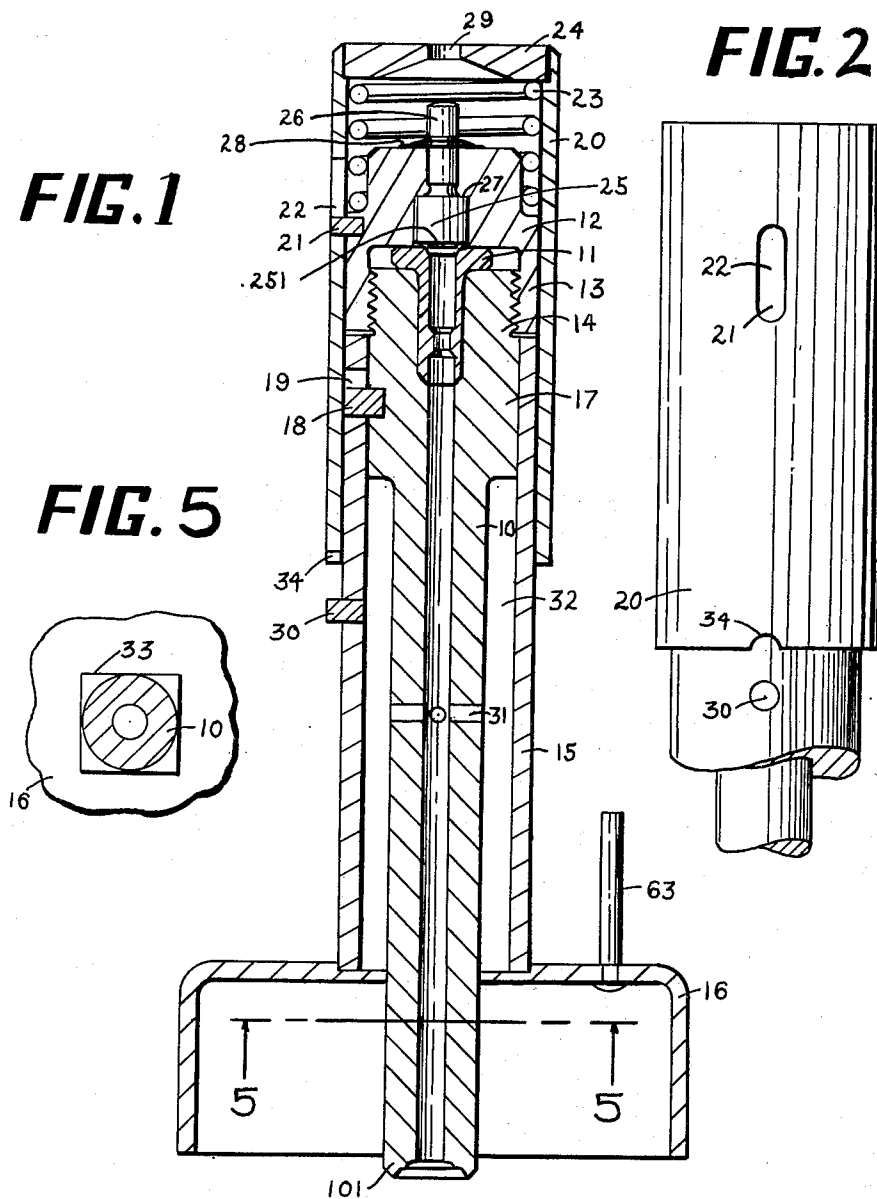


Filed Aug. 4, 1955

CARTRIDGE-POWERED TOOL

4 Sheets-Sheet 1



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Oct. 30, 1956

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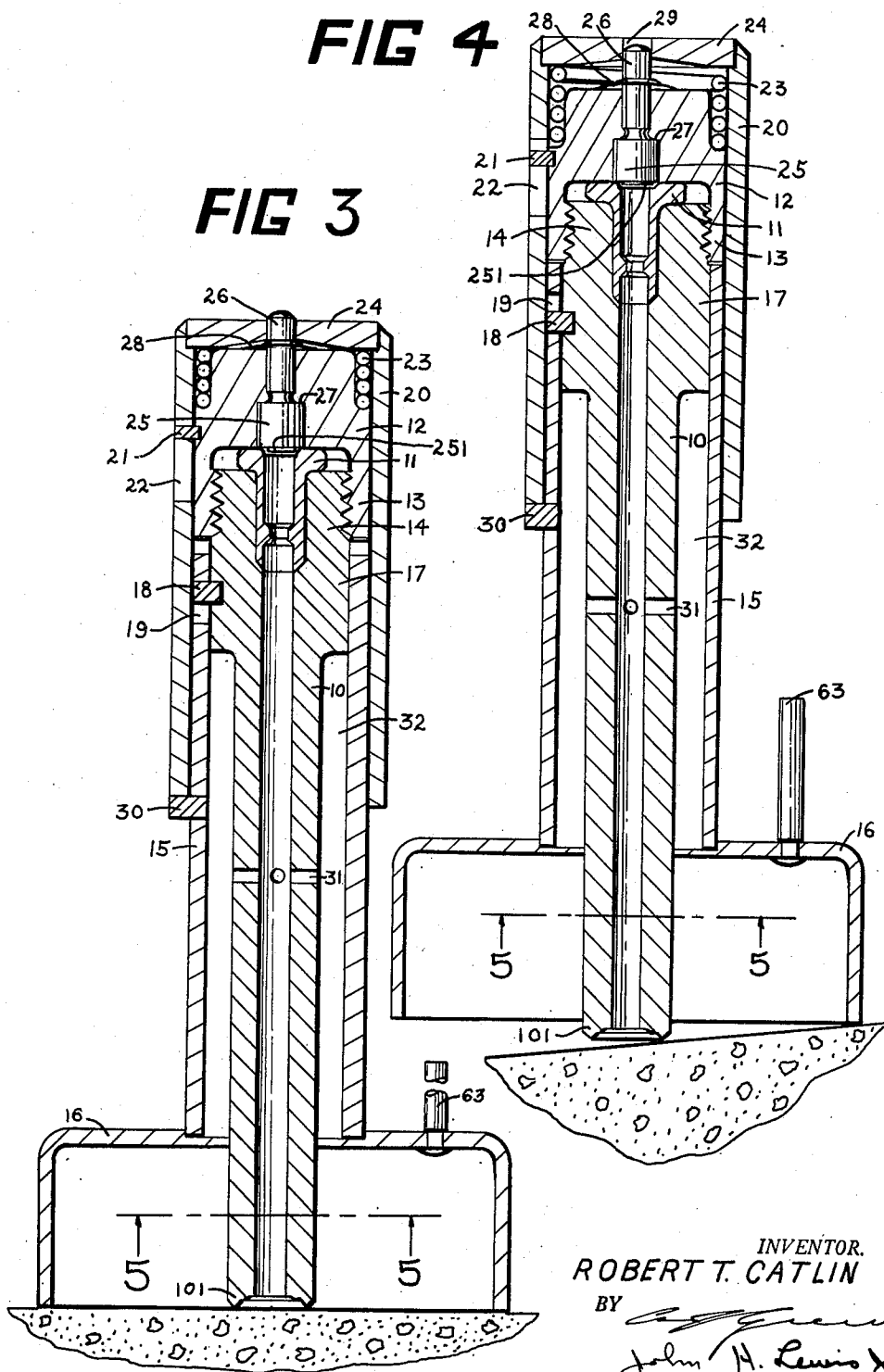
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Filed Aug. 4, 1955

4 Sheets-Sheet 2

FIG 4

FIG 3



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4 Sheets-Sheet 3

FIG 6

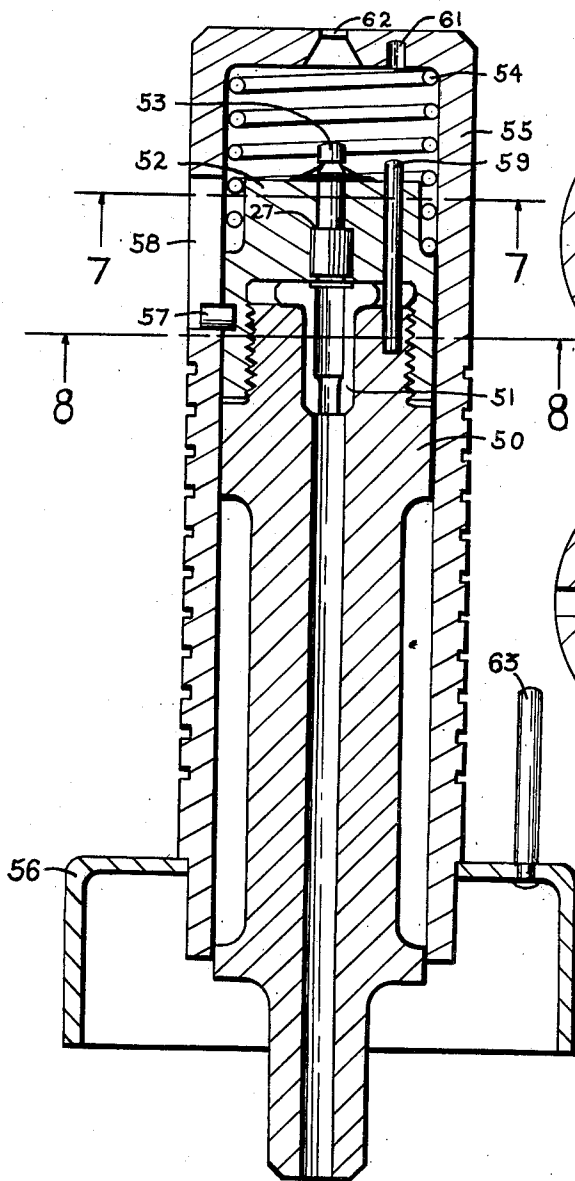


FIG 8

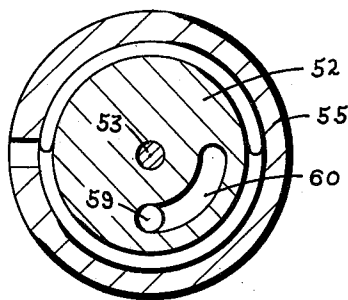
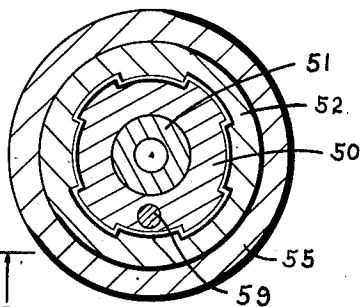


FIG 7

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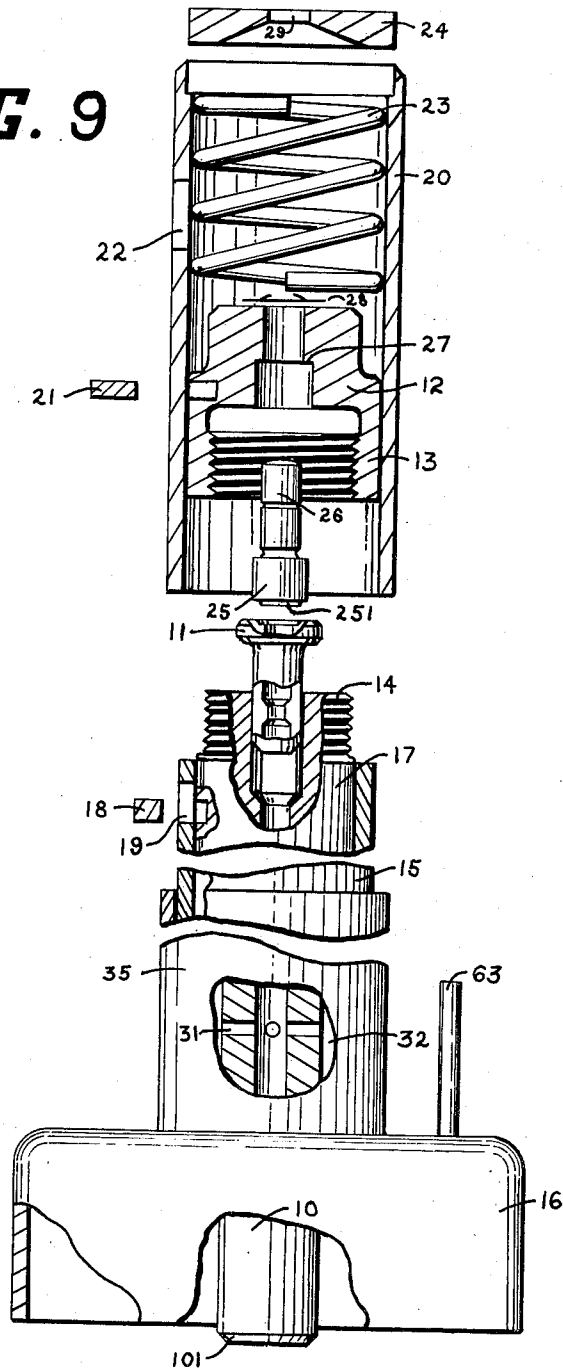
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4 Sheets-Sheet 4

FIG. 9



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CARTRIDGE-POWERED TOOL

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Application August 4, 1955, Serial No. 526,405

12 Claims. (Cl. 1—44.5)

This invention relates to powder actuated tools, and contemplates a simplified, rugged, low cost tool particularly adapted to the driving of fastening studs into difficultly penetrable materials, such as steel and aged concrete.

In the drawings:

Fig. 1 is a vertical sectional elevation of a tool comprising one embodiment of the invention, the tool being in "relaxed" or non-firing condition.

Fig. 2 is a fragmentary elevation of the tool shown in Fig. 1.

Fig. 3 is a sectional elevation of the same tool in firing condition.

Fig. 4 is a sectional elevation of the same tool illustrating the necessity for holding the tool substantially perpendicular to the work face to enable firing.

Fig. 5 is a fragmentary transverse section illustrating a minor modification, the section being substantially on the line 5—5 of Fig. 1.

Fig. 6 is a sectional elevation of a modification of the tool.

Fig. 7 is a transverse section substantially on the line 7—7 of Fig. 6.

Fig. 8 is a transverse section substantially on the line 8—8 of Fig. 6.

Fig. 9 is an exploded elevation, partly in section, illustrating a modification.

The tool comprises a barrel 10, the breech end of which is counterbored to receive a chamber bushing 11, which bushing is preferably but not necessarily of the type described in the co-pending application of Catlin et al., Serial No. 517,524, filed June 23, 1955. The breech block 12 preferably comprises an interiorly threaded skirt 13 which receives a threaded boss 14 on the barrel 10. The threads may be continuous, or they may be interrupted as shown in Fig. 8, to enable locking and unlocking of the breech by a quarter-turn of the breech block and associated parts. A lower housing 15 surrounds a major portion of the barrel and has secured to its forward end a guard 16 which may be of the plain box-type illustrated or may be transversely adjustable with respect to the housing, as described in the patent to Catlin et al., No. 2,700,764, February 1, 1955. Housing 15 is held for limited longitudinal movement on the barrel by suitable means such as a stud 18 projecting outwardly from the barrel and received in an opening 19 in the housing. An upper housing 20 surrounds the upper portion of the lower housing 15 and the breech block 12, movement of said upper housing relative to the breech block being provided and limited by means such as a stud or breech pin 21 extending outwardly from the breech block and received in a slot 22 in the upper housing. The upper end of the breech block is of reduced diameter, to provide an annular recess and shoulder for the reception and support of a spring 23 interposed between said shoulder and the inner face of the transversely disposed end wall 24 of the upper housing 20.

The breech block comprises a counterbored aperture adapted to receive a firing pin comprising a large diameter

2

lower end portion 25 and a smaller diameter upper end 26, the configuration of the firing pin conforming to that of the counterbored aperture therefor in the breech block. The firing pin may also comprise a short cartridge engaging tip 251 of substantially cartridge head diameter projecting from the end of part 25. The firing pin is urged upwardly against the shoulder 27 of said aperture by suitable means such as a spring washer 28 which may be a commercial Tinnerman nut, the peripheral portion thereof bearing against the end of the breech block, while the margin of the aperture therein is received in a peripheral recess in portion 26 of the firing pin. An aperture 29 in end wall 24 is aligned with the firing pin. It will be obvious that, the tool being in the condition illustrated in Fig. 3, a light blow on the projecting end 26 of the firing pin will drive the inner end of the firing pin against the head of a cartridge in the chamber, and thus fire the cartridge.

The construction is such that unless the barrel and breech assembly are displaced relative to the upper housing substantially to the limit allowed by the engagement of breech pin 21 with the upper end of slot 22, the firing pin remains inaccessible within the upper housing. The normal condition of the tool is shown in Fig. 1. Spring 23 is relaxed and thrusts the upper housing upward with respect to both the lower housing and the barrel, locating the end of the firing pin some distance within the end closure 24 of the upper housing. With the upper housing and the barrel urged to their opposite extents of reciprocation by spring 23, the barrel muzzle extends downwardly in advance of the guard 16. To render the firing pin accessible for a light blow, the barrel muzzle 101 must be disposed in the plane of the mouth of guard 16, as shown in Fig. 3. With the parts of the tool in the normal position shown in Fig. 1, the operator grasps the tool by the upper housing and advances the barrel muzzle into contact with the work face. If the tool has been presented to the work face substantially perpendicular thereto, continued downward pressure on the upper housing will cause the upper housing to move downwardly with respect to the barrel which is in abutment with the work face, thus compressing spring 23 until the bottom end of the upper housing engages abutment 30 associated with the lower housing. At this point, the mouth of guard 16 is in substantial facial engagement with the work face, and the parts of the tool are in the relative positions shown in Fig. 3.

When the tool is presented obliquely to a work face as shown in Fig. 4, it will be seen that the firing pin is not rendered accessible, and the tool therefore cannot be fired. As the tool is obliquely advanced toward the work face, an outer edge of the mouth of guard 16 will strike the work surface, stopping downward movement of the guard and the associated lower housing, and preventing disposition of the guard coplanar with barrel muzzle 101. Downward movement of the upper housing relative to the lower housing is limited by the abutment 30, and as long as the barrel is extended in advance of the mouth of the guard, the firing pin will not project through end cap 24 on the upper housing and cannot be struck. If the tool is now rocked to a position in which substantially the entire periphery of the mouth of the guard is brought in contact with the work face, the housing members will be moved downward relative to the barrel which impinges on the work face, and the guard and barrel muzzle will be coplanar, and the firing pin will protrude above the end cap of the upper housing as shown in Fig. 3. If the tool is tilted from the perpendicular with respect to the work face, one side of guard 16 will be raised relative to the barrel, and the housing members will move upwardly relative to the barrel which is maintained in contact with the work face by spring 23. This upward movement of

3

the housing members disposes end cap 24 above the end 26 of the firing pin, thus preventing impact of the firing pin. The muzzle 101 of the barrel projects outwardly from the plane of the mouth of guard 16. If the tool is now rocked to a position in which substantially the entire periphery of the mouth of guard 16 engages the work, the assembly of barrel, breech block and firing pin is thrust upwardly with respect to the upper housing to the position shown in Fig. 3, in which the end 26 of the firing pin projects outwardly from the housing.

It will be noted that the firing pin is simply a 2-diameter rod and that the end face of its enlarged end 25 engages substantially the entire end face of a cartridge in the chamber bushing 11, the counterbore of the chamber in said bushing being of such diameter as to receive tip 251 of the firing pin. The firing pin itself thus becomes the breech device which receives the rearward thrust of the cartridge case when fired; this thrust being transmitted to the breech block shoulder 27.

To reduce recoil, the barrel may be vented by providing therein one or more transverse apertures 31, giving access to the space 32 between the barrel and the lower housing. When this is done, it is desirable to provide means for venting gas from the space 32 into the guard. This may be conveniently done by providing in the back of the guard a square hole 33 for the reception of the barrel 10, as shown in Fig. 5. The mid-portion of the sides of the square serve as a barrel guide, while the corner portions provide venting openings between the space 32 and the interior of the guard.

Means may be provided for insuring a full engagement of the barrel threads with the breech block threads as a prerequisite to firing. This is particularly desirable when interrupted threads are used, as shown in Fig. 8. This means may comprise a notch 34 in the lower margin of upper housing 20 for the reception of the abutment 30 (see Fig. 2). It will be apparent that unless notch 34 is in alignment with abutment 30 the abutment will stop the downward movement of the upper housing in a position in which the end 26 of the firing pin does not project outwardly from the end closure 24 of the upper housing. If the breech block is a full revolution or thread removed from fully locked position, the firing pin stands too far from the cartridge head to engage it with sufficient force to effect ignition.

The lower housing previously described embodies an abutment 30 to limit downward movement of the upper housing. Fig. 9 illustrates a modified construction in which a sleeve member 35 of the same diameter as the upper housing is provided on the lower housing to serve as an abutment against which the upper housing is detented in downward movement. The sleeve 35, in the construction shown, is joined to the guard 16 and to the lower housing 15 by brazing or other means. The lower housing 15 may extend within sleeve 35 into junction with the guard 16, thus providing a double wall reinforced construction, or lower housing 15 may be cut off slightly below the top of sleeve 35 and fixed therein, in which case an increased volume is provided in space 32 for gases vented from the barrel by vents 31. Optionally, the upper housing, the lower housing, and the sleeve 35 may be made of standard seamless steel tubing of selected nesting sizes to reduce manufacturing costs. One advantage of the described construction resides in the fact that the upper housing has full 360 degree support about its axis when impinged against the sleeve 35, and recoil forces tending to lift the guard 16 are thus uniformly transmitted to the upper housing. Other forms of 360 degree abutments are easily contemplated. In one instance, a simple ring may be fixed on the lower housing to be engaged by the upper housing.

The modification shown in Figs. 6, 7 and 8, comprises a barrel 50, chamber bushing 51, breech block 52, firing pin 53, and action spring 54, comparable with those above described. This assembly is received in a one-

4

piece housing 55 secured to guard 56. A stud 57 projecting outwardly from breech block 52 enters a slot 58 in the housing, to enable and limit relative movement. An interrupted thread is used. A pin 59 secured to and extending upwardly from the breech end of the barrel is received in an arcuate slot 60 in the breech block and limits the relative rotation of breech block and housing. The end of pin 59 projects upwardly from the breech block and when the interrupted threads are fully engaged is in alignment with a recess 61 in the end wall of the upper housing. Only when pin 59 enters said recess can the upper housing be thrust forward with respect to the assembly therein to a position in which the end of firing pin 53 will project outwardly through aperture 62 in the upper housing end wall. As before, the barrel is of such length that its muzzle end must be displaced substantially into the plane of the mouth of guard 56 to enable firing.

To load the tool, the breech block is detached from the barrel by a rotation of the housing (in Figs. 1-5 the upper housing) relative to the barrel, and the assembly of breech block and housing is then removed, exposing the end of the barrel and the chamber bushing. If a cartridge has previously been fired, the fired shell is within the chamber bushing and must be removed. The pin 59 is a convenient fixture for this purpose, the chamber bushing with the shell therein being withdrawn from the barrel and thrust down over said pin. Optionally, a pin 63 for this purpose may be placed on the back of the guard, as shown in Fig. 1. The chamber bushing being empty and out of the barrel, the operator first drops into the barrel the stud to be driven, then replaces the chamber bushing, places a fresh cartridge in the chamber, applies the breech assembly to the barrel assembly, locks the breech by rotating the breech assembly on the barrel assembly, applies the tool to the work face substantially perpendicular thereto, thrusts the housing forward, to expose the firing pin, and strikes the firing pin a light blow with a hammer or other suitable tool.

It will be obvious that the tool as described is susceptible to variations and modifications, all within the scope of the appended claims.

What is claimed is:

1. An explosively actuated tool comprising a barrel having a breech end and a muzzle end, a cartridge receiving chamber in said barrel breech end, a breech block removably secured to the breech end of said barrel, said barrel and said breech block constituting an assembly, a firing pin reciprocally mounted in said breech block for impacting engagement with a cartridge in said chamber, said firing pin having a striking surface projecting above the surface of said breech block, a cover housing surrounding said assembly and comprising a sleeve portion and a closed end portion having therein a firing pin aperture, means mounting said housing on said breech block for limited longitudinal movement from a retracted position in which said firing pin is disposed completely within said sleeve portion inaccessible to impact to an advanced position in which said striking surface of said firing pin projects through said aperture and is accessible for impact, and spring means between said breech block and said cover housing urging said cover housing to retracted position.

2. Apparatus according to claim 1, comprising means for holding said firing pin in said breech block and biasing said firing pin toward the closed end of said upper housing.

3. An explosively actuated tool comprising a barrel having a breech end and a muzzle end; a cartridge receiving chamber in said breech end; a breech block removably mounted on said barrel, said barrel and said breech block constituting an assembly; a firing pin reciprocally mounted in said breech block for impacting engagement with a cartridge in said chamber, said firing pin having a striking surface projecting above the upper

5

6

surface of said breech block; a lower housing including a guard mounted on said barrel for limited longitudinal movement from a retracted position in which the muzzle end of said barrel is disposed in advance of said guard, to an extended position in which the muzzle end of said barrel is disposed substantially in the plane of the mouth of said guard; an upper housing mounted on said breech block for limited longitudinal movement and comprising a sleeve portion and a closed end having a firing pin aperture therein; said upper housing being longitudinally and rotationally movable with respect to said lower housing, an abutment on said lower housing, spring means urging said upper housing and said breech block in opposite directions of movement whereby said firing pin striking surface is disposed within said upper housing inaccessible to impact, said upper housing being movable into abutment with said lower housing to expose said firing pin striking surface through said aperture for impact when said lower housing is in said extended position.

4. Apparatus according to claim 3, in which said firing pin striking surface extends through the aperture in the end of said upper housing and is thereby rendered accessible for impact when said spring means is substantially fully compressed.

5. A stud driver comprised of a barrel having a chambered and an exteriorly threaded breech end and a muzzle end, a breech block having an interiorly threaded portion adapted to receive the threaded portion of said barrel, a firing pin reciprocally mounted in said breech block and having a striking surface projecting from said breech block, a lower housing surrounding said barrel and having an open-mouthed guard secured thereto, said lower housing being mounted on said barrel for limited longitudinal movement from a safe position in which said barrel projects from the mouth of said guard to a firing position in which the mouth of said guard is coplanar with the muzzle end of said barrel, an upper housing mounted for limited longitudinal movement and fixed against rotation on said breech block and comprising a cup-like element shrouding said breech block and having a firing pin aperture in the closed end thereof, spring means urging said upper housing away from said breech block to dispose said firing pin striking surface within said upper housing, abutment means on said lower housing for limiting compressive movement of said upper housing against said spring, said firing pin striking surface being exposed through said aperture for impact when said upper housing is in compressive abutment with said lower housing in firing position.

6. Apparatus according to claim 5, in which the means for limiting the movement of the lower housing on the barrel comprises a stud projecting from the barrel.

7. Apparatus according to claim 5, in which the means for limiting the movement of the upper housing on the lower housing comprises a stud on the lower housing.

8. Apparatus according to claim 5, comprising a stud on said breech block received in a longitudinal slot in said upper housing.

9. Apparatus according to claim 5, in which firing is controlled by the relative positions of said breech block and said upper housing.

10. Apparatus according to claim 5 in which said upper housing is rotatable with respect to said barrel and said lower housing, said upper housing being non-rotatably mounted on said breech block whereby said breech block may be separated from said barrel by rotation of said upper housing.

11. An explosively actuated tool comprising a barrel having a breech end and a muzzle end, a chamber bushing removably mounted in the breech end of said barrel and having a countersunk bore for peripherally containing the body and base rim of an explosive cartridge, a breech block removably secured to the breech end of said barrel, said barrel and said breech block constituting an assembly, a firing pin mounted in said breech block for limited reciprocation, a striking surface on one end of said firing pin projecting above said breech block, a flat cartridge impacting face formed on the opposite end of said firing pin and disposed for facial engagement with the base of a cartridge in said chamber bushing, said impacting face having substantially the same diameter as said cartridge base, a cover housing surrounding said assembly and comprising a sleeve portion and a closed end portion having therein a firing pin aperture, means mounting said housing on said breech block for limited longitudinal movement from a retracted position in which said firing pin striking surface is disposed within said housing inaccessible to impact, to an advanced position in which said striking surface of said firing pin projects through said aperture and is accessible for impact, and spring means between said breech block and said housing urging said housing to retracted position.

12. A tool according to claim 11, wherein said firing pin comprises an upper stem portion terminating in said striking surface, an intermediate body portion of greater cross-sectional area contiguous with said stem and forming a shoulder at the juncture with said stem, and a lower protuberance on said body portion, said protuberance terminating in a flat cartridge impacting face having a diameter substantially equal to the base diameter of a cartridge in said chamber bushing, said firing pin being mounted for limited reciprocation in a complementary shouldered bore in said breech block, said cartridge impacting face transferring the force of an impacting blow on said striking surface to the entire base of said cartridge, and said shoulder transferring the reaction forces of explosion of said cartridge to said breech block.

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