

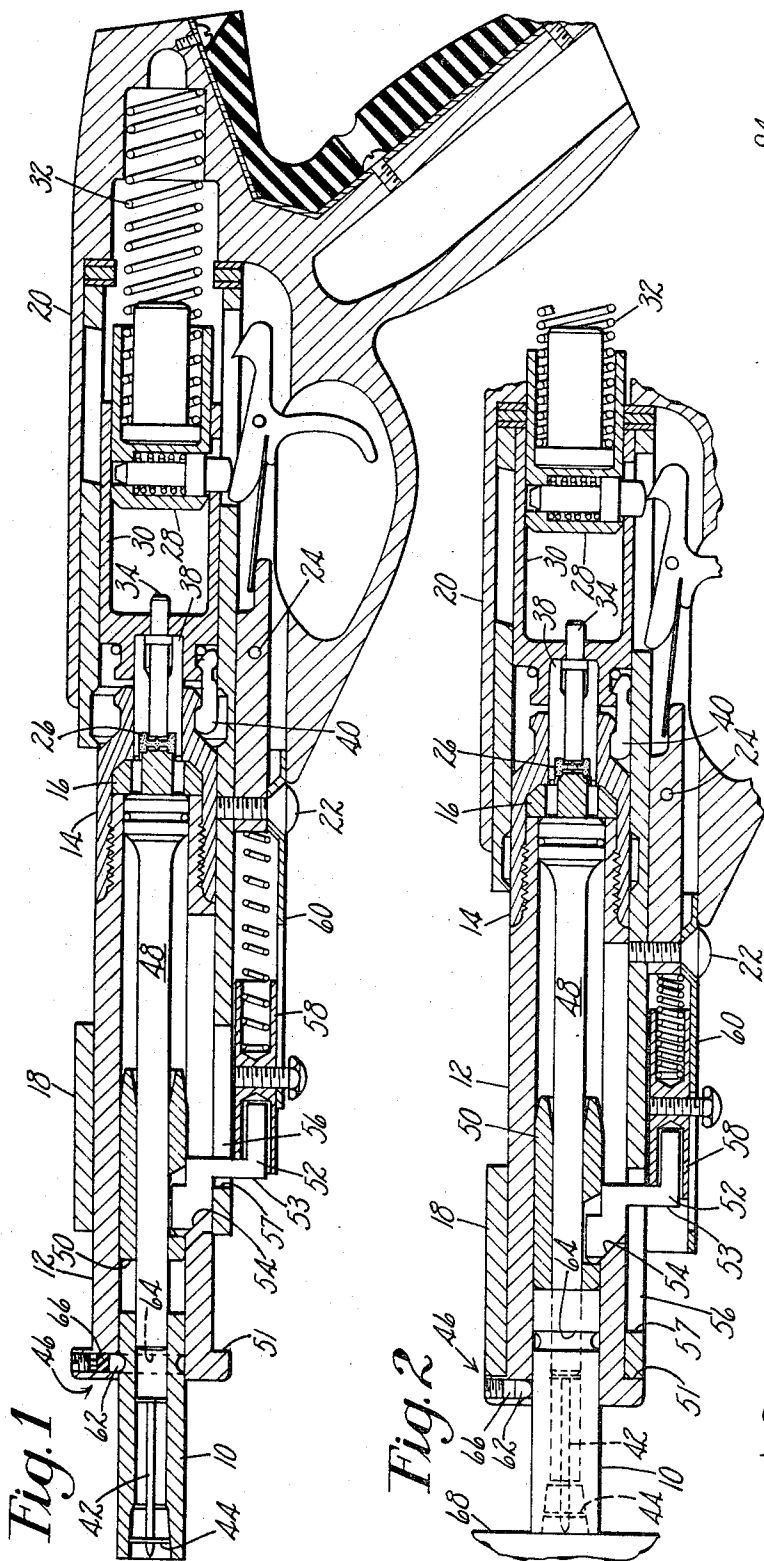
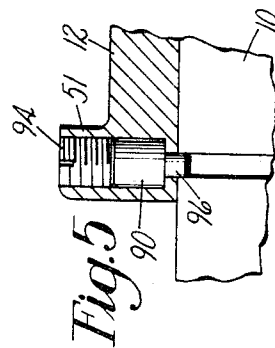
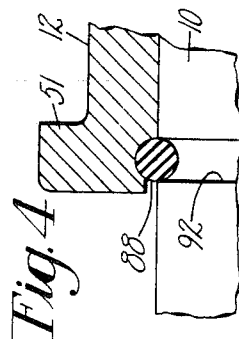
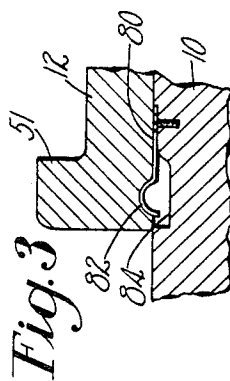
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DEVICES FOR PREVENTING DROP-FIRE

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DEVICES FOR PREVENTING DROP-FIRE

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ABSTRACT OF THE DISCLOSURE

A safety device to prevent drop-fire of an explosively actuated tool consists of a nosepiece having releasable, energy-absorbing mounting on a barrel muzzle. The nosepiece is adapted to be predeterminedly releasable when incurring shock absorbing force less than that required to impact-ignite an explosive charge, but is nonreleasable when subjected to normal endwise cocking force.

Background of the invention

This invention relates to impact-ignitable devices, and more especially to means for preventing drop-fire in explosively actuated tools, for instance, the type used for driving fasteners.

One of the precautionary measures employed in explosive tools designed for driving fasteners, or otherwise exerting sudden operating force, is to require that their muzzles be bought to bear with pressure upon selected portions of the work in order to cock the tools. Muzzle-mounted shields of different types also afford safety. There nevertheless is a risk incurred with certain impact-ignitable explosive devices when they are accidentally dropped and transmit the shock of impact upon landing either directly or indirectly to a charge, cartridge or other power source. Even though a fastener, for instance, is thus driven inadvertently, it may not be completely ejected from the tool but is may be driven detrimentally into the wrong part of a work piece, and will undoubtedly delay an operator in installing a fastener in its proper position as well as jeopardize his personal safety. The present invention accordingly provides, in an explosively actuated device, a means for cushioning impact, particularly the inadvertent impact incurred on a nose portion of a dropped tool, whereby premature firing is avoided.

Summary of the invention

A primary object of this invention is to avoid drop-fire in an impact-ignitable explosive tool, especially the firing which may occur when the muzzle end of the device accidentally strikes a surface. To this end a feature of the invention resides in the provision of impact cushioning means associated with the nosepiece of the tool. The nosepiece is thus adapted to be released when subjected to the axial force incurred in dropping of the tool muzzle down, and the nosepiece releasing means is operative with less force than that required to ignite the explosive, and non-operative by normal cocking force. As herein shown, though normally held in its forward or cocking position on the tool frame, the nosepiece is releasably held by means which may be in the form of a detent, flat spring, deformable or shearable element, or the like, and which permits the nosepiece upon release to move rearwardly harmlessly absorbing the kinetic energy imparted to the tool.

Brief description of the drawings

Organization and operation of the invention will now be more particularly described as applied to an illustrative embodiment, and with reference to the accompanying drawings thereof. It will be understood that although the invention is herein explained with reference to an impact-

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ignitable solid low explosive not requiring a primer for purposes of ignition, it is not thus limited, nor is it restricted to fastener driving tools.

In the drawings:

FIG. 1 is a longitudinal section of a hand-held stud or nail driving tool incorporating a releasable nosepiece in accordance with my invention, the tool being shown in its uncocked but breech closed and charged condition and provided with a fastener to be driven;

FIG. 2 is a view largely corresponding to FIG. 1 but showing the parts in their relative positions when the tool has been dropped muzzle-down; and

FIGS. 3-5 show alternative releasable nosepiece holding means which may be used.

Description of the preferred embodiment

The illustrative tool, largely resembles the fastener driving device of FIGS. 8-11 fully disclosed in an application Ser. No. 593,144, filed Nov. 9, 1966 in the names of Robert C. Kvavle et al. It is designed to practice a method of primerless impact-ignition disclosed in United States Letters Patent No. 3,283,657 and accordingly may employ a charge or explosive pellet of the type disclosed in an application No. 524,168, filed Feb. 1, 1966, in the name of Robert C. Kvavle now Patent No. 3,372,643, granted Mar. 12, 1968. Hitherto disclosed portions of the tool will accordingly be described herein only so far as necessary to understand the present invention.

Referring to FIGS. 1 and 2, except for a nosepiece 10 and its mounting hereinafter to be described, the tool though shortened overall, is essentially like the tool of the cited application Ser. No. 593,144 and comprises a barrel having threadedly aligned portions 12, 14 for removably containing a vented anvil 16, a tubular housing 18 for slidably receiving the barrel, and a pistol-grip assembly 20 affixed to the housing 18 by means of a screw 22 and a pin 24.

As previously disclosed, firing mechanism in the housing cooperates with the anvil 16 when the barrel is in its rearward or breech closed position to impact-ignite a charge shown herein as a primerless pellet 26 of the type referred to in Patent No. 3,372,643. For this purpose a trigger controlled striker 28 axially slidable within an action 30, itself axially slidable in the housing 18, is urged forwardly by a cocking spring 32 for engagement with a firing pin 34, assuming the tool to have been cocked as will later be described. It will be understood that the striker 28 is released by trigger-depression of a spring-pressed sear in the striker, and that the firing pin 34 is slidably carried, for alignment with the pellet 26, in the mouth of a shroud 38 having force-fit mounting in the action 30.

For facilitating a rear breech loading (or unloading) of the pellet 26 in the shroud 38 and for convenience in disassembly of the tool, the barrel 12, 14 is axially slidable forwardly in the housing 18 relative to the action 30 when the barrel and action, shown connected by locking levers 40 (one only shown in FIGS. 1 and 2), are disconnected as by swinging the tool to extend its barrel by inertia. FIG. 1 shows the uncocked tool with its breech loaded and closed and ready to have its nosepiece 10 pressed against a work piece into which a fastener 42 is to be driven. The axial pressure thus exerted for cocking the spring 32 serves several additional functions: it thrusts the fastener 42 further rearwardly into the nosepiece 10 until a washer 44 on the fastener stem frictionally engages in a tapered mouth of the nosepiece, if the fastener was not thus earlier retained; it transmits axial force through a releasable holding means in the form of a detent 46 to the barrel thus moving the latter into reconnected and breech-

closing relation with the action 30; it returns in the barrel a piston-like ram 48 adapted to drive the fastener when explosively generated gases are evolved from impact ignition of the pellet 26; and it causes the pellet 26 together with the shroud 38 to seal off the firing chamber on the breech side of the anvil 16 preparatory to this ignition.

Unlike the tool of the cited copending application Ser. No. 593,144, a tubular guide 50 for the ram 48 is not in this case adapted to receive the fastener, but is slotted to receive one end of a safety key 52 which is axially slidable in a longitudinal slot 54 in the barrel. The key 52 is also longitudinally slidable in a slot 56 in the barrel housing 18, the engagement of one end 57 of this slot with a face 53 of the key limiting relative forward movement of the barrel. Much as in the manner disclosed in United States Letters Patent 3,168,744, issued in the name of Robert C. Kvavle, the key 52 prevents rotation of the barrel and is yieldable rearwardly in the slots 54, 56 against resistance of a spring plunger 58 which is mounted in a guideway 60 secured to the underside of the housing.

When the uncocked tool of FIG. 1 has been loaded with its pellet 26 and fastener 42, the releasable nosepiece holding means generally designated 46 is relied upon to prevent dropfire should a workman accidentally allow the tool to fall with its muzzle in end-down position. For this purpose the force required to effect release of the detent 46, which may consist of a plunger 62 normally projecting internally in the barrel muzzle and into a groove 64 (FIGS. 1 and 2) in the nosepiece and backed, though not necessarily, by a spring or elastomer 66, is predeterminedly less than the energy required to ignite the pellet 26. Also, the nosepiece holding means 46 is predeterminedly non-releasable by exertion of axial force of the order required to cock the spring 32 as above described.

If the tool is dropped nose first on a surface 68 (FIG. 2) while in the ready to cock condition shown in FIG. 1, the various parts will move to the relative positions indicated in FIG. 2. Thus, landing impact displaces the nosepiece 10 rearwardly in the muzzle, the release of the detent 46 absorbing some of the kinetic energy of the fall. The inner end of the nosepiece 10 then abuts the guide 50, and the housing 18 almost simultaneously relatively advances on the barrel to abut an end flange 51 on the barrel muzzle. This relative advance of the housing causes additional kinetic energy to be absorbed in compressing of the spring acting on the plunger 58, the key 52 being blocked from moving muzzleward. Some kinetic energy is also absorbed by the ram 48 advancing and bearing endwise on the head of the fastener 42 to urge it out of the tool. The rearward movement of the key 52 in the housing slot 56 transfers force to the housing 18 via the plunger 58 through its spring thereby permitting the advance of the barrel and the connected action 30 together with the pellet 26 and avoiding transfer of igniting force to the pellet.

The detent means 46 may alternatively take the forms shown in FIGS. 3 to 5 inclusive. In FIG. 3, for instance, a flat spring 80 has one end fast in the nosepiece 10, and a curved, yieldable end 82 of the spring is nestable in a notch formed internally in the barrel portion 12. A recess 84 in the nosepiece is disposed to receive the yieldable end of the spring 80 when the force of landing causes relative axial motion of the nosepiece, deflection of the spring from the barrel (occurring at a force lower than that required for impact ignition) affording some of the cushioning effect desired.

FIG. 4 shows an elastomeric detent ring 88 as one alternative for yieldably releasing the nosepiece 10 to

axial movement with respect to the barrel portion 12, and FIG. 5 shows a shear pin 90 for similarly predetermining release force requisite to obtaining the relative motion of the nosepiece. The ring 88 is subjected to shear stress at the moment of impact and becomes compressed in its nosepiece groove 92 while resisting the relative axial motion. The pin 90 is radially retained in the barrel by a setscrew 94 (FIG. 5), an inner end of the pin having a reduced shank 96 extending into a circumferential groove in the nosepiece and being deformable or shearable with a predetermined force (less than needed for impact ignition) upon incurring landing impact. Clearly, though not shown, the detent may take the form of a reusable screw an end of which is deformable on incurrance of the energy due to tool motion.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a tool of the type having a barrel provided with a breach end and a muzzle end, and firing means adapted to engage an impact-ignitable explosive charge adjacent the breech end to cause an element to be driven from the muzzle end, a piston-like ram interposed between the firing means and said element thus to drive the latter, and a device for preventing premature ignition of said charge by said firing means upon dropping the tool muzzle-down, the device comprising a nosepiece mounted coaxially on and normally stationary with respect to the muzzle end of the barrel, said nosepiece being telescoped on an end of said ram, and a detent means for releasably holding the nosepiece in projected relation with respect to said muzzle end and normally preventing relative axial displacement of the nosepiece, the nosepiece having its outer end formed to axially guide said element as it is driven by the ram, said detent means being operative to release the nosepiece for retractive shock-absorbing movement upon its incurrance of a predetermined energy which is less than that required to ignite the charge.

2. A tool as set forth in claim 1 wherein the detent means includes a frangible protrusion mounted in one of the barrel and the nosepiece and normally extending into a recess formed in the other, the frangibility of said protrusion due to sheer stress being predetermined to be slightly less than the force required to impact ignite the charge.

3. In an explosive device of the type having a barrel provided with a breech end and a muzzle end, and having a spring-actuated firing mechanism cockable by urging the barrel muzzle end toward a work piece in preparation for exploding an impact-ignitable charge in the barrel breech end, a nosepiece for holding an element to be explosively driven from the breech end, and detent means for releasably holding said nosepiece in projecting relation in the muzzle end of the barrel and preventing relative inward movement of the nosepiece, said detent means being releasably operative on the nosepiece incurring an endwise force less than that required to be applied by the firing mechanism for igniting the charge, and nonoperative to release the nosepiece during said cocking movement of the barrel.

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