

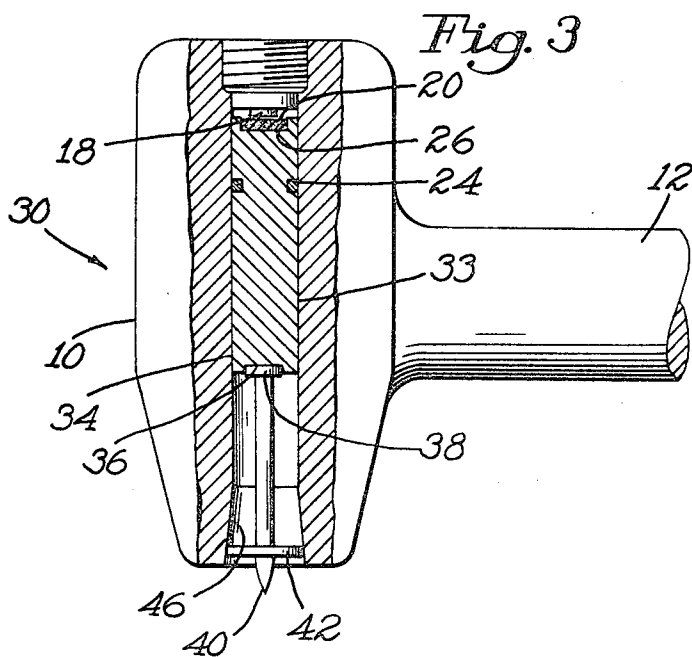
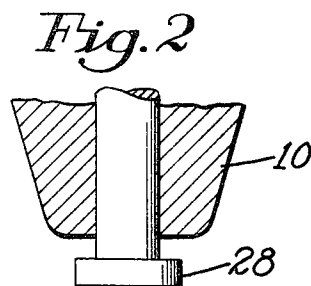
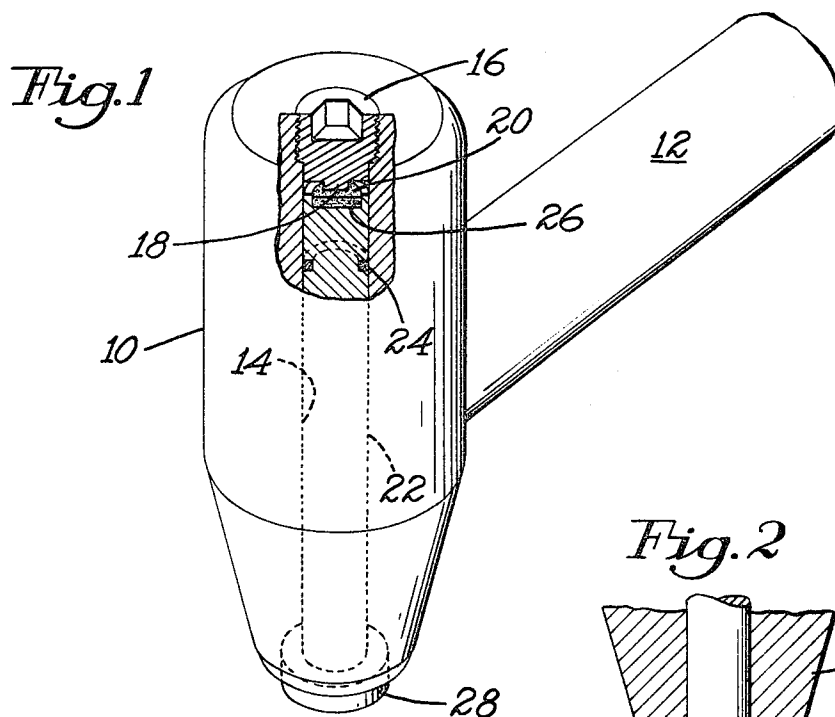
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EXPLOSIVELY ACTUATED IMPACT TOOLS

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EXPLOSIVELY ACTUATED IMPACT TOOLS
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1 Claim. (Cl. 227—10)

ABSTRACT OF THE DISCLOSURE

A hammer type tool using a caseless charge of explosive has a bore axially receiving a striker. When the tool is directed for impact toward a work piece, an inner end of the striker confining the charge centrally against the closed end of the bore effects impact ignition of the charge. Resultant explosive force, acting wholly in alignment with the striker, may cause a fastener to be driven into the work piece, or a forming, punching, or cutting operation may be performed.

This invention relates to impact devices, and more especially to manually operable, explosively actuated tools for driving fasteners, for instance, or for simply delivering a hard power-assisted blow. While the invention is herein illustrated as embodied in simple hand-held hammers of both types, it will be understood that usage of the invention is not thus limited, and many modifications in details of construction will become apparent to adapt the invention for particular applications requiring impact.

Numerous situations exist in the construction and other industries where one or more hard blows must be struck on a work surface. Often mechanical or electrical power is unavailable for the purpose or a device operable by such power would be impractical, inconvenient or unavailable to use. Moreover, hard manual labor and considerable expenditure of time are usually necessary where repetitive hammer blows have to be struck, as for instance in driving a spike into hard wood, or in pounding out a dented metal plate, in cutting a cable, or performing a punching operation.

In view of the foregoing it is an object of this invention to provide a safe, reliable, explosive-assist type tool of the impact type, for instance a hammer.

Another object of the invention is to provide a hand-guided, explosively actuated device adapted to deliver impact for driving large fasteners such as spikes or to break or reshape work pieces.

To these ends and in accordance with a feature of the invention, an improved impact device is provided comprising a hammer head having a bore open at one end and closed at the other, a striker slidable axially in the bore and having one end adapted to engage a work surface and another end adapted to confine a charge of explosive in the bore, the closed end of the bore constituting an anvil, and means for directing the hammer head toward said work surface whereby compression of said one end of the striker therewith causes its said other end to cooperate with the anvil in compressing and igniting the charge, the gases evolving from the explosion reacting on the anvil to force the striker against said work surface. In one embodiment shown herein the striker is formed as a ram having its shaped work engaging head extending initially beyond the hammer head and retractable therein to effect ignition; in the other illustrative embodiment, the striker does not initially extend beyond the hammer head, but is recessed in the bore and adapted to receive the head of a fastener or other element to be driven which does project initially from within the bore. In both embodiments there preferably is provided means

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herein shown as a friction ring for yieldably retaining the striker in the bore.

The above and other features of the invention, including various novel details of construction, will now be more fully described in connection with only two of many possible exemplary forms of the invention, and with reference to the accompanying drawings thereof, in which;

FIG. 1 is a perspective view, with a portion broken away, of an explosively actuated impact device in the form of a hammer adapted to be hand operated;

FIG. 2 is a vertical section of the work-engaging end of a striker shown in FIG. 1; and

FIG. 3 is a view in side elevation, with a portion broken away of an alternate device according to my invention, an explosively actuated tool for driving fasteners.

Referring first to FIGS. 1 and 2, a hammer head 10 is provided with an operating handle 12. The head is formed with a bore 14 which is threaded at its upper end to receive a plug or anvil 16. The latter preferably has a central protrusion or igniter portion 18 for effecting ignition of an explosive charge 20 as will later be described. Slidably mounted in the bore 14 is a striker 22 which may be of circular cross section. A friction ring 24 seated in an annular groove formed on the striker may be of an elastomer such as rubber. This ring or other equivalent means serves yieldably to retain the striker in an initial operating position wherein the charge 20, which may have been deposited in an ignition cavity 26 formed in the striker, is proximate to the anvil protrusion 18 and arranged to be engaged thereby. It will be understood that in lieu of the cooperating protrusion 18 and relatively movable cavity 26, the protrusion may project from the striker 22 and the cooperating ignition recess may be centrally formed in the anvil 16.

The lower end of the striker 22 is formed with an outwardly projecting work engaging head 28 shown in its initial position in FIG. 2. It will be understood that the head 28 may have any selected shape for performing a reshaping, cutting, pounding punching operation or the like. Having loaded the device as above indicated, its handle 12 is swung to direct the head 28 against a work piece to be subjected to impact. There is thus an initial, manually caused blow struck on the work piece which simultaneously forces the striker 22 axially inward of the head 10 thereby causing rapid compression and ignition of the confined charge 20 between the protrusion 18 and the cavity 26. As a consequence of the explosion of the charge, the gas evolved acts, wholly in alignment with the striker, to drive the striker with a much greater force against the work piece, an equal and opposite force working in the opposite direction to overcome momentum of the head and then reversely move the head 10, which preferably is heavier than the striker, away from the work piece.

The charge 20 preferably is a relatively stable, low explosive, for instance gunpowder or a fibrous nitrocellulose wherein the nitrogen content is not more than 15% by weight. These have proven to be entirely safe in use since their deflagration, but not detonation, can be incurred by the direct mechanical impact in a substantially closed chamber as above described. While the charge may be used in the form of a powder, it is generally more convenient to employ the charge as a preformed pellet, the explosive powder having been compacted sufficiently to retain its own shape corresponding substantially to that of the cavity 26 provided. It is not desirable to make the pellet too hard since it is probable that porosity permits entrapment of air within the pellet which is useful in the frictional ignition incurred upon sudden crushing of the explosive particles in the confining chamber. Percussion

ignition of low explosive in the manner indicated is further disclosed and claimed in a prior application Ser. No. 371,242, filed May 29, 1964, in my name, now Patent 3,283,657. A deflagrating pellet of preferred type is disclosed in a copending application Ser. No. 524,168, filed Feb. 1, 1966, in my name.

Referring now to FIG. 3, a fastener driving tool generally designated 30 largely resembles the impact device of FIGS. 1 and 2 in structure and mode of operation, like parts bearing like reference characters. The tool 30 employs a shorter striker 33 disposed wholly therein, its work engaging end 34 being recessed at 36 to accommodate a head 38 of a nail 40 to be driven, which, for purposes of illustration only, is shown as having a washer 42 mounted on the lower portion of the stem 44 of the nail. The bore 14 accordingly in this case has a tapered mouth 46 for frictionally retaining and centering the washer 42 and hence its nail to be driven. A feature of the striker 33 is that it may be reversed end for end in the bore, the ignition cavity 26 becoming a work engaging head, and the former recess 36 becoming an ignition cavity. Thus a simple, explosively actuated hammer is readily adapted to accommodate different fasteners with a size of charge appropriate to the force of blow required. It will be understood that, in lieu of a tapered mouth 46, various frictional or other retaining means, as appropriate for particular nails, studs or other fasteners to be driven, may be employed.

The tools shown deliver single explosive blows which are adequate for many jobs. A six inch spike, for example, may be sunk into white or hard pine. Moreover, the tool lends itself to directing the blow with substantially the same accuracy as a carpenter experiences with the usual hammer that is repetitively struck. In general a larger charge will be used for heavier work. Means (not shown) may be provided for feeding successive pellet charges into the ignition cavity when more rapid repeat operation is desired, but the delay for reloading single blow tools

of the type shown is not great since the striker 22 or 33 is easily withdrawn from the bore 14 for this purpose.

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

1. An explosively actuated, manually directed hammer for driving a fastener of the type provided with an elongated shank having a head at one end and a guide washer adjacent to its other end, comprising a main body having an axial bore and movable toward and from engagement with a work piece into which the fastener is to be driven, one end of said axial bore being formed to provide a tapered mouth for frictionally retaining the washer of the fastener to be driven, an anvil secured in the other end of said axial bore and having a raised igniter portion axially disposed, and a slidably removable striker in sealing engagement with the wall of said bore intermediate the anvil and the retained fastener, the striker being of less mass than that of the main body and having an axial length approximately corresponding to the length of said bore less the combined lengths of the anvil and of said fastener shank, said striker being reversibly mountable in said bore and formed at each of its axially opposite ends with a central recess, said recesses being respectively adapted to receive the head of said fastener or a primerless solid explosive cooperative with said igniter portion.

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