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FIRING MECHANISM FOR EXPLOSIVELY ACTUATED TOOLS

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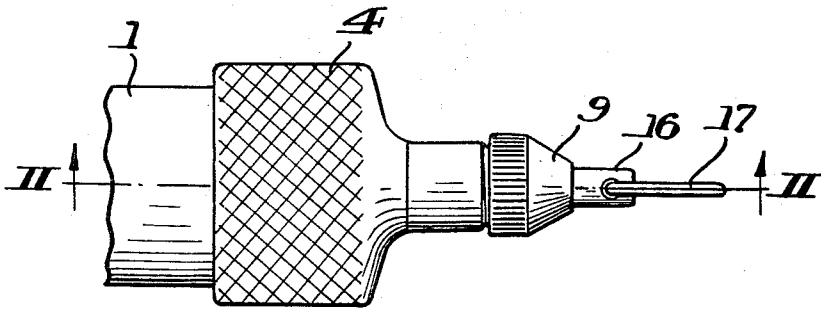


Fig. 1.

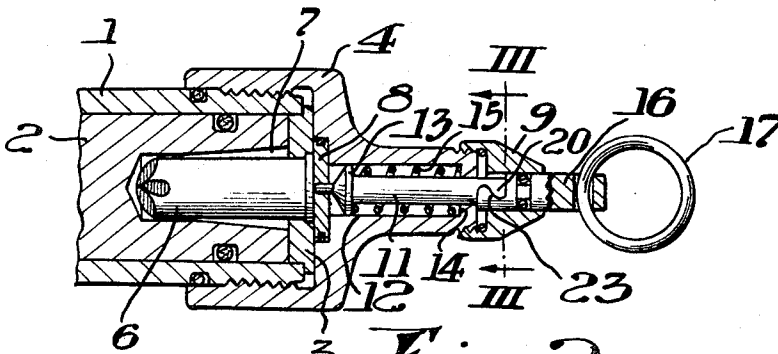


Fig. 2.

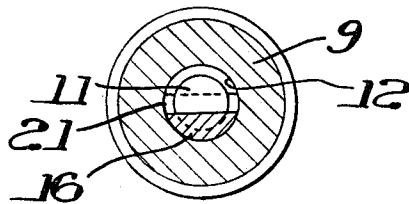


Fig. 3.

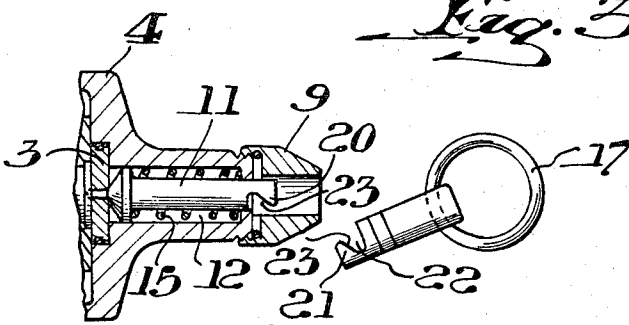


Fig. 4.

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FIRING MECHANISM FOR EXPLOSIVELY ACTUATED TOOLS

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ABSTRACT OF THE DISCLOSURE

The rear end of a firing pin and the front end of a pin retractor are hooked together in such a manner that when the retractor is pulled back far enough, it will automatically separate from the firing pin, which will be driven forward by a spring. Even in its released position, the rear end of the pin projects from its support so that the retractor can be connected to it again.

Such tools are those in which a cutter, punch, bonder or other working projectile is caused to move forward at high velocity by detonating an explosive charge behind it. Usually, the explosive is in a blank cartridge that is fired by a firing pin. Some firing pins are operated by tapping them with a hammer. Others are urged forward by springs and have rings or the like at their rear ends for retracting them to compress the springs. When such a ring is released, the spring will drive the firing pin forward. Sometimes, such as when the tool is to be operated at a distance, for example under water, it is difficult to tell when the pull ring should be released, and there may be enough drag on it to prevent the firing pin from striking the cartridge sharply enough to fire it.

It is among the objects of this invention to provide a firing mechanism for a tool, in which the firing pin is automatically released after it has been retracted a given distance, and is simple and dependable in construction and operation.

In accordance with this invention, the barrel of an explosively actuated tool has means at its rear end for holding an explosive charge. Firing pin retaining means are mounted on the rear end of the barrel and provided with an axial passage in which a firing pin is slidably mounted. A spring urges the pin forward toward the charge. The rear end of the pin is spaced forward of the rear end of the passage. Slidably mounted in the passage behind the firing pin is a pin retractor. The adjoining ends of this retractor and the firing pin are hooked together, and means is provided for pulling the retractor rearwardly completely out of the passage. The hooked-together ends of the pin and retractor are so formed that they will separate automatically as the retractor leaves the passage, whereby the firing pin will be released and driven forward by the spring.

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

FIG. 1 is a fragmentary side view of our tool;

FIG. 2 is a longitudinal section taken on the line II—II of FIG. 1;

FIG. 3 is an enlarged cross section taken on the line III—III of FIG. 2; and

FIG. 4 is a fragmentary section similar to FIG. 2, but showing the retractor just after it has separated from the firing pin.

Referring to FIGS. 1 to 3 of the drawings, the tool may be of any conventional design provided with a barrel 1 in which there is a working projectile, which may be a cable cutter 2 for example. The rear end of the cutter engages a cartridge holder 3 mounted in the rear end of the barrel, where it is clamped by a cap 4 screwed onto the barrel. The cartridge holder is provided with a

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central opening, in which is mounted the rear end of an explosive cartridge 6 that extends forward into an axial chamber 7 in the cutter. A breechblock 8 with a central hole is pressed against the cartridge by the cap. The cap has a reduced portion that extends rearwardly away from the barrel. Screwed on the rear end of the cap is a nut 9.

The nut and cap form retaining means for a firing pin 11, and therefore they are provided with an axial passage 12 in which the firing pin is slidably mounted. The firing pin has a shoulder 13 near its front end, between which and another shoulder 14 in the rear end of the cap a coil spring 15 that encircles the firing pin is compressed to urge the pin forward. The firing pin extends out of the cap and into the hollow nut, where a short pin-like retractor 16 that has a pull ring 17 in its rear end is slidably mounted.

It is a feature of this invention that the adjoining ends of the firing pin and retractor 16 are hooked together in such a manner as to permit the retractor to pull the firing pin back away from the cartridge until the retractor leaves nut 9. At that moment the retractor automatically separates from the firing pin and the released pin is driven forward by the coil spring. Accordingly, the adjoining ends of the firing pin and retractor are formed with interengaging hook portions 20 and 21, at least one of which includes an outwardly flaring recess 22 (FIG. 4) that receives the other hook portion. Preferably, the two hook portions are nearly identical so that they fit snugly together and have engaging sides 23 that are pressed together when the retractor is pulled and which are inclined lengthwise of the pin in a direction to cause the retractor to slide laterally away from the firing pin as the retractor is pulled out of passage 12, as illustrated in FIG. 4. The hook portions can be formed by cutting radial notches across the two pins and removing part of the outer wall of each notch. The inner side of each notch may be flat in a radial plane, but the outer side (the side nearest the end of the pin) slopes outwardly from the flat surface to form the flaring recess 22.

With a firing mechanism such as disclosed herein, all that has to be done in order to operate it is to pull on the ring. As soon as the retractor leaves the hollow nut, the retractor hook will slip out of the firing pin hook and thereby release the firing pin, whereupon the coil spring will drive the firing pin forward to detonate the cartridge. It will be seen that the operator does not have to tap the firing pin or release it after he has retracted it. The same motion that retracts the pin results in its being released.

Another important feature of this invention is that the tool will not discharge if accidentally dropped on retractor pin 16. This is because the diameter of the retractor is greater than the inner diameter of shoulder 14, and the length of the firing pin is such that while the inner end of the retractor pin is held against the shoulder by the coil spring the front end of the firing pin is not far enough forward to fire the cartridge and of course cannot move forwardly until after the firing pin has been released from the retractor, as in FIG. 4.

This tool is provided with a number of sealing rings in various places to exclude water from the cartridge and the inside of the firing mechanism.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claim, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. In an explosively actuated tool provided with a bar-

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rel having means at the rear end thereof for holding an explosive charge, a firing mechanism comprising a cap removably mounted on the rear end of the barrel and provided with an axial passage therethrough, a breech-block mounted in the front end of the passage, a firing pin in the cap slidably mounted in said passage and projecting from its rear end, a spring in the passage urging the pin forward, a nut behind the cap with only its front end screwed onto the rear end of the cap, the nut having an axial opening through it in line with the firing pin, a pin retractor in said nut opening in slidably and rotatable engagement with the wall of that opening and supported by said wall, said retractor being provided with a circumferential groove containing a sealing ring engaging said wall, the adjoining ends of the pin and retractor being

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hooked together inside the nut, and means for pulling the retractor rearwardly completely out of said nut, said hooked-together ends being formed to separate as the retractor leaves said nut to thereby release the firing pin, and said retractor being slidably far enough forward through the nut after the nut has been unscrewed from said cap to allow the retractor to be hooked onto the rear end of the firing pin again before the nut is screwed back onto the cap.

References Cited

UNITED STATES PATENTS

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SAMUEL W. ENGLE, *Primary Examiner*.