Dec. 22, 1970 L. F. MULNO 3,548,590

POWER ACTUATED TOOL

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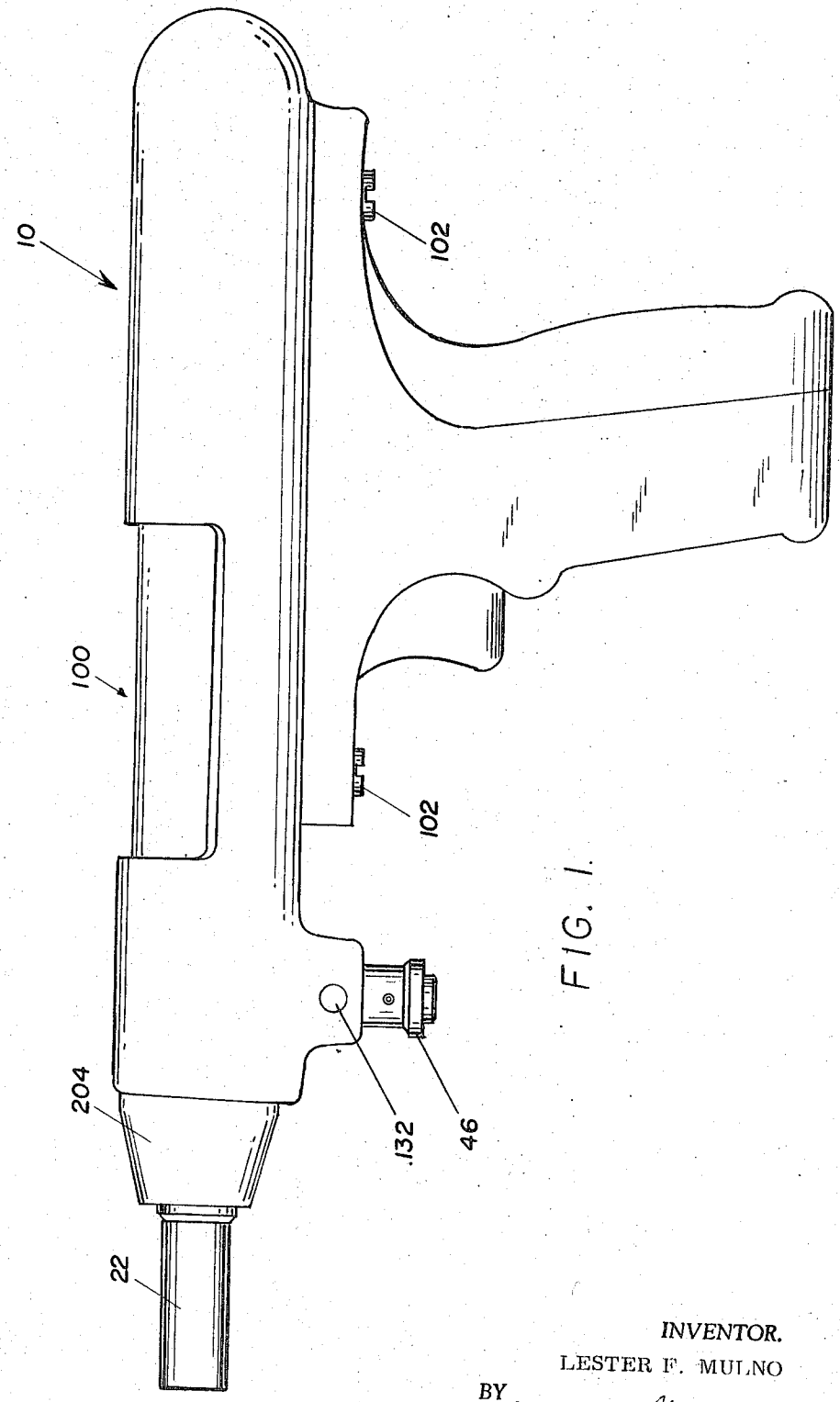


FIG. 1.

INVENTOR.
LESTER F. MULNO
BY
Friedman & Goodman
Attorneys

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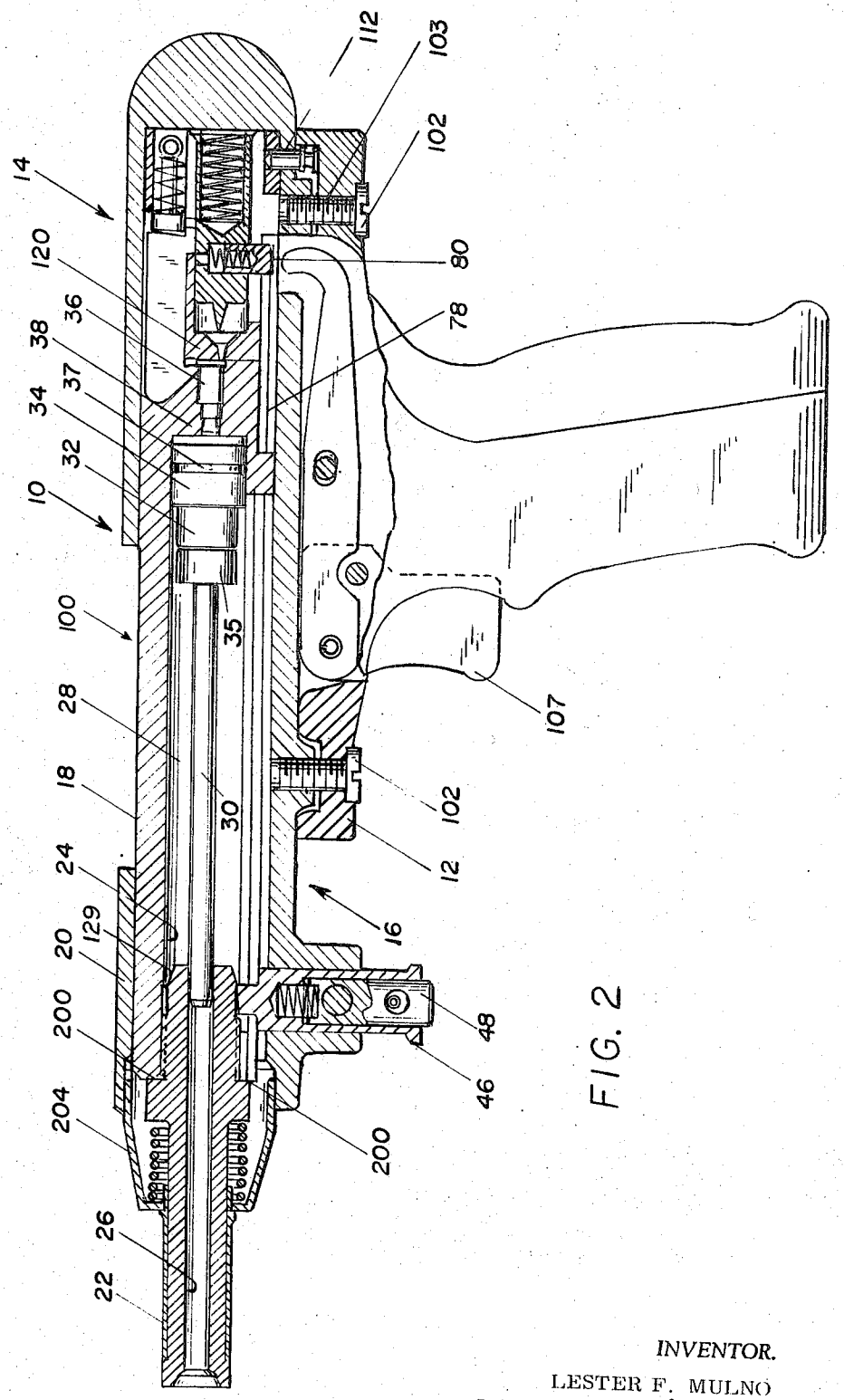


FIG. 2

INVENTOR.
LESTER F. MULNO
BY Friedman & Goodman
Attorneys

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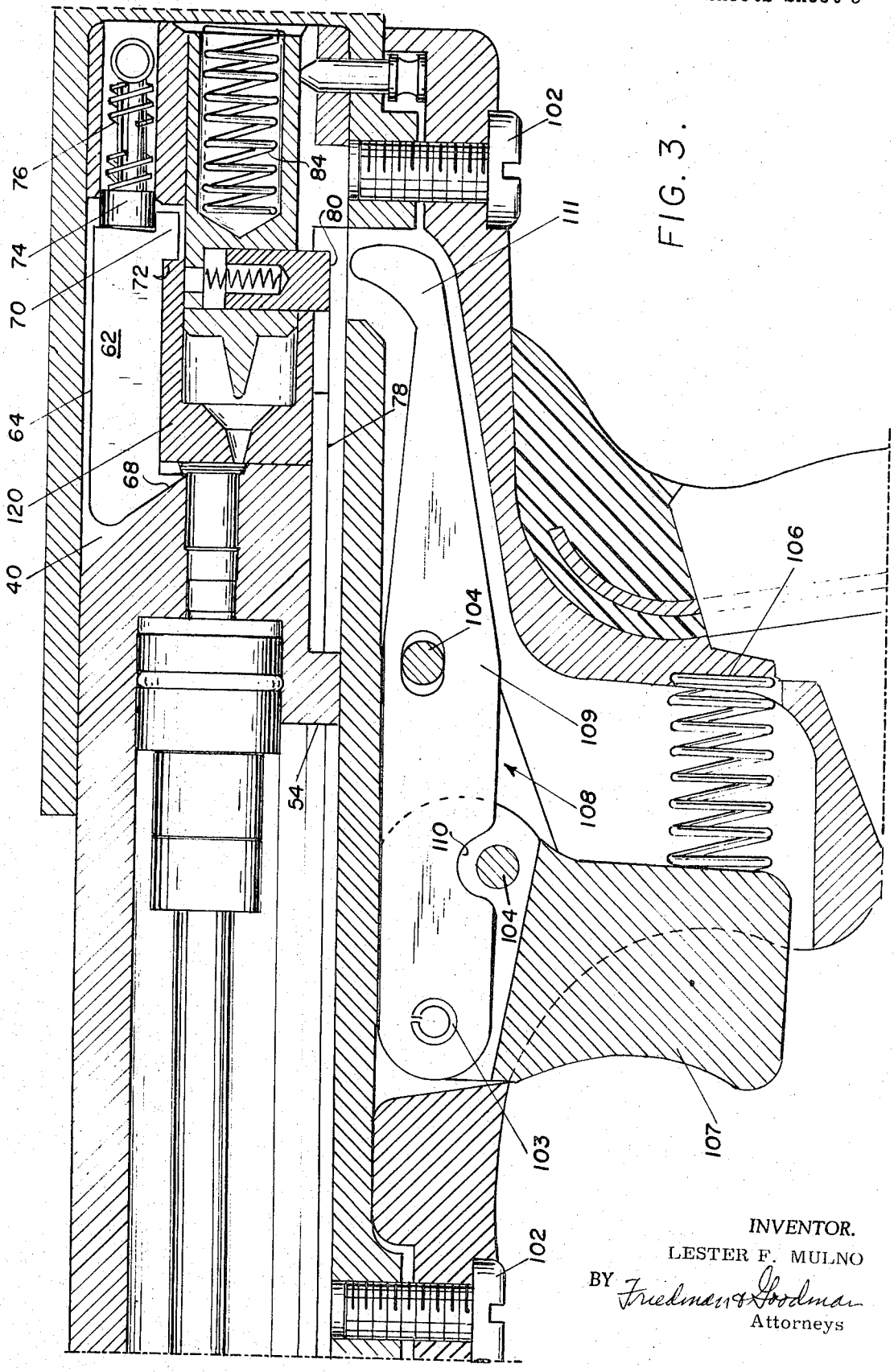


FIG. 3.

INVENTOR.
LESTER F. MULNO
BY Friedman & Goodman
Attorneys

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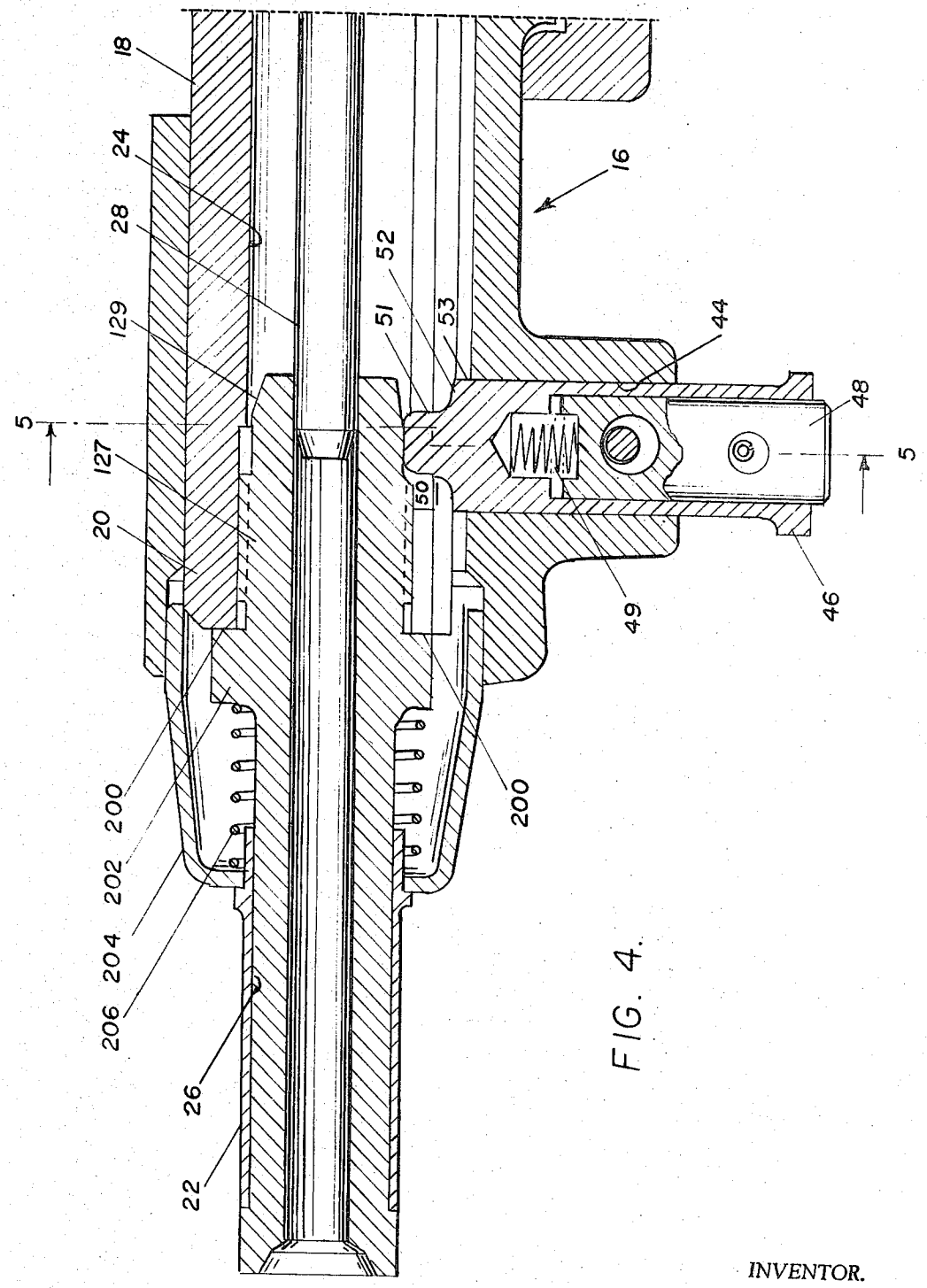


FIG. 4.

INVENTOR.
LESTER F. MULNO
BY Friedman & Goodman,
Attorneys

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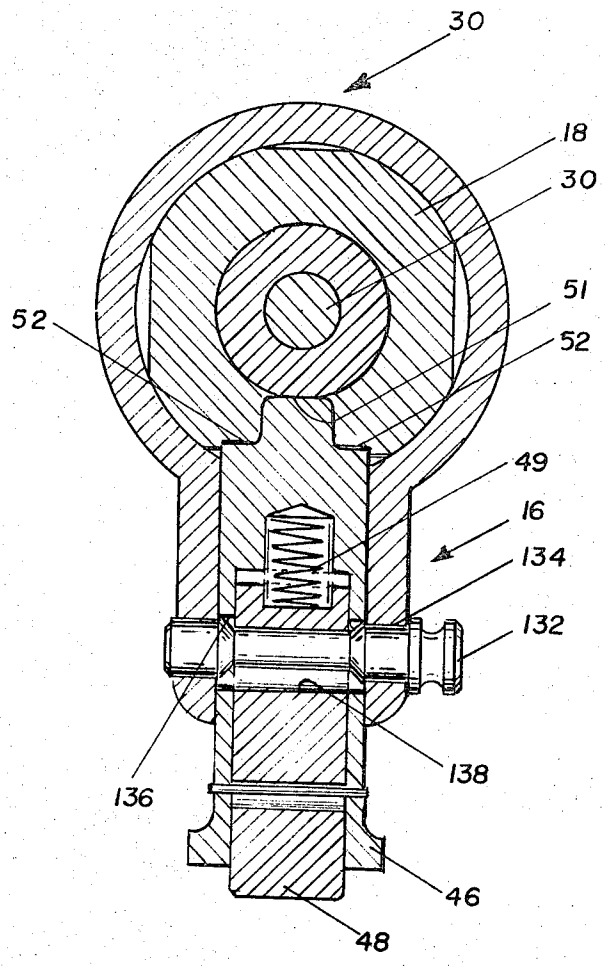


FIG. 5.

INVENTOR.
LESTER F. MULNO
BY Friedman & Goodman
Attorneys

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3,548,590

POWER ACTUATED TOOL

Lester F. Mulno, Newburgh, N.Y., assignor to Star Expansion Industries Corporation, Mountainville, N.Y., a corporation of Delaware

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Int. Cl. F01b 29/08; B25c 1/08
U.S. Cl. 60—26.1 6 Claims

ABSTRACT OF THE DISCLOSURE

An explosively-actuated power tool including a housing and a barrel axially movable relative to said housing, said barrel being provided with an internal bore and a piston axially movable within said bore having improved means for controlling the relative position of said barrel with respect to said housing and for controlling the relative position of said piston with respect to said barrel, improved removable gripping means for said tool including improved means for minimizing or eliminating accidental firing of the tool by dropping it when loaded.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to power actuated tools, and more particularly, to an explosive-actuated power tool for driving fasteners and the like.

Description of the prior art

Explosive-actuated tools for driving fasteners are well known in the art and are widely used. In general, such tools comprise a housing of pistol-like form comprising a grip with an associated trigger and a generally tubular forward portion, a barrel mounted within the tubular forward portion of the housing and adapted to move axially therein, and a piston contained within the barrel and adapted to move axially with respect to the barrel.

In the usual form of such tools, the breech end of the barrel is recessed to form a chamber for an explosive cartridge, the chamber communicating with the bore so that the gases generated by the explosive charge are transmitted to the face of the piston, and a more or less conventional firing mechanism including a firing pin is located in the housing.

In the operation of the tool, the barrel is moved forward with respect to the housing, and a cartridge is inserted in the chamber. A fastener or the like is positioned in the muzzle end of the barrel, forward of the piston. The barrel is then moved rearwardly with respect to the housing, bringing the chamber into proximity with the firing pin, and also, by way of suitable operating rods, cams, or the like, cocking the firing mechanism. As a safety feature, it is common to provide that the firing mechanism is cocked by moving the barrel rearwardly against a substantial spring bias, generated by pressing the muzzle of the tool against the surface into which the fastener is to be driven.

While the tools of this general type heretofore proposed have been effective and have obtained wide acceptance, they are nevertheless subject to certain disadvantages, or areas susceptible of improvement.

SUMMARY OF THE INVENTION

It is, therefore, among one of the principal objectives of this invention to provide an improved explosively-actuated power tool.

In accord with the invention, there is now provided an improved explosive-actuated power tool including a housing having a breech portion and a generally tubular forward portion, a barrel mounted in said tubular forward portion and axially movable therein, said barrel having a breech end and a muzzle end, a piston mounted in said barrel and axially movable therein, said piston having a portion of relatively larger diameter nearer the breech end of said barrel and a portion of relatively smaller diameter nearer the muzzle end of said barrel, said larger diameter portion and said smaller diameter portion cooperating to define a shoulder facing toward the muzzle end of said barrel, the improvement comprising providing an aperture in said barrel to define an axially elongated slot, and a depressible barrel guide removably connected to said forward portion of said housing and extending through said slot in position to control the relative position of said barrel with respect to said housing and the relative position of said piston with respect to said barrel.

In another important aspect the invention is directed to providing improved removable gripping means for said tool, including an improved trigger mechanism associated with said gripping means for minimizing or eliminating the accidental firing of the tool by dropping it in the loaded condition.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be hereinafter more fully described with reference to the accompanying drawing, in which:

FIG. 1 is a side elevation of an explosive-actuated power tool according to the invention;

FIG. 2 is a longitudinal cross-section of the tool, showing the tool in the loaded and cocked condition, before firing;

FIG. 3 is an enlarged sectional detailed view of the firing mechanism shown in FIG. 2 in conjunction with the entire tool;

FIG. 4 is an enlarged sectional detailed view similar to FIG. 3 and showing the front or muzzle end of the tool; and

FIG. 5 is a transverse cross-section of the tool, taken along line 5—5 of FIG. 4.

Referring now more particularly to FIGS. 2–5, the tool as there illustrated comprises a housing, indicated generally at 10, comprising a pistol grip 12, a breech section 14 and a generally tubular forward section 16. Housed in the forward section 16 is a barrel 18, which is free to move axially within the housing. In the illustrated form of the invention, the barrel is made in two sections, namely a main section 20 and a muzzle section 22.

The main section 20 is provided with a central axial bore 24, and muzzle section 22 with a somewhat narrower bore 26.

Within barrel 18 is housed a piston 28 having three cylindrical portions 30, 32 and 34, of relatively increasing diameter in the order named. The diameter of piston section 30 is sized to fit closely, but slidably, within the bore 26 of the muzzle piece, and that of piston section 34 is sized to form a sliding, but substantially gas-tight fit in the bore 24 of main barrel section 20. A shock absorbing member 35 is provided in front of the cylindrical portion 32 of the piston. A friction ring 37 is provided around the cylindrical portion 34 for yieldingly resisting relative motion of said piston with respect to the barrel 18.

The breech end of barrel main section 20 is chambered to accommodate an explosive cartridge 36, and bored to provide a gas passage 38 communicating with bore 24. The breech end is also provided with slot 40.

Projecting axially and rearwardly from the breech end of barrel main section 20 is a cocking rod 78.

Near the forward end of housing forward portion 16 is an aperture 44, adapted to receive a barrel guide 46.

Guide 6 is adapted to receive a guide plunger 48, atop of which is provided a barrel guide spring 49. The rectangular upper portion 51 of guide 46 projects upwardly into bore 24, through an axial slot 50 provided for the purpose in barrel main section 20.

The juncture between the lower cylindrical portion and the upper rectangular portion of guide 46 provides a pair of segment-shaped shoulders 52, positioned to bear against the surface of barrel main section 20. The lower cylindrical portion of guide 46 is recessed, as mentioned, to receive the guide plunger 48, intermediate of which is provided the guide spring 49. The pressure with which shoulders 52 bear against the barrel is provided by the tension of guide spring 49.

The upper rectangular portion 51 of guide 46, when not depressed, as will be described more fully below, projects into bore 24 sufficiently far to intercept the maximum diameter portion 34 of the piston, so that it can control the relative position of said piston with respect to said barrel.

The function of the frictional force exerted by shoulders 52 on main barrel section 20 is to yieldingly restrain the barrel against movement relative to the housing. This helps to avoid unnecessary wear, and facilitates handling and operation of the tool, because the barrel tends to remain in whatever position the operator has placed it, while other operations are performed, such as loading, etc.

The function of the upper portion of barrel guide 46 is three-fold. First function: as the barrel is moved forward relative to the housing, for example, to the forward or loading position, the rectangular portion 51 of guide 46 intercepts maximum diameter section 34 of the piston and prevents the piston from going forward with the barrel. Thus, as the barrel moves forward and the piston remains stationary relative to the housing, the piston is moved to the rear of bore 24, in proper position for firing. The same motion clears bore 26 in the muzzle piece for the insertion of a fastener to be driven.

Second function: the upper portion 53, FIG. 4, of guide 46 is to limit the forward motion of the barrel, by abutment at the back end 54 of elongated slot 50 (FIG. 3) in barrel 20, thus removing the heavy load of stopping the barrel on rectangular portion 51.

Third function: uses the rectangular portion 51 of guide 46 to limit the rotation of the barrel.

Additionally, the barrel guide is removably connected to the forward portion 16 of the housing 10 by means of a barrel guide pin 132 which is inserted into bores 134, 136 and 138 of the forward portion 16, barrel guide 46 and barrel guide plunger 48, respectively, when all bores are in registry. Barrel guide pin 132 has an intermediate central portion 133 which is of smaller diameter than the rest of the pin, this central portion fitting inside bores 136 and 138 of the barrel guide and plunger. When the plunger bore 138 is brought into registry with the other bores, the spring 49 is resultingly compressed, providing a tension force which is transmitted to the shoulders 52 bearing against the surface of barrel main section 20. This tension force provides a frictional drag which holds the barrel from sliding unwantedly back and forth. The spring 49 also serves another function, and it is another critical feature of the invention, and that function is to allow barrel guide 46 to be depressed downwardly when muzzle section 22 moves thereover, when the tool is in the firing condition shown in FIGS. 2 and 4, specifically. This becomes critically important when the tool is fired, as will be described below, since it prevents the piston portion 34 from shearing off the upper rectangular portion 51 of the barrel guide.

According to another feature of the invention, there is provided a pistol grip 12 which is adapted to be removable from housing 10 by means of grip screws 102, provided at opposite ends of the grip, which are threadingly engaged in associated threaded bores 103 provided in the housing. A breech pin 112 intermediate the grip

12 and the housing locks the breech end 14 in position. The aforementioned feature thus renders the tool susceptible of easy dismantling for repair and servicing.

An improved trigger mechanism 107 is associated with the pistol grip comprising two trigger pivot pins 104 passing through the trigger mechanism and journalled into the housing at either side of the trigger. A trigger spring 106 is also provided, which operates by conventional means. A novel sear release 108 is connected to the trigger by means of a trigger assembly pin 103. Sear release 108 has an elongate main body portion 109 having a curved front end and which tapers rearwardly, i.e. in the direction of the breech pin 112, terminating integrally into an upwardly projecting tail portion 111. The bottom of main portion 109 is recessed as at 110 in order to accommodate a pivot pin 104. The other pivot pin 104 passes through main body portion 108. Thus, in essence, sear release 108, in side elevational view resemblies the general shape of an "airplane body," as it were, to describe it in simpler terms. This novel construction for the sear release provides a balance to the trigger mechanism so that the tool cannot be accidentally discharged if it is dropped while loaded.

The extractor assembly, which is known, includes an extractor hook plate 62 accommodated in a suitable radial slot 64 in breech block 120. At the forward end of extractor hook plate is an extractor hook 68 of generally conventional form. At the rear end of the extractor hook plate is a depending lug 70, the forward end of which bears against a suitable abutment 72 formed by the shape of the slot 64 in breech block 120. A resilient assembly comprising a plunger 74 and a plunger spring 76 exerts a yielding forward bias against the upper portion of the rear end of extractor hook plate 62.

Referring to FIG. 3, as the barrel is brought back into "ready" position (as more fully illustrated in FIG. 2) the rim of the cartridge forces the extractor hook upwardly, against the bias of spring 76. Once the cartridge rim has cleared the hook, the hook drops back into place. The hook remains in this position during cocking and firing. When the barrel is subsequently moved forward to "load" position, the cartridge is held back by the hook and thereby removed from the chamber. Once free of the chamber, the cartridge falls free of the hook and can be ejected from the tool by simply shaking it out through a suitable opening in the housing.

It should be noted that this arrangement provides the necessary pivotal motion required to enable the extractor hook to be deflected by the rearwardly-moving rim of the cartridge, and then drop back to hook the rim, without requiring a pivot pin.

The operation of the tool is as follows: The barrel is first moved forward manually, or by "throwing" the tool to create a forward centrifugal force. This moves the piston to the rear of the barrel, by the act of barrel guide 46, as described above. The tool is inverted, if necessary, sufficently to drop the spent cartridge out through loading aperture 100 in the housing (FIGS. 1 and 2). A fresh cartridge 36 is inserted, through loading aperture 100, into the chamber provided in the breech end of barrel 18, and the barrel is returned manually, or by pushing it against a suitable surface, to the "ready" position. Because of the action of friction ring 37, as previously described, the piston remains in its rearward position relative to the barrel, as the barrel is moved back. Moreover, barrel guide 46 is depressed downwardly by virtue of the muzzle body 127 slidingly passing thereover. The rear end 129 of muzzle body 127 is tapered to facilitate this.

A fastener (not shown) is inserted in the muzzle piece, and the action is cocked by pushing the muzzle piece forcibly against the surface into which the fastener is to be driven, shoulders 200 formed by an intermediate larger body portion 202 of the muzzle section 22 abutting against the forward end of the barrel 18, portion 202

housed within a tapered sleeve **204** therefor. A spring **206** is biased between portion **202** and the end of the sleeve **204**. The cocking action causes cocking rod **78** to push sear **80** and the firing pin back against the bias of firing pin spring **84**, in the manner described above. The trigger is squeezed, lifting sear **80** off cocking rod **78** by means of tail portion **111** of sear release **108**, and allowing the firing pin to spring forward and fire the cartridge. Expanding gases from the cartridge pass through gas passage **38** and drive the piston forward, driving the fastener before it into the wall or other surface into which it is to be driven.

If the fastener overpenetrates, the forward motion of the piston is arrested by the striking of the shock absorbing member **35**, in front of intermediate diameter portion **32** of the piston, against the rear end of muzzle section **22**. Moreover, as earlier noted, by virtue of the fact that guide barrel **46** has been depressed out of the way, portion **34** of the piston will not strike it but will pass harmlessly thereover. The tool is then taken away from the wall; the barrel moved forward to the "load" position; and the cycle is repeated for the next fastener.

What is claimed is:

1. In an explosive-actuated power tool including a housing having a breech portion and a generally tubular forward portion, a barrel mounted in said tubular forward portion and axially movable therein, said barrel having a breech end and a muzzle end, a piston mounted in said barrel and axially movable therein, said piston having a portion of relatively larger diameter nearer the breech end of said barrel and a portion of relatively smaller diameter nearer the muzzle end of said barrel, said larger diameter portion and said smaller diameter portion cooperating to define a shoulder facing toward the muzzle end of said barrel, the improvement comprising providing an aperture in said barrel to define an axially elongated slot, and a depressible barrel guide removably connected to said forward portion of said housing and extending through said slot in position to control the relative piston of said barrel with respect to said housing and the relative position of said piston with respect to said barrel.

2. A tool according to claim **1**, wherein said barrel guide comprises a generally cylindrical portion and a generally rectangular portion, said generally rectangular portion extending through said slot in said barrel into the interior thereof, said generally cylindrical and said generally rectangular portion cooperating to define, at their juncture, a pair of segment-shaped shoulders adapted to bear frictionally against the surface of said barrel adjacent said slot, said barrel guide being adapted to receive a guide plunger, spring means being disposed between said barrel guide and guide plunger so that said barrel guide is simultaneously adapted to be depressible and at the same time provide the force for the shoulders to bear frictionally against the surface of said barrel.

3. A tool according to claim **2** wherein said muzzle end of said barrel is adapted to depress said barrel guide when said barrel axially moves in said tubular forward portion in response to the initiation of cocking actuating means for said tool.

4. A tool according to claim **3** wherein said muzzle end of said barrel further comprises a muzzle body having one end tapered at the rear thereof, the tapered end facilitating the depression of said barrel guide by said muzzle body, said tapered end passing over said generally rectangular portion of said barrel guide, a portion intermediate said tapered end of said muzzle body and the front end of said muzzle body being provided, which is of larger diameter than the rest of said muzzle body, thereby providing a pair of shoulders adapted to abut against the extreme end of said barrel, a portion of said muzzle body including said intermediate portion being housed in a sleeve therefor, spring means biased between said intermediate portion and the forward end of said sleeve.

5. A tool according to claim **1** including a pistol grip secured to said housing, the improvement comprising adapting said pistol grip to be removably engageable with said housing.

6. A tool according to claim **5** wherein said pistol grip is secured by means of a pair of removable threaded screws threaded into said housing by means of associatingly threaded bores contained therein.

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WENDELL E. BURNS, Primary Examiner

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