

Dec. 7, 1965

R. J. KOPF ETAL
POWDER ACTUATED TOOL

3,221,966

Filed Jan. 11, 1963

3 Sheets-Sheet 1

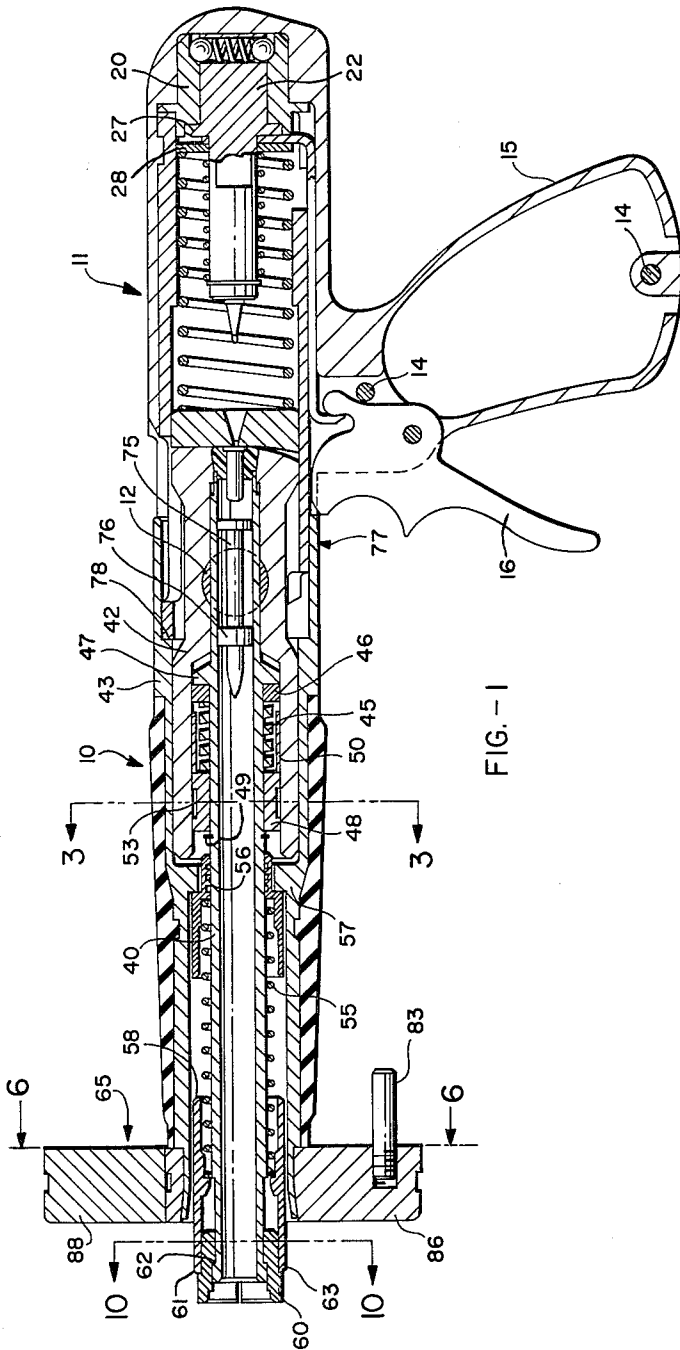


FIG. - 1

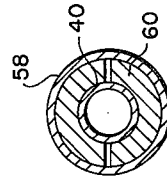


FIG. - 10

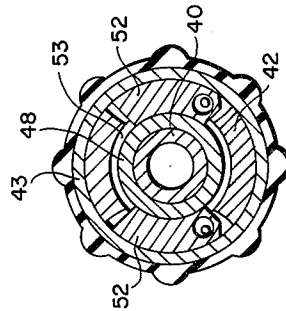


FIG. - 3

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3 Sheets-Sheet 2

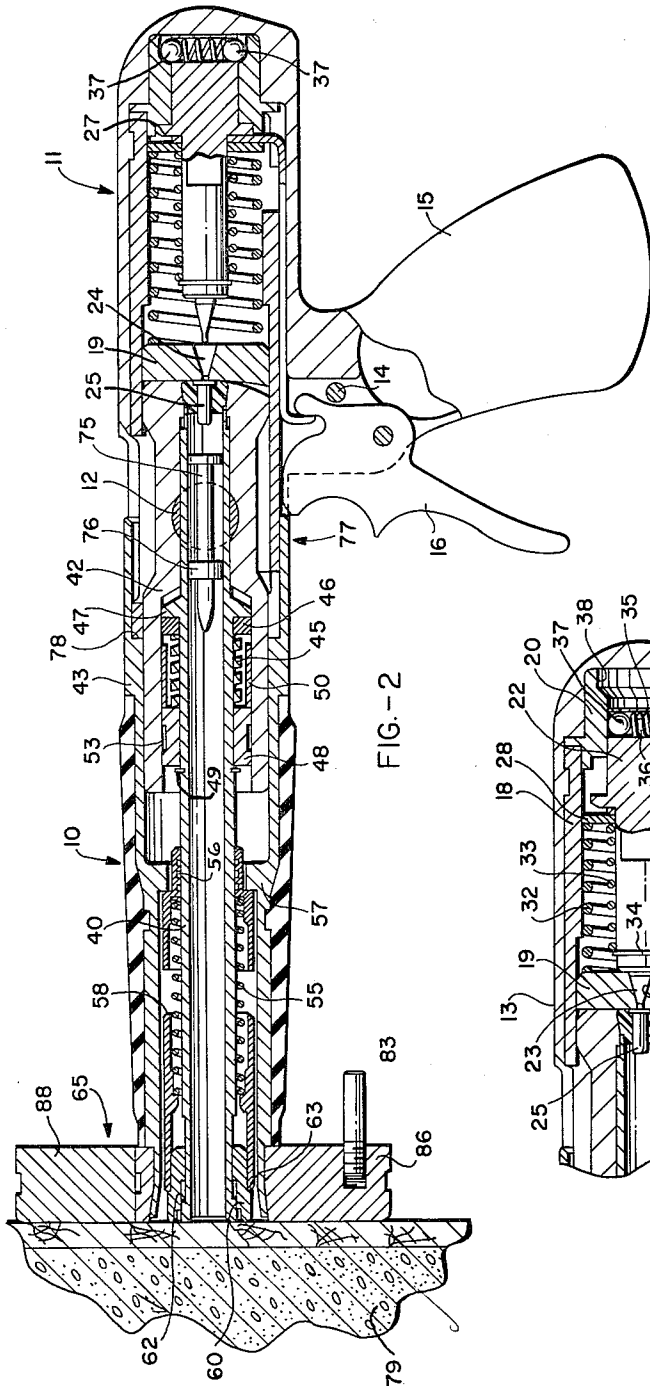


FIG. 2

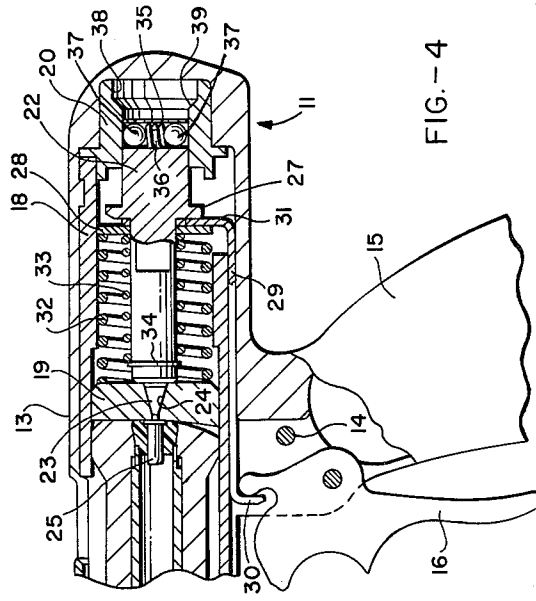


FIG. 4

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POWDER ACTUATED TOOL

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3 Sheets-Sheet 3

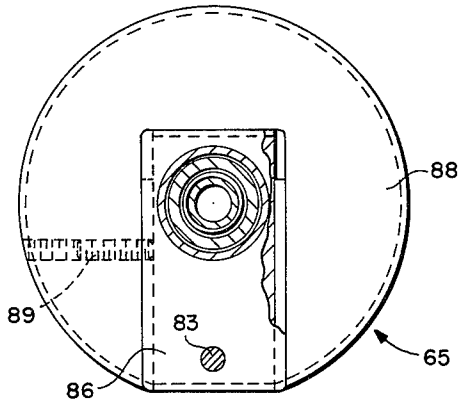


FIG.-6

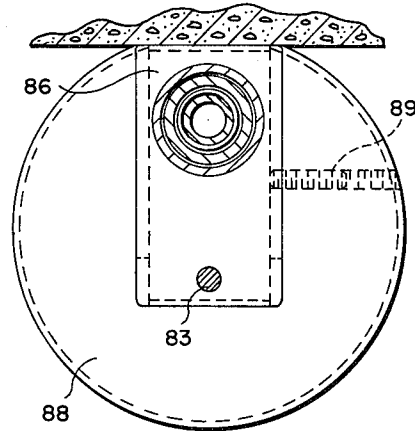


FIG.-7

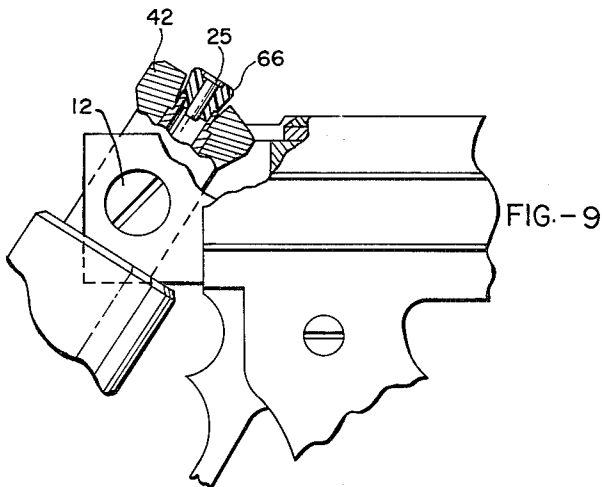


FIG.-9

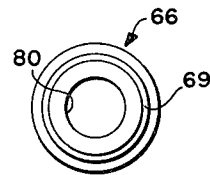


FIG.-11

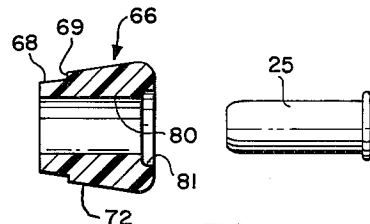


FIG.-8

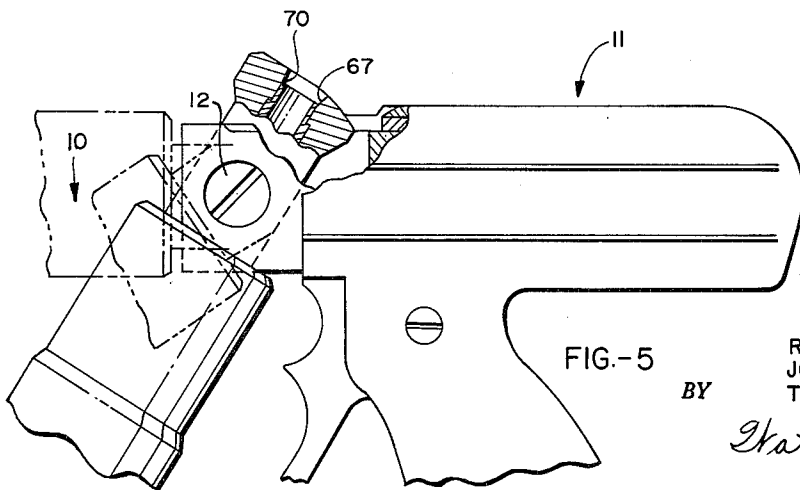


FIG.-5

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3,221,966

POWDER ACTUATED TOOL

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Filed Jan. 11, 1963, Ser. No. 250,926
6 Claims. (Cl. 227—11)

This invention pertains to powder actuated tools and more particularly to an improved explosively energized tool for imbedding fasteners in construction members.

Tools known as powder actuated tools are now well known. With these tools, an explosive charge carried by a blank cartridge is ignited and the force supplied by the expanding gases of the ignited charge propels a fastener from the tool and imbeds it in a construction member.

There are two principal types of powder actuated tools which are; (1) a piston type, and; (2) a ballistic, or free-flight type. With the freeflight type of tool, the force of expanding gases is applied directly to the fastener and the fastener is ballistically expelled from the barrel of the tool. With the piston type of tool, the force is used to propel a piston and the piston drives the fastener.

The tool disclosed here is a ballistic tool. Many features of this invention are applicable to piston type powder actuated tools as is demonstrated by an analysis of copending application for patent, Serial No. 250,952 filed January 11, 1963, for a Piston Powder Actuated Tool.

With powder actuated tools the pre-eminent objective is to provide a tool which is safe. The problem which has been solved by this invention is the provision of a workable, simple, dependable and versatile tool which is lighter and simpler to use than prior tools while safety standards established by the best prior tools are maintained or exceeded.

Since with powder actuated tools an accidental premature firing can be dangerous, a universal objective in the powder actuated tool industry has been to build tools which cannot be fired until the tool is positioned for connecting a fastener to a construction member. Customarily, this is accomplished by providing some mechanism which renders a triggering mechanism effectual only when a sensing mechanism is depressed as the tool is positioned against the construction member.

If the cartridge fires after this sensing mechanism has been depressed there is usually adequate safety. However, if the cartridge fails to fire because of some malfunction, a dangerous condition is present. If the cartridge misfires; that is, the explosive charge fails to ignite at all, with the prior art, one must raise the gun to a position which is unsafe under the circumstances and press it down again to again ready the trigger mechanism for firing.

With the present invention this dangerous condition is completely eliminated because the triggering mechanism may be repeatedly actuated and the hammer driven forward to drive the firing pin against the cartridge repeatedly until there is an explosion. At the same time, pulling the trigger at any time other than when the tool is both properly assembled and positioned for inserting a fastener in a construction member cannot ignite the explosive.

The prevention of ignition except when properly positioned, is accomplished by providing a mechanism in which pressure is applied as the tool is positioned against a construction member to shift the cartridge rearwardly to its ignition position. Prior to this rearward shifting the cartridge is maintained sufficiently far forward so that the firing pin cannot strike it even if the trigger is pulled.

Ignition is further prevented through the provision of a

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construction wherein the cartridge will be shifted too near to the hammer if the tool is not properly assembled. When the cartridge is too near the firing mechanism it is not possible for the hammer to strike the cartridge with sufficient force to ignite it.

With many prior art breech loading tools, so called "air firings" can and sometimes have occurred. One type of an "air firing" occurs when a cartridge is exploded at a time when the breech is not fully closed. With the present tool this possibility is completely obviated by providing a tool in which a barrel housing is normally biased into telescopic locking arrangement with the breech assembly to positively lock the two against relative pivotal movement. This structure further provides a tool which is easy to "break" intentionally but locked against breaking at other times.

High velocity ballistic tools are usually equipped with a guard around the muzzle end. The usual purpose of the guard is to prevent ricochets and the like. With this invention, the guard is also used to inhibit damage to a construction member known as "spall."

In tools of this invention spall is inhibited by absorption of the shock wave imparted to the construction member by the impact of the fastener. This tool further limits spall through confining the impact of the escaping explosive gases on the construction member. To obtain these advantages three elements are provided: the muzzle end of the barrel, a muzzle ring, and the guard all about the construction member. These three elements are each movable axially relatively to the others and separately maintained in their engagement with the member. During recoil, these members are separately and sequentially lifted out of engagement with the construction member by the recoil forces. This sequential release of the member contact permits contact to be maintained until the explosive gases and fastener impact forces are dissipated thereby substantially completely eliminating spall.

Prior art guards have limited the use of the tool. When one wishes, for example, to imbed a fastener in a floor near a wall, unless special provision is made, the guard will obstruct and prevent the gun from being positioned close to the wall.

With the present invention a novel guard is provided wherein a relatively small guard body is provided which is generally rectangular and which extends only a relatively small amount from the top of the barrel and to the sides. A removable guard attachment is supplied which when assembled with the guard body in its usual position provides a guard which in appearance resembles prior known guards in that it is an annular ring, concentric about the barrel. By reversing the guard attachment, however, one obtains an eccentric guard to provide full protection while positioning the tool against the wall or the like. If the fastener is to be embedded in a corner or other place where there is a space limitation one may remove the guard attachment altogether and use simply the rectangular guard body.

The loading of a powder actuated tool is another difficulty which has been encountered in the prior art. If the cartridge is inserted in a breech loading technique in a most desired position which is in axial alignment with the barrel, then it has been necessary to either: (1) provide an annular insert to surround the cartridge; or, (2) use a relatively large size cartridge; or, (3) load the fastener through the muzzle. The first of these is the most satisfactory solution.

It has been proposed to use a plastic annular insert to position the cartridge in the breach. This permits a large enough breech opening for the insertion of a fastener and at the same time provides an expendable insert. Another of the advantages of the cartridge holder is that

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cartridges of different caliber can be used selectively in a single tool without the need for interchanging barrels or reusable inserts or in any other way modifying the tool. Previous proposals for this solution to these problems have resulted in a construction in which the exploding gases have sometimes escaped radially from the explosion chamber tending to dirty and then jam such things as the ejection mechanism. With the present invention this has been overcome through the provision of a novel and improved plastic carrier for the cartridge which carrier serves a multiple purpose.

The carrier, when the tool is used, is wedged between a breech block and a cartridge holder to effect fluid tight seals between the carrier and the cartridge holder and cartridge. In addition, the carrier has a shoulder which abuts the end of the barrel and shifts the barrel forwardly somewhat to energize an ejection mechanism. Thus, the carrier is also wedged between the breech block and the barrel providing a second seal against the escape of gases radially or rearwardly.

The thus far described seals and energizing of the ejection mechanism are obtained when the tool is closed after loading. The breech block cams the cartridge carrier forwardly into the cartridge holder and against the barrel. In addition, the cartridge carrier has a forwardly extending skirt which projects into a barrel and which surrounds the cartridge. The gases from the explosion drive this skirt outwardly into a fluid tight seal with the barrel to provide yet another seal against escape of gases from the explosion chamber. Thus, the ejection mechanism and all other mechanism surrounding the explosion chamber are fully sealed and protected from the expanding gases, powder and the like by this plastic cartridge holder.

One object of the invention is to provide an improved triggering mechanism which may be repeatedly fired without raising the tool away from a construction member to which a fastener is to be applied.

Another object of the invention is to provide a novel and improved powder actuated tool in which the cartridge is appropriately positioned for firing when, but only when, the tool is properly assembled and is pressed against a construction member.

A further object of the invention is to provide a novel and improved guard for a powder actuated tool which permits the tool to be positioned very closely to adjoining construction members.

A related object of the invention is to provide a novel and improved guard which muffles the sound of the explosion.

A major object of the invention is to provide a novel and improved tool construction which substantially eliminates spall.

An additional object of this invention is to provide a novel and improved cartridge carrier.

More specifically an object of this invention is to provide a cartridge carrier which is used to both transmit energizing force to the ejection mechanism and to effect seals between the explosion chamber and surrounding firing mechanism.

A principal object of the invention is to provide a novel and improved powder actuated tool which is dependable, safe, and simple to manufacture, use, and repair.

A further object of the invention is to provide a tool in which the guard remains against a construction member while recoil is absorbed by the remainder of the tool.

Other objects and fuller understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings in which:

In the drawings:

FIGURE 1 is a sectional view of a loaded tool;

FIGURE 2 is a sectional view of a loaded tool positioned for firing;

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FIGURE 3 is a sectional view as seen from the plane indicated by the line 3—3 of FIGURE 1;

FIGURE 4 is a foreshortened sectional view of the breech assembly at the time of firing of the tool;

FIGURE 5 is a fragmentary elevational view, with parts broken away, of the tool broken for loading;

FIGURES 6 and 7 are sectional views as seen from the plane indicated by the line 6—6 of FIGURE 1 showing elevational views of the guard in two positions;

FIGURE 8 is an enlarged exploded view of the cartridge and the carrier;

FIGURE 9 is a view corresponding to FIGURE 5 with a cartridge and carrier inserted;

FIGURE 10 is a sectional view as seen from the plane indicated by the line 10—10 of FIGURE 1; and

FIGURE 11 is an end elevational view of the cartridge carrier.

Referring now to the drawings and to FIGURES 1 and 2 in particular, barrel and breech assemblies are shown generally at 10 and 11. These assemblies are relatively pivotable about the pin 12 to permit breech loading of the tool.

The breech assembly

The breech assembly 11 includes a housing 13. This housing is a two-piece housing of members which meet along a longitudinal axial plane and are secured together as by bolts 14. The housing 13 includes a handle portion 15. A trigger 16 is pivotally connected to the handle portion for actuating a firing assembly. The housing 13 carries a reinforcing sleeve 18. A breech block 19 is slidably carried in the forward end of the reinforcing sleeve. An annular hammer retainer 20 is secured to the rearward end of the sleeve 18 and also positioned within the housing 13.

A hammer 22 is snugly telescoped in the hammer retainer 20. A firing pin 23 is on the forward end of the hammer 22. When the tool is in the firing position of FIGURE 2, the firing pin 23 is selectively projectable through a firing pin aperture 24 in the breech block 19 to ignite a powder charge carried by a cartridge 25.

The hammer 22 (FIG. 4) includes a radially extending shoulder 27 which abuts the forward end of the hammer retainer 20. A spring compression washer 28 surrounds the hammer near the shoulder 27. A firing slide 29 is slidably mounted between the housing 13 and the sleeve 18. The firing slide 29 has a downwardly extending trigger arm 30 in actuating engagement with the trigger 16. The firing slide 29 has an upwardly extending spring compression arm 31 positioned between and normally in engagement with both the washer 28 and the hammer shoulder 27.

A hammer return spring 32 is interposed between the breech block 19 and the washer 28 to urge the washer back against the compression arm 31, and the arm 31 in turn against the hammer shoulder 27. The return spring 32, then, maintains the hammer in its rearward position as shown in FIGURE 1 except when the trigger 16 is actuated. The return spring also returns the hammer to the position shown in FIGURE 1 after such actuation of the trigger.

A striker spring 33 surrounds the hammer 22. The striker spring 33 is interposed between the washer 27 and a retaining ring 34 carried near the forward end of the hammer. When the tool is fired this striker spring 33 drives the hammer 22 forward to cause the firing pin 23 to ignite the powder.

One of the outstanding features of this invention resides in the novel pressure releasable hammer retainer which is provided. At the rearward end of the hammer 22 there is a transverse hammer bore 35. A retainer spring 36 is positioned in the bore to bias a pair of retainer balls 37 outwardly. Normally the balls rest against the walls of an annular recess 38 in the hammer retainer 20. This recess 38 terminates at its forward end in a camming surface 39.

When the trigger 16 is depressed it pulls the firing slide 29 forward. This causes the washer 28 to be brought forward compressing both the return spring 32 and the striker spring 33. The forward movement of the washer 28 compressing both springs will continue until the compressing force building up in the striker spring 33 overcomes the hammer retaining force of the retainer spring 36. Once the compressive force in the striker spring 33 has reached this level, the hammer 22 will be moved forward and the camming surface 39 will cam the retainer balls 37 into the hammer bore 35, compressing the retainer spring 36. Once these balls have been compressed into the bore and assume the position shown in FIGURE 4, the hammer 22 will be thrust forward at an accelerated rate. This will drive the firing pin 23 against the cartridge 25 to ignite the charge in the cartridge 25. The forward end of the hammer 33 will strike the breach block 19 to arrest the hammer 33 and prevent further forward motion. This is the position of FIGURE 4. Once the trigger 16 is released the return spring 32 will drive the hammer and associated parts rearwardly to the position shown in FIGURES 1 and 2.

One of the features of this invention resides in the fact that the hammer can be repeatedly thrust forward so long as the trigger is repeatedly depressed. Unlike the prior art devices, there is no need to assume that all malfunctions are misfires and to reactuate the tool. With the usual prior art devices there is some mechanism provided to render the triggering system effectual each time the tool is positioned for inserting a fastener in a construction member. With the present invention, however, the triggering mechanism is effectual at all times to drive the hammer forward. Safety is provided, however, in that the breech block is either (1) maintained in a forward position out of reach of the hammer except when the tool is in the FIGURE 2 position and ready for firing; or, (2) moved too far rearwardly if the tool is positioned for firing at a time when it is not properly assembled. The details of the movement of the breech block which provides this safety will be explained below.

The barrel assembly

The barrel assembly 10 includes a central barrel 40. A heavy annular cartridge holder 42 surrounds the rearward end of the barrel 40 and extends forwardly about one-half of the length of the barrel. The cartridge holder 42 is slidably mounted in a barrel housing 43. The barrel 40 is axially slidable relative to the cartridge holder 42, and the cartridge holder and barrel are both axially slidable relative to the barrel housing 43. The details of this relative axial movement will be explained in greater detail below.

The pivot pin 12 is snugly mounted in the cartridge holder 42 and the housing 13, and pivotally connects the barrel 40 and the cartridge holder to the breech block. The barrel 40 extends through and is slidable relative to the pivot pin 12. The breech block 19, as is standard and well known in the art has a pair of slotted arms pivotal and slidable on the pivot pin 12. This permits the barrel and the cartridge holder to be moved axially rearwardly to slide the breech block 19 rearwardly in the reinforcing sleeve 18 and ready the tool for firing.

A heavy ejection spring 45 surrounds the barrel, 40. The ejection spring 45 acts rearwardly against a spacer 46 which abuts an annular shoulder 47 on the barrel. A cartridge holder engaging ring 48 is connected to the cartridge holder and abutted by the forward end of the ejection spring 45. A snap ring 49 is fixed to the barrel 40 to limit forward movement of the holder ring 48 relative to the barrel 40. A spaced ring 50 surrounds the ejection spring 45 and is axially interposed between the spacer 46 and the cartridge holder ring 48 to prevent overcompression of the ejection spring 45.

The cartridge holder ring 48 and the cartridge holder 42 are secured together against relative axial movement.

The mechanism securing the two together is shown in FIGURE 3. A pair of dogs 52 are pivotally carried by the cartridge holder 42. These dogs extend into an annular groove 53 in the periphery of the cartridge holder ring 48. The dogs fit snugly in the ring to inhibit relative axial movement between the ring and the holder. The dogs 52 are held in this groove 53 by the surrounding relatively slidable barrel housing 43.

A housing retraction spring 55 surrounds the barrel near its forward end. An annular spring retainer 56 is interposed between the housing spring 55 and a shoulder 57 on the barrel housing 43. An annular spring retainer and retainer guide 58 abuts the forward end of the housing spring 55. The retainer guide 58 is in slidable engagement with the periphery of the barrel 40 and with the interior of the barrel housing 43.

A two-piece split muzzle ring 60 surrounds the forward end of the barrel and projects past it. The ring 60 telescopes into a forward projection 61 on the retainer guide 58. The split ring 60 overlies a radially extending shoulder 62 on the muzzle end of the barrel 40 which limits axial forward movement of the split ring and maintains it in the guide projection 61.

A shoulder 63 on the muzzle split ring 60 abuts the forward end of the retainer guide 58. The force of the housing retraction spring maintains the retainer guide in biased relationship with the shoulder 63 and therefore the split ring 60 in engagement with the barrel shoulder 61.

A guard 65 is secured to the forward end of the barrel housing 43. The guard 65 provides several of the outstanding features of this tool, and it will be described in greater detail below.

Operation of the tool and the cartridge carrier

In FIGURE 8 the cartridge 25 and a plastic cartridge carrier 66 are shown in exaggerated scale. When the tool is to be used, the cartridge is first telescoped into the cartridge carrier 66. The tool is then broken. To accomplish this breaking, it is necessary to manually pull the barrel housing 43 axially forwardly relative to the breech assembly and against the action of the housing retraction spring 55. This forward relative shifting is continued until the barrel housing 43 and the breech reinforcing sleeve are no longer in telescopic overlapping relationship, which overlapping relationship is shown at 77 in FIGURE 1. Once the overlapping relationship has been terminated, the barrel and breech assemblies 10, 11 are pivoted about the pin 12 to "break" the tool and place it in the position shown in FIGURES 5 and 9.

After the tool has been broken, a fastener 75, FIGURE 1, is inserted into the barrel through the breech. The fastener 75 may have a friction washer 76, or the like around it to maintain it in appropriate aligned relationship in the barrel and to retain it at the rearward end of the barrel prior to ignition of the cartridge 25.

The cartridge and carrier are then telescoped into a tapered seat at 67 in the cartridge holder 52. A tapered forward skirt portion 68 of the cartridge carrier guides the carrier into alignment as it telescopes into a rearward end of the barrel 40. The carrier is inserted until a barrel abutting shoulder 69 is in contact with the rearward end 70 of the barrel and a rearward part of the skirt portion is somewhat compressed by the barrel. At this time the carrier and cartridge are in the position shown in FIGURE 9 with both projecting somewhat rearwardly past the rearward surface of the cartridge carrier 42.

The tool is now pivoted closed. As the tool closes, the forward surface of the breech block 19 will cam the carrier 66 into the cartridge holder 42. This wedges a tapered carrier seating surface 72 of an enlarged tapered portion tightly against the tapered seat 67. It also drives the carrier 66 forwardly into the cartridge holder and against the rearward end 70 of the barrel 40, thus forcing the barrel 40 forward somewhat. This forward move-

ment of the barrel 40 relative to the holder 42 compresses the ejecting spring 45 an amount appropriate to effect the subsequent ejection. This will cause the barrel 40 to shift forwardly slightly so that the retaining snap ring 49 is slightly out of engagement with the holder ring 48. This spacing has been exaggerated in FIGURES 1 and 2 for clarity.

In addition the housing retraction spring 55 will drive the barrel housing 43 axially rearwardly when the tool is closed from its forwardly located, "open" position that the barrel housing occupies when the tool is broken, establishing the telescopic relationship of the barrel housing and sleeve retainer 18 at 77. This positively locks the barrel and breech assemblies in aligned relationship preventing any accidental breaking of the tool. The housing retraction spring 55 maintains a shoulder 78 located near the rearward end of the barrel housing 43, in abutment with the forward end of the sleeve retainer 18.

After the fastener 75 and the cartridge 25 have been loaded into the tool and it has been closed, the split muzzle ring 60 is positioned against a member 79 to which the fastener 75 is to be connected. The barrel housing 43 may be grasped in one hand and the handle portion 15 in the other and the operator then presses forwardly. The forward pressing produces a triple contact of the construction member with three closely spaced concentric rings of contact. This triple contact is obtained because, as the operator presses forwardly:

(1) The muzzle ring 60 is pressed against the construction member and caused to slide rearwardly relative to the barrel and against the action of the housing retraction spring 55. This rearward sliding continues until the forward end of the barrel abuts the construction member 79.

(2) Continued pressing of the tool against the construction member drives the barrel 40 and breech block 19 rearwardly against the action of the return spring 32 and the muzzle ring 60 against housing retraction spring 55. This rearward movement continues until the face of the guard 65 abuts the construction member 79.

(3) Once the face of the guard abuts the construction member further compression is prevented by reason of the abutment of barrel housing shoulder 78 and the sleeve retainer 18.

At this time the forward end of the barrel is in engagement with the construction member 79. This engagement is closely surrounded by the concentric engagement of the split muzzle ring 60 which in turn is closely surrounded by the third ring of engagement that is supplied by the guard 65.

The telescopic rearward movement of the barrel 40 pushes the barrel against the cartridge carrier 66 which in turn presses against breech block 19 shifting the breech block 19 rearwardly to its firing position of FIGURE 4. The friction of the carrier 66 together with the compaction through the ejection spring 45 brings the cartridge holder 42 rearwardly with the barrel and breech block. Since the guard 65 is prevented from moving rearwardly the amount of depression of the barrel and therefore the position of the breech block is controlled by the guard.

The breech block is constructed in a manner which will permit the breech block 19 to be moved rearwardly from its firing position of FIGURE 2. Accordingly, if the tool is either improperly assembled or not completely assembled, rearward pressure applied to the barrel will cause excess rearward travel of the breech block. Unless the breech block is exactly in the position shown in FIGURE 2, the tool will not fire because (1) if the breech block is forward of that position the firing pin 23 cannot reach the cartridge 25 and (2) if it is rearward of that position the hammer 22 cannot gain sufficient momentum to cause an ignition of the explosive charge in the cartridge 25.

When the tool is in the position shown in FIGURE 2 the tool is ready for firing. At this time the breech block

19 has been moved rearwardly sufficiently such that when the hammer 22 is forced forwardly by actuating the trigger 16 the firing pin 23 will strike the cartridge causing it to ignite.

Recoil

Once the tool has been fired another of the features of the invention comes into being. The rearward reaction from the force of the explosion will act against the breech assembly 11 and the barrel and cartridge holder moving them all rearwardly against the resistance of the hammer return spring 32 and relative to the remainder of the tool. As the barrel and breech block recoil rearwardly against the action of the hammer return spring 32, the remainder of the breech assembly will be driven rearwardly by force transmitted to it by the spring. As the barrel continues to recoil, the barrel shoulder 62 will engage the muzzle ring 60 lifting the ring from its engagement with the construction member and transmitting some of the recoil force to the barrel housing spring 55. Finally, the guard will be lifted from the construction member but only after a substantial part of the recoil force has been expended and the gases have been substantially completely eliminated.

Thus, the recoil will lift the barrel 40 upwardly away from the construction member 79 and relative to the barrel housing 43, while the muzzle ring 60 and guard 65 are maintained in engagement with the construction member. Therefore on firing, the barrel housing 43, the muzzle ring 60 and the guard 65 will be maintained in their positions with the guard pressing tightly against the member 79 to provide full shielding against any possible the ricochet and confining the expanding gases to a very small area within the bore of the shield so as to substantially eliminate spall.

Ejection

After the fastener has been set the tool is again broken. As the tool breaks the ejection spring 45 drives the barrel 40 rearwardly relative to the cartridge holder 42 until the snap retaining ring 49 strikes the holder ring 48. This movement is sufficient to eject the cartridge and carrier from the cartridge holder 42.

The cartridge carrier

One of the features of this invention resides in the cartridge carrier 66. An examination of FIGURE 8 will show that the cartridge carrier has a bore 80 which receives the cartridge 25. The holder is counterbored at its outer end, the right-hand end of FIGURE 8, at 81 to telescopically receive the head of the cartridge.

When the cartridge is ignited expanding gases act rearwardly against the somewhat tapered skirt portion 68 expanding it radially outwardly into snug abutment with the internal surface of the rearward end of the barrel 40. This snug abutment effects a very effective gas seal to prevent escape of the gases rearwardly. In addition, since the shoulder 69 is cammed tightly against the rearward end of the barrel 40, a second gas seal is provided. Thus, any gases tending to escape into a space between the barrel and the cartridge holder must not only follow a tortuous path, but also a path which is effectively sealed at two places. For this reason the problem of dirt and gases getting between the barrel and cartridge holder is eliminated. In addition, the camming of the cartridge carrier 66 into the tapered seat 67 compresses the carrier radially between the tapered seat 67 and the cartridge 25. This together with the tight seal effected by the camming of the cartridge itself forwardly into the counterbore 81 prevents any rearward escape of gas between the cartridge and the carrier.

The guard

As suggested previously one of the features of this invention resides in the guard 65. As an examination of FIGURES 6 and 7 will show the guard is in reality an assembly. The assembly includes a generally rectangular

guard body 86. The guard body 86 has an offset transverse bore. The barrel housing 43 projects through this guard bore and the guard body is eccentrically secured to the barrel housing. A generally circular guard attachment 88 is provided. The guard attachment 88 has an eccentric generally rectangular notch open at one end and sized to telescope tightly over the guard body 86.

Usually the guard attachment 88 is positioned such that it is concentric about and in axial alignment with the barrel 40. Thus the attachment is telescoped over the guard body 86 to the position shown in FIGURE 6 so that the attachment and guard together define an annular generally circular shield concentric with the barrel. The guard and body have an interlocking tongue and groove construction at 83 which locates the two relatively. A set screw 89 is carried by attachment 88 to secure it to the body.

When one wishes to place a fastener near another construction member such as, for example, in a floor near an adjoining wall, the guard attachment 88 may be reversed. Thus, the attachment 88 is positioned eccentrically as shown in FIGURE 7 and the set screw 89 is again used to secure the body and attachment together.

When one wishes to position a fastener in a corner or other confined space the guard attachment 88 is removed altogether and the guard body 86 is used alone.

This guard has several positive advantages over prior guards. It is a spall reducer confining the forces of the gases to a very small area. In addition, it serves as a silencer effectively muffling the noise of escaping gases and considerably quieting the operation of the tool.

Dismantling

One of the outstanding advantages of the construction of this tool is the facility with which the entire mechanism can be dismantled for cleaning and/or repair. To dismantle the tool, one first removes the split muzzle ring 60 by pushing the retainer guide 58 rearwardly back off of the ring 60 and then moving the halves of the ring off the end of the barrel 40. Once the muzzle ring is removed, it is possible to slide the barrel housing 43 axially to the left with respect to the barrel 40 and strip the barrel housing, the barrel guide 58, the retraction spring 55 and the spring retainer 56 from the barrel. Once the barrel housing 43 has been removed, the barrel retaining dogs 52 may be pivoted out of the annular groove 53 in the cartridge holder engaging ring 48. This permits the barrel to be removed from the cartridge holder.

After the barrel 40 has been removed, the pivot pin 12 may be easily pressed out of the bores in the cartridge holder and out of a slot (not shown) in the reinforcing sleeve 18. This separates the cartridge holder 42 from the breech assembly. Once the cartridge holder and breech block assembly are removed, the breech 19 and the hammer positioning spring may be shaken out of the breech assembly. At this point removal of the handle screws 14 and manipulation of the firing lever 29 can be used to bring the hammer 22 and the parts connected to it forward out of the breech assembly.

From the preceding discussion it can be seen that dismantling of the tool can be accomplished with a minimum of tools and effort.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. In a powder actuated tool having a sleeve surrounding a barrel, a combination of:

- (a) a generally rectangular guard body eccentrically fixed to the sleeve, and a generally circular guard attachment removably connectable to the guard body;

(b) said guard attachment being connectable to the body in at least two positions;

(c) said body and attachment together being generally circular and concentric with respect to the sleeve when the attachment is secured in one position; and,

(d) said body and attachment being generally circular eccentric to the sleeve when the body and attachment are connected together in a second position.

2. In a powder actuated tool having a barrel, a combination of:

(a) a generally rectangular guard body member having a through transverse bore offset toward one end;

(b) the barrel projecting through the bore and the guard being eccentrically connected to the barrel;

(c) a generally circular guard attachment, removably connecting the attachment to the guard body;

(d) the member including a rectangular notch open at one end, the notch being shaped to accommodate the body member;

(e) said attachment member being connectable to the body member in at least two positions;

(f) said members together being generally circular and concentric with respect to the barrel when the attachment member is secured in one position;

(g) said members being generally circular and eccentric to the barrel when the members are connected together in a second position; and,

(h) means carried by one of the members and coactable with the other to maintain the members in a selected one of the two positions.

3. A cartridge carrier comprising a unitary one-piece tubular plastic member;

(a) said member having first, rear end and a second, forwardly positioned, front;

(b) said member having an enlarged tapered portion adjacent first, rear end tapering inwardly proceeding toward the second, gas end;

(c) said member having a small skirt portion adjacent the second, gas end of a substantially less diameter than the adjacent end of the tapered portion and projecting forwardly from the adjacent end of the tapered portion; and,

(d) said member includes a generally radially disposed shoulder intermediate the portions and adjacent the skirt portion,

said member having an axial bore therethrough for receiving a cartridge and also having a short counter-bore at the rear end thereof for receiving a rim of a cartridge inserted into the bore.

4. In a powder actuated tool having a barrel, a combination of:

a guard body eccentrically connected to the barrel, and a guard attachment removably connectable to the guard body,

said guard attachment being connectable to the body in at least two positions,

said body and attachment together being concentric with respect to the barrel when the attachment is secured in one position, and

said body and attachment being eccentric to the barrel when the body and attachment are connected together in a second position,

the body being generally rectangular and the body and the attachment having interlocking tongue and groove structures maintaining the two in a selected, connected condition.

5. In a powder actuated tool,

a barrel having a muzzle end adapted to engage a member to receive a fastener,

a muzzle ring slidable on the barrel between a normal position projecting forwardly of the muzzle end of the barrel and a retracted position in which the muzzle end of the barrel and the forward end of the ring are flush,

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means urging the muzzle ring toward the normal position thereof,
and a guard surrounding the muzzle ring and adapted to remain in contact with the member while the barrel and the muzzle ring move seriatim away from the member during recoil of the barrel and muzzle ring.
6. In a powder actuated tool,
a breech housing having a longitudinal bore therein and a pair of opposed, camming, detent recesses,
a hammer fitting closely and slidably in the breech housing and having a transverse bore therethrough,
a pair of detent balls slidable in the bore,
a compression spring in the bore and urging the balls away from each other to press the balls into the detent sockets when the hammer is in a cocked position thereof,
trigger means for pulling the hammer forwardly from

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the cocked position thereof to cause the balls to be cammed out of the detent recesses.
and spring means urging the hammer forwardly,
the wall of the longitudinal bore in the breech housing serving to retain the balls in the transverse bore in the hammer during travel of the hammer.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,221,966

December 7, 1965

Rowland Joseph Kopf et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 41, for "gun" read -- tool --; column 5, line 70, for "spaced" read -- spacer --; line 72, for "space" read -- spacer --; column 9, line 53, strike out "block" and insert the same after "breech" in line 54, same column 9.

Signed and sealed this 18th day of October 1966.

(SEAL)

Attest:

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Commissioner of Patents