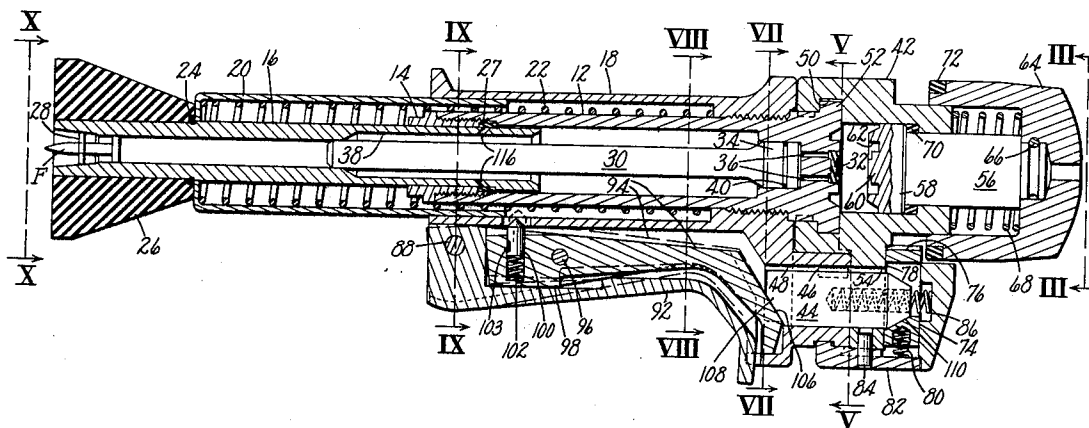


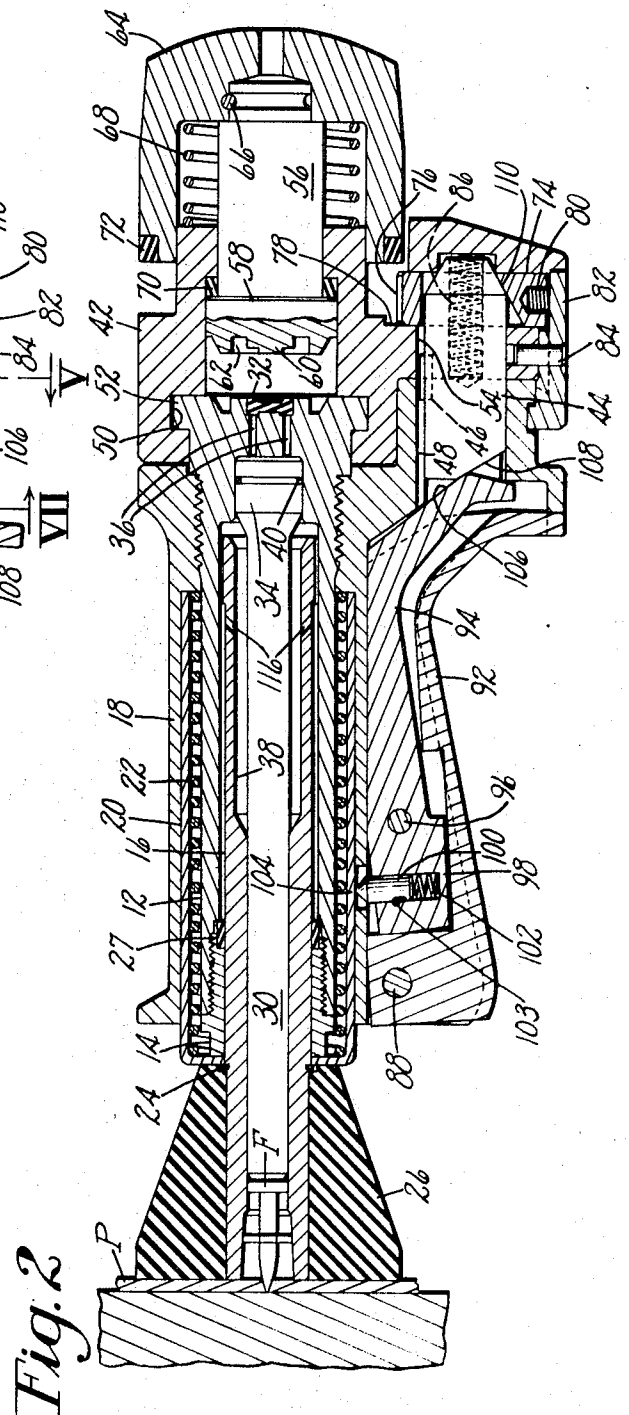
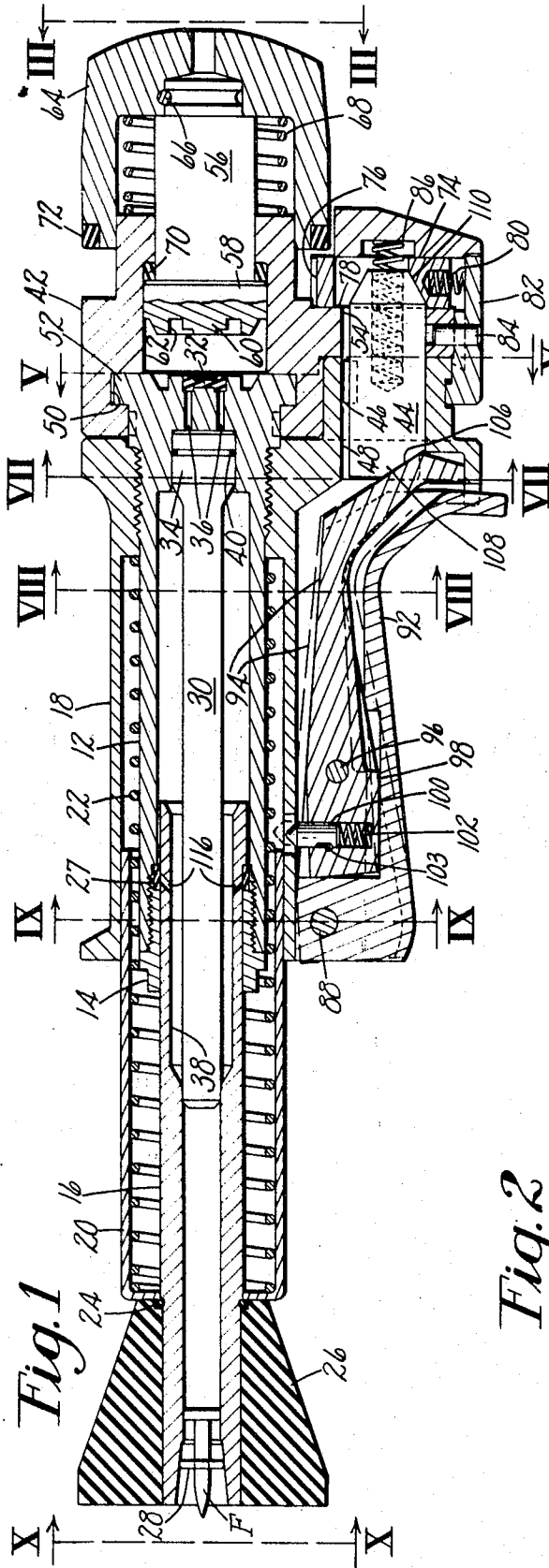
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 [21] Appl. No. **832,751**  
 [22] Filed **June 12, 1969**  
 [45] Patented **Jan. 26, 1971**  
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**a corporation of New Jersey**

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 3,075,197 1/1963 Kissane ..... 227/8  
*Primary Examiner*—Granville Y. Custer, Jr.  
*Attorneys*—W. Bigelow Hall, Richard A. Wise and Carl E. Johnson

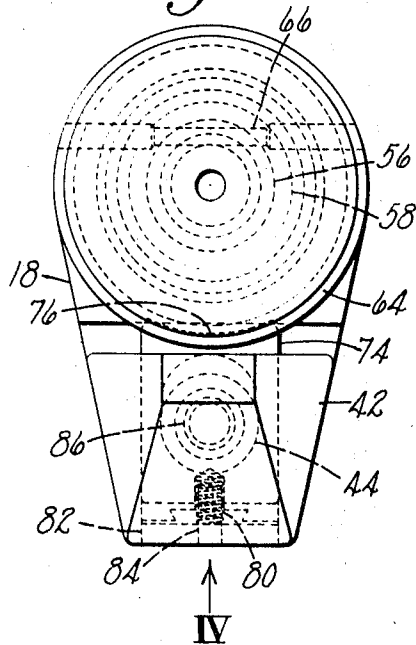
[54] **HAMMER IGNITION EXPLOSIVE TOOLS WITH SAFETY MEANS**  
**10 Claims, 10 Drawing Figs.**  
 [52] U.S. Cl..... **227/8**  
 [51] Int. Cl..... **B25c 1/14**  
 [50] Field of Search..... **227/8, 9, 10, 11**

**ABSTRACT:** When employed for driving fasteners or the like the tool has a muzzle end yieldably engageable with the work and a hinged housing carrying an element for striking the charge. A barrel breech end receives the charge when the housing is open and holds the charge for ignition when the housing is closed. Safety mechanisms controlled by a hand grip releasably locks the housing in operative position relative to the barrel and prevents firing of the charge unless the muzzle end is first thrust against the work by means of the grip.

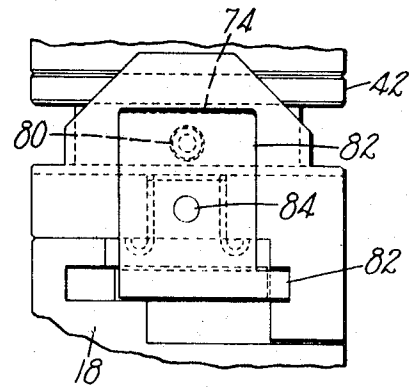




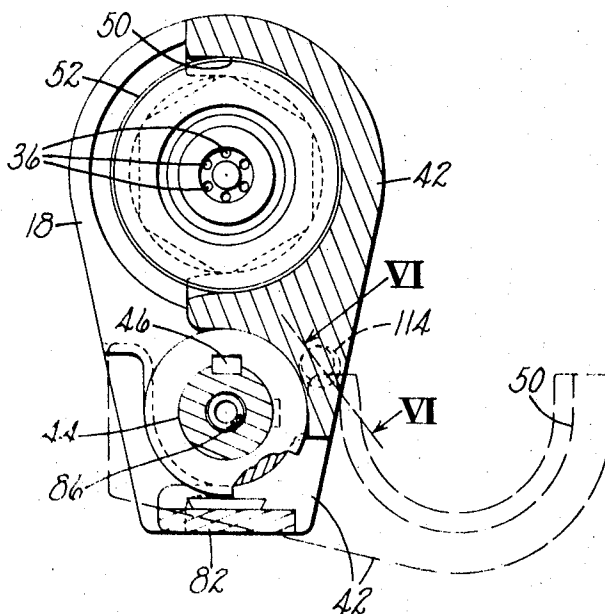
*Fig. 3*



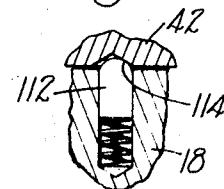
*Fig. 4*



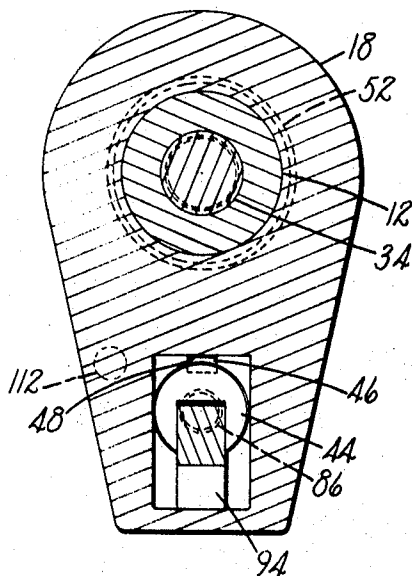
*Fig. 5*



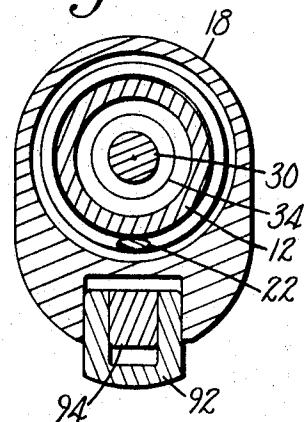
*Fig. 6*



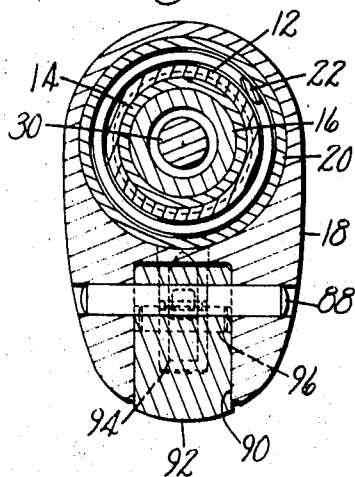
*Fig. 7*



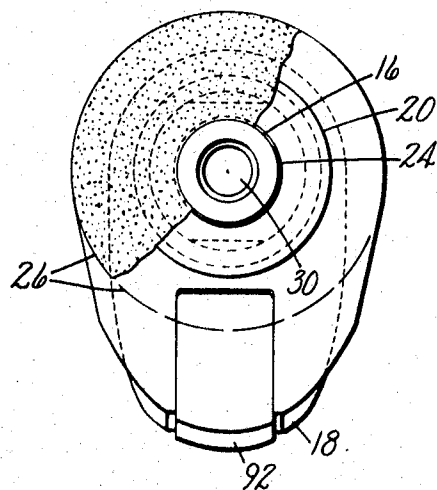
*Fig. 8*



*Fig. 9*



*Fig. 10*



# HAMMER IGNITION EXPLOSIVE TOOLS WITH SAFETY MEANS

## CROSS REFERENCE TO RELATED APPLICATIONS

Other applications pending and pertaining especially to fastener driving tools preferably employing caseless impact-ignition charges as the source of energy are: U.S. Pat. No. 3,469,757, issued Sept. 30, 1969 - Kvavle et al. U.S. Pat. No. 746,220, filed Jul. 19, 1968 - A.E. Newton et al. U.S. Pat. No. 746,712, filed Jul. 18, 1968 - C.J. DeCaro.

## BACKGROUND OF THE INVENTION

A caseless charge of the type disclosed in U.S. Letters Pat. No. 3,372,643, issued Mar. 12, 1968 upon an application filed in the name of Robert C. Kvavle is widely used, for instance in construction and industry, because of its convenience and safety, the charge being capable of impact ignition only when confined in a substantially closed chamber. The charge may be nonprimed and yet, like primed cartridges, may be impact ignited in such a chamber.

Various safety mechanisms for use in fastener driving tools have been proposed whereby explosive ignition cannot be effected unless the muzzle end of the tool abuts a work piece which is to receive the fastener to be driven. Nevertheless accidents can and do occur when such tools are fired upon being dropped muzzle or butt downward or when the safety mechanisms are misused or can be easily disregarded. Many of the prior safety devices for such tools are unduly complicated and add excessively to their weight and cost. The present invention is principally directed to providing reliable yet convenient safety means in a hand held explosive fastener driving tool, especially one of the type having a manually actuatable striker for igniting a caseless charge, but it will be understood that the invention is applicable also to tools employing conventional case charges.

## SUMMARY OF THE INVENTION

In view of the foregoing it is an object of this invention to provide improved safety mechanism for controlling operation of a breech loading handheld fastener driving tool wherein a manually actuated striker is provided for effecting explosive ignition.

It is another object of the present invention to provide a low recoil, easily maneuverable handheld explosive tool which is easily reloaded and adapted to drive different lengths of fasteners without necessitating the substitution of interchangeable parts.

As herein shown a hand grip secured in coaxial relation to a barrel of the tool is employed to cause its muzzle to bear yieldingly on a work piece and incorporates safety means comprising levers fully operable, and as one member, only when the muzzle is thus applied to release a cap for impact operation of the striker. Moreover as shown, the lever mechanism is advantageously arranged to permit such operation of the striker only when a housing therefor is in releasably locked and closed relation to the barrel. So-called "dry firing" is prevented. On completion of the fastener driving operation, an operator merely removes the tool from the work piece, swings the housing to its breech open position for reloading of another charge, recloses the housing, and, upon insertion in the muzzle end of the next fastener to be driven, is ready for the next cycle of operation.

In the preferred embodiment illustrated herein the barrel is formed at its breech end with a cavity to receive and hold the charge, a larger cavity in the barrel receives the piston head of a fastener driving ram, and exhaust vents communicating between the cavities. The striker is constantly urged yieldingly away from the charge-carrying cavity of the barrel, and the igniting end of the striker is formed with a complementally sealed formation cooperative with an annular configuration on the barrel.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and features of the invention including various novel details of construction and combinations of parts will now be more particularly described in connection with an illustrative embodiment and with reference to the accompanying drawings, in which:

FIG. 1 is an axial section of an explosive fastener driving tool in extended or inoperative condition, its bolt housing being closed and a safety block disposed to prevent ignition;

FIG. 2 is a view similar to FIG. 1, the tool now being in ready-to-fire condition with the muzzle abutting a work piece;

FIG. 3 is an end view looking in the direction of the arrows III-III of FIG. 1;

FIG. 4 is a bottom view of certain parts as assembled and looking in the direction of the arrow IV of FIG. 3;

FIG. 5 is a vertical section taken on the broken line V-V of FIG. 1, assuming the charge to be removed, and the open position of the bolt housing being indicated by dashed line;

FIG. 6 is a detail view looking in the direction of arrows VI-VI in FIG. 5 and showing a spring-pressed latch for the bolt housing;

FIG. 7 is a view taking on the line VII-VII of FIG. 1;

FIG. 8 is a view taken on the line VIII-VIII of FIG. 1;

FIG. 9 is a view taken along the line IX-IX of FIG. 1; and

FIG. 10 is a muzzle end view of the tool.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring mainly to FIGS. 1 and 2 the illustrative tool comprises a barrel 12 which threadably receives at one end a bushing 14 for slidably holding in coaxial relation an adapter or ram guide 16. The other end of the barrel 12 is exteriorly threaded for securing a tubular hand grip 18. An adapter tube 20 telescoping over the barrel 12 and the bushing 14 has a compression spring 22 confined therein and abutting an interior shoulder of the grip 18. The tube 20 has an intumed end abutting a retaining ring 24 on the ram guide 16 and is thus connected for joint axial movement with the guide relative to the barrel 12. Accordingly, the arrangement is such that, as indicated in FIG. 1, the ram guide 16 and the adapter tube 20 are urged forwardly, i.e. muzzleward, along with a spall pad 26 preferably of rubber carried on the muzzle end of the ram guide 16. In order to prevent the ram guide, spall pad, and adapter tube from being ejected from the tool assembly, a slightly enlarged rearward end of the ram guide 16 is engaged by a buffer ring 27 disposed in an annular recess in the portion 14. The mouth of the ram guide 16 preferably is internally tapered to frictionally retain a fastener F to be driven, a washer 28 of a relatively short drive pin being shown in this instance engaging the tapered mouth.

For driving the fastener F, whether it be a short one as shown, or one on the order of 3" in length, a ram or piston 30 is desirably moved axially by the force of explosion from ignition of a caseless charge 32 shown in this instance as loaded in a firing chamber received in the breech end of the barrel 12. The piston 30 has a head 34 receivable in a cylindrical portion of the barrel, the head initially closing off axial barrel vents 36 communicating with the firing chamber. The stem of the piston extends forwardly through an enlarged tubular portion 38 of the ram guide and has bearing in the reduced forward portion of the guide 16.

The tool is designed to practice what is often termed "zero stand off." This is to say that when a fastener F of any given length, say from 1" to 3" is inserted in the muzzle and is in contact with the locality of a work piece P wherein it is to be driven, as shown in FIG. 2, the ram stem abuts the fastener F endwise and the ram head 34, with its O-ring 40, is fully nested in the inner cylindrical portion of the barrel. Seizing the grip 18 with one hand and, against resistance of the spring 22, bringing the muzzle end of the tool with its fastener F to bear with pressure on the work piece P seats the ram 30 as required for ignition of the charge 32 by means hereinafter described.

The breech end of the tool will next be explained. A bolt housing 42 (FIGS. 1, 3 and 5) is mounted to swing, when permitted, about an axis extending parallel to the axis of the barrel 12. For this purpose the housing 42 is fulcrumed on a hinge pin 44 which also serves in a safety mechanism later to be described. The pin 44 fixedly carries a key 46 and slidably extends axially into a bore formed in the enlarged breech end of the grip 18. In its forward position shown in FIG. 1 the upwardly projecting portion of the key 46 is wholly seated in a longitudinal keyway 48 formed in the wall of the mentioned grip bore, and the bolt housing 42 may swing into breech closed position as shown in FIGS. 1 and 5, a 180° circumferential cavity 50 on the housing mating with a 360° flange 52 formed on the barrel 12. When, by operation of the safety mechanism hereinafter to be described, the hinge pin 44 is axially moved with its key 46 relatively rearward so that the latter is also partly seated in an aligned keyway 54 in the bolt housing 42, this housing is locked in closed position as required in preparation for firing.

The housing 42 slidably holds a bolt 56 an enlarged head 58 of which is formed with a central striker portion 60 arranged to impact the charge 32 centrally. Surrounding annular barrel-mating formations 62 of the bolt are adapted to seal the charge in its firing chamber at the instant of ignition thereby insuring that all gases of combustion are expelled through the vents 36 to drive the ram 30 and hence the fastener F. A cap 64 adapted to be struck a hammer blow when the charge is to be exploded is secured to the bolt 56 by means of a retaining pin 66. The bolt 56 is urged away from charge impacting position by a compression spring 68 confined between an end of the bolt housing 42 and an inner recessed end of the cap 64, the bolt head 58 preferably abutting a buffer ring 70. Desirably, too, a cap buffer 72 is seated on an inner end of the cap 64.

With the cap 64 and the bolt 56 retracted to their inoperative position, a hollow safety block 74 slidable in a radial slot in the housing 42 and receiving a conical rear end of the hinge pin 44 has a projection 76 interposed between a shoulder 78 of the bolt housing 42 and the cap buffer 72 positively to prevent ignition. The safety block 74 is urged into such locking position by a compression spring 80 one end of which is recessed in the block 74 and having an outer end bearing on a retainer plate 82. This plate is secured to the housing 42 by a retainer pin 84 (FIGS. 1-4), is preferably dovetailed to the housing, and has an turned forward end rotatably guided in a partly circumferential curve on the grip 18.

As has been noted with reference to FIG. 1, when the muzzle end of the tool is not engaged with a work piece P with endwise pressure, the spring 22 relatively moves the adapter tube 20 fully forwardly, and the safety block 74 is in an interference position preventing ignition operation of the cap 64 and the bolt 56. This condition is termed "air fire control." It will be noted that a compression spring 86 abutting the housing 42 internally is nested in an axial bore of the hinge pin 44 to urge it forwardly. Safety mechanism axially controlling the hinge pin 44 and next to be described is provided for rendering the tool operative only when the muzzle end engages the surface P as shown in FIG. 2.

Pivoted on a pin 88 (FIGS. 1, 2 and 9) spanning a longitudinal kerf 90 in the grip 18 is a grip lever 92 which may be actuated by one hand while firmly seizing the grip 18. Recessed in a longitudinal slot in the grip lever 92 is a safety lever 94 fulcrumed on a pin 96 secured in the grip lever. With the tool in firing position, as shown in FIG. 2, a front portion 98 of the safety lever 94 is urged into contact with an inner wall of the grip lever 92 by means of a pivot actuator 100 and a spring 102 seated in the safety lever 94, an end of the pivot actuator 100 now abutting the relatively retracted adapter tube 20. A retainer pin 103 in the lever 94 extends in a side recess in the actuator 100 to limit its axial movement. Accordingly, as the grip lever 92 is depressed and pivoted about the pin 88 into the position shown in FIG. 2, the safety lever 94 is immediately rotated about a contact point 104 of the actuator pivot 100

with the adapter tube 20. As a consequence a rear beveled surface 106 of the safety lever 94 engages a front surface 108 of the hinge pin 44 to cam it rearwardly against resistance of the spring 86. Hence a rear cam surface 110 of the hinge pin 44 acts on an internal bevel formed in the safety block 74 to cause it to be disengaged from interference with the cap 64. Not only is the tool now in condition to effect impact ignition of the charge 32 by means of a blow on the cap to drive the bolt 56, but the hinge pin key 46 has been relatively shifted rearwardly, as will be noted from a comparison of FIGS. 4 and 2, so that the key mates with both keyways 48, 54 and thereby insures interlocking of the barrel 12 and the bolt housing 42 in closed relation until the tool is subsequently removed from the work surface P. With the tool in air fire control condition shown in FIG. 1, depression of the grip lever 92 is ineffective to shift the hinge pin axially rearwardly sufficiently to render the tool operative since the adapter tube wall is not then in position to provide a resistance or pivot point for the safety lever 94.

After loading the charge 32 into the open breech of the tool, for insuring that the bolt housing 42, when swung into breech-closed relation with the barrel 12 will remain radially biased into closed position, a spring-pressed latch 112 (FIGS. 5-7) nested in the grip 18 abuts a wall of a conical recess 114 in the housing 42.

From the foregoing description the mode of operation of the tool is apparent. It will be understood that alternatively the bolt 56 may be adapted to receive and hold the charge 32 for impact ignition against the rear face of the barrel 12. The shapes of the confronting faces of the bolt and the barrel would then be interchanged, operation remaining essentially the same. For use in holding either a caseless charge 32 or a conventional cartridge to be impact ignited in the tool, an interchangeable loose-fitting breech plug (not shown) may be removably mounted in the breech end of the barrel 12.

Conveniently, when a longer fastener F is to be driven, the same ram 30 may be used. This advantageous feature is due to the fact that when the shortest fastener F is in the muzzle in ready-to-fire condition as shown in FIG. 2, the adapter tube 20 is most fully retracted relatively to the ram 30, and the ram guide 16 is then also fully telescoped toward the breech end. When a longer fastener F (up to about 3") is in the tool to be driven, the adapter tube 20 will be axially retracted a lesser distance relative to the barrel to seat the ram head 34 therein. Importantly, for all fastener lengths the ram guide 16 can, as indicated in FIG. 1, receive the stem of the ram 30 for guiding, and the adapter tube 20 will, when free to be axially positioned by the takeup spring 22, not provide a resistance or pivot point 104 for the pivot actuator 100 until the tool is in its ready-to-fire condition as illustrated in FIG. 2.

I claim:

1. In an explosively operated fastener driving tool, the combination with a barrel of a bolt housing relatively pivotal about an axis parallel to that of the barrel for movement between breech-open and breech-closed positions, of a grip associated with the barrel for manually brining the muzzle end of the tool yieldingly into ready-to-fire relation to a work piece wherein the fastener is to be driven, and a safety mechanism extending at least partly in the grip and movable during operation of the grip to lock the barrel and bolt housing in breech-closed relation while rendering a charge in the breech impact ignitable by the bolt of said housing.

2. In an explosively operated tool for driving fasteners, a barrel, a bolt yieldingly cooperative with the breech end of the barrel to impact ignite a charge, one of the bolt and the barrel breech end being adapted to receive and hold the charge until its gases of combustion exhaust into the barrel, a grip connected to the barrel, a tubular member coaxially telescoped in the grip and yieldingly urged to project muzzleward for engagement with a work piece, a bolt housing hinged on the grip and slidably carrying the bolt into and out of operative sealing relation to the breech end of the barrel when the housing is in breech-closed relation to the barrel, interlock means movably

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mounted in the housing for preventing relative movement together of the bolt and the barrel, and manually operable safety means movably mounted in the grip and effectively operable to render the interlock means inoperative only when the tubular member is forced against the work piece by relative movement of the grip and said member.

3. A tool as set forth in claim 2 wherein the bolt housing is pivotally mounted on a hinge axis parallel to and offset from the axis of the barrel.

4. A tool as set forth in claim 3 wherein a hinge pin extending in the grip and the bolt housing serves as fulcrum for the latter, and the safety means is arranged to displace the hinge pin relative to the interlock means to render the interlock means inoperative.

5. A tool as set forth in claim 3 wherein the housing slidably carries a cap for receiving a blow for impacting the bolt with the barrel, and the interlock means includes a safety block yieldingly urged into an interference position between the cap and the housing to bar operation of the bolt.

6. A tool as set forth in claim 4 wherein the safety means comprises a grip lever pivoted on the grip, and a safety lever pivoted on the grip lever, the safety lever having at one end cam engagement with the hinge pin and at the other end a pivot actuator, the arrangement being such that said pivot actuator only has operative engagement with a wall of the tool to displace the hinge pin when said tubular member forcibly engages the work piece.

7. A tool as set forth in claim 6 wherein the interlock means includes a safety block spring biased into interference position and having a cam surface arranged to be engaged by the hinge pin to displace the block from said position in response to actuation of the grip lever in the grip.

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8. In an explosively actuated fastener driving tool of the type having a barrel provided with a fastener driving ram and a bolt slidable in a bolt housing closeable on the barrel to cooperate with the barrel in impact igniting an explosive charge between the ram and the bolt, a tubular ram guide axially telescoped in the barrel and having a forwardly projecting muzzle end for receiving different lengths of the respective fasteners to be driven into a work piece, an adapter tube telescoped on the barrel and yieldingly urged forwardly thereof, the ram guide and the adapter tube being connected for joint axial movement relative to the barrel and independently of the ram, an element movably mounted in the housing between a first position wherein the bolt and barrel are prevented from cooperating and a second position wherein they can cooperate when the housing is closed on the barrel, and a safety control mechanism including a pivot actuator and effectively operable manually to shift said element to its second position only when the adapter tube is sufficiently retracted relative to the barrel by engagement of the ram guide with the work piece to provide a resistance point for the pivot actuator.

9. A tool as set forth in claim 8 wherein the safety control mechanism includes a grip connected to the barrel, a lever pivotally mounted in the grip, a safety lever pivoted to the grip lever and carrying said pivot actuator, and cam means operable by the safety lever for controlling the movement of the element.

10. A tool as set forth in claim 9 wherein said cam means includes a hinge pin on which said housing may be turned between breech-open and breech-closed positions relative to the barrel.

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