and a rearward end, a housing, a firing pin carrier carried for sliding movement in said housing, carrier spring means engaging said carrier and urging it forwardly of said tool, and an annular series of inwardly formed portions of said housing forming a stop for said carrier, said carrier having a longitudinal groove therein, and said housing having an inwardly formed portion forming a key engaging said groove.

2. In an explosively actuated stud driving tool having a barrel at its forward end, a housing at the rearward end of said tool, a firing pin carrier connected to said barrel for movement therewith and mounted for sliding movement relative to said housing, carrier spring means engaging said carrier and urging it forwardly of said tool, a firing pin mounted for sliding movement in said carrier, a firing pin spring interposed between the housing and means on said firing pin for urging said pin forwardly with respect to said carrier, a trigger latch on said carrier normally engaging said pin to restrain movement of said pin, a control member in said housing mounted for movement therewith to control firing of the tool and including means for moving said latch out of engagement with said pin, said control member

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and said housing being mounted for forward movement relative to said firing pin carrier in response to pushing engagement of the barrel of the tool with the surface into which the stud is to be installed, said forward movement bringing said control member into active relation with said firing pin carrier and said trigger latch, and means for re-engaging said latch with said pin.

3. In an explosively actuated stud driving tool having a forward end and a rearward end, a housing, a firing pin carrier carried for sliding movement in said housing, carrier spring means engaging said carrier and urging it forwardly of said tool, a firing pin slidably mounted in said carrier, a firing pin spring urging said pin forwardly with respect to said carrier, a trigger latch on said carrier normally engaging said pin to restrain movement of said pin, a cylindrical control cam in said housing having a cam slot extending inwardly from one end, said cam slot being defined on one side by a longitudinal straight edge and defined on the other side by a cam edge providing a narrow entrance portion, an enlarged intermediate portion and a narrow terminal portion, said cam being mounted for limited rotative movement to control firing of the tool and being disposed about a portion of said carrier, said carrier including an element normally disposed in the narrow entrance portion of said slot and said trigger latch including a part projecting into said slot, forward sliding movement of said housing and said cam relative to said carrier serving to place said element in said intermediate portion of said slot and said latch part in said narrow terminal portion, whereby rotation of the control cam is permitted and said control cam disables said latch upon rotation, and means for effecting re-positioning of said control cam upon returning movement thereof.

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