Feb. 12, 1957 A. J. LANDA ET AL 2,780,812

MULTIPLE WORK FEELER SAFETY CONTROL

Filed Dec. 22, 1954 2 Sheets-Sheet 1

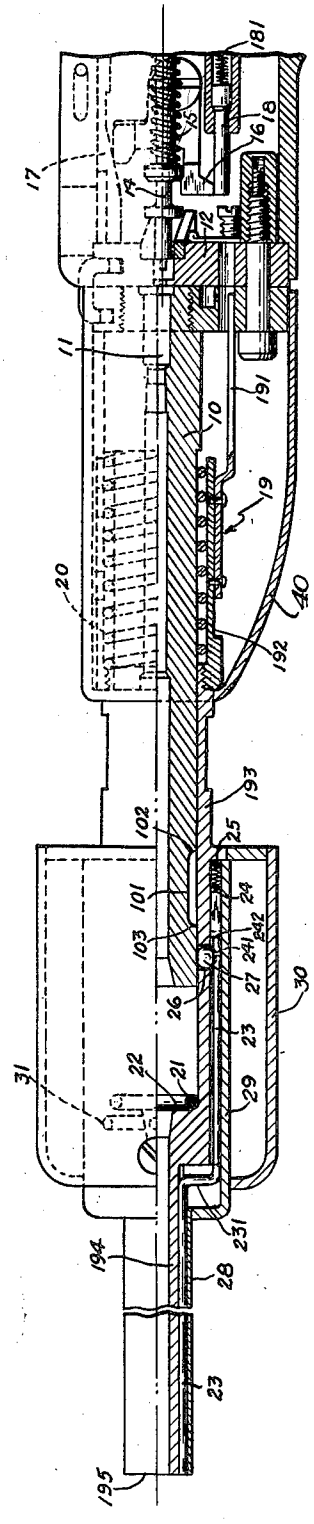


Fig. 1

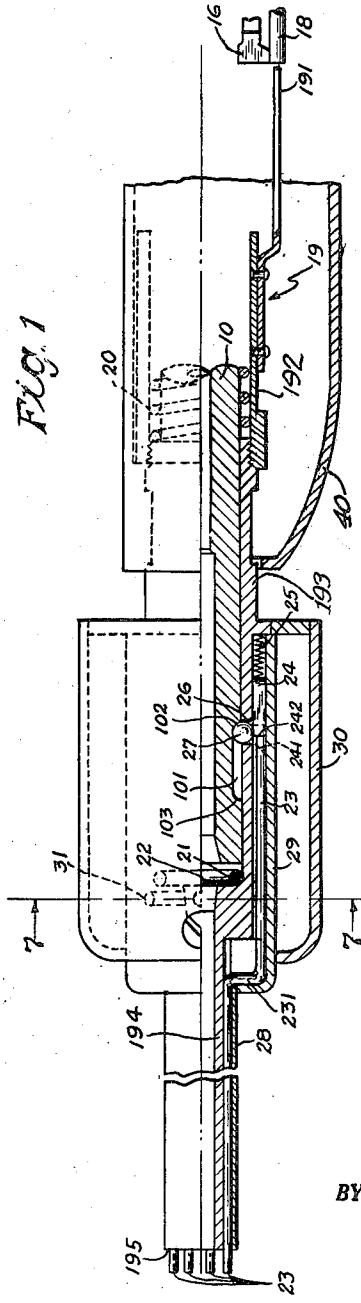


Fig. 2

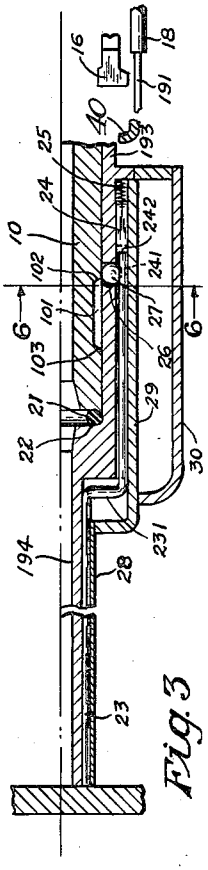


Fig. 3

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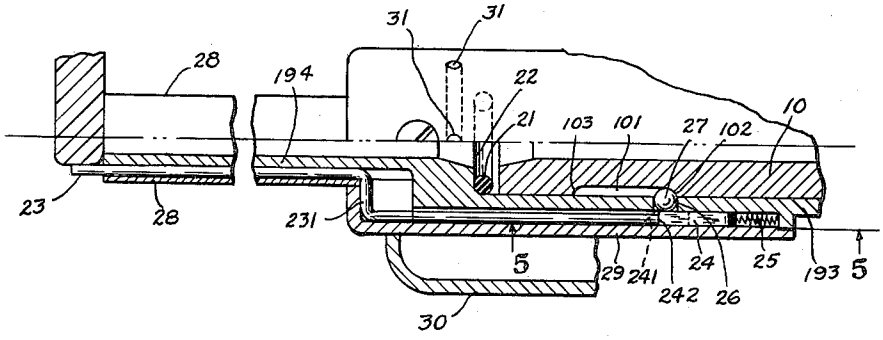


Fig. 4

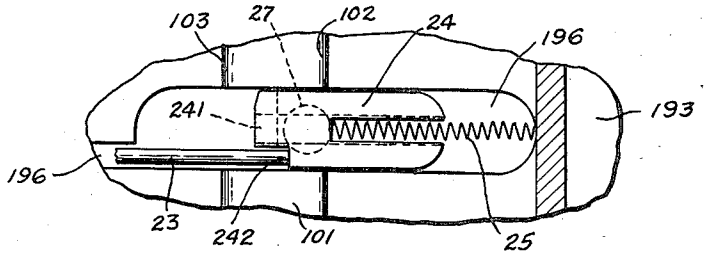


Fig. 5

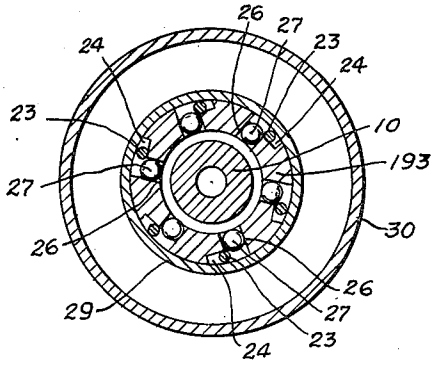


Fig. 6

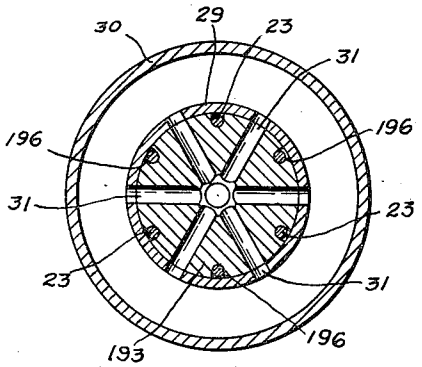


Fig. 7

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United States Patent Office

2,780,812

Patented Feb. 12, 1957

2,780,812

MULTIPLE WORK FEELER SAFETY CONTROL

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Application December 22, 1954, Serial No. 476,992

12 Claims. (Cl. 1—106)

This invention relates to powder actuated tools, and contemplates a fire control mechanism designed to insure, as a condition precedent to firing, the presence of a workpiece so positioned with respect to the muzzle as to receive and stop the explosively driven stud.

Tools of this character have the capacity for driving fastening devices into structural steel, and are well adapted for the securing to steel beams and purlins of fasteners for wall or roof covering sheets. The fastener projects outwardly from the purlin through a preformed hole in the sheet, and its free end is threaded or otherwise adapted to receive a fitting which engages the exterior surface of the sheet. To drive the fastening stud into the purlin in proper relation to the hole in the sheet it is desirable to pass the muzzle of the stud driving tool through the hole and into contact with the purlin. The driving tool is commonly so constructed as to require, as a prerequisite to firing, that at least a part of the muzzle be firmly pressed against a purlin or other stud receiving workpiece, but when such contact is made through a hole in a covering sheet the hole may be so close to an edge of the purlin that there is inadequate metal in alignment with the tool to receive and stop the driven stud. Since the studs are expelled from the tool at high velocity, a flying or ricochet stud in a substantial hazard to objects and persons in its path.

The present invention contemplates a stud driving tool provided with devices adapted to sense the presence of a solid surface in line with the entire perimeter of the tubular member through which the stud is delivered, and to prevent firing of the tool in the absence of a complete ring of solid material about the area to be penetrated by the stud.

In the drawings:

Fig. 1 is a fragmentary side elevation, partly in section, showing one form of the invention and a typical form of firing mechanism adapted to be controlled thereby. The parts are in the "normal" position which they assume when a stud has been fired and the tool removed from the work. The work feelers are held retracted and the firing mechanism is locked.

Fig. 2 is a skeleton view of some of the parts shown in Fig. 1, the fire control means in an intermediate position in which the feelers are advanced and the firing mechanism locked.

Fig. 3 shows the same parts as Fig. 2, the tool being pressed against an adequate work surface and thus unlocking the firing mechanism.

Fig. 4 is a fragmentary sectional elevation showing that the application of the tool to an inadequate work surface, such as the edge portion of a purlin, does not unlock the firing mechanism.

Fig. 5 is a fragmentary horizontal section substantially on the line 5—5 of Fig. 4.

Fig. 6 is a transverse section substantially on the line 6—6 of Fig. 3.

Fig. 7 is a transverse section substantially on the line 7—7 of Fig. 2.

The tool comprises a barrel 10 having associated with the breech end thereof a cartridge receiving chamber 11 adapted to be closed by a suitable breech piece or block 12. The stud to be driven by the combustion of the propellent powder of a cartridge in chamber 11 is suitably held in the barrel in front of the cartridge. The rearward portion of barrel 10 and associated parts may be enclosed within a housing 40. Typical firing means may comprise a striker 14 adapted to be driven against the proper part of the head of a cartridge by a spring 15 and held in cocked position against the thrust of spring 15 by a sear 16 adapted to be displaced to release the striker by a manually operable trigger 17. Movement of sear 16 to release the striker 14 is normally blocked (Figs. 1 and 2) by a sear lock 18 which is urged to effective position by spring 181, and it is only when sear lock 18 is displaced (by means to be described) to its Fig. 3 position that the sear can be displaced to enable the striker to perform its cartridge firing movement.

To displace the sear lock 18 from its Fig. 1 position to its Fig. 3 position and thus permit firing, said sear lock is engaged by the end portion of a bar 191 which is one element of an integrated fire control assembly identified generally by numeral 19. In the illustrative construction shown in the drawings, bar 191 extends forwardly in generally parallel relationship to the barrel 10, and is joined to a tubular member or sleeve 192 which surrounds the barrel and is urged forward (toward the muzzle) relative to the barrel by suitable means, such as a spring 20.

The tool as above outlined is more fully described in the patent to Catlin, No. 2,669,716, February 23, 1954, but it will be understood that the invention about to be described is equally applicable to other tools of widely varying construction, the firing mechanism in particular being susceptible to numerous modifications. It is essential only that the firing mechanism include a control element capable of activation by the rectilinear movement of the fire control assembly 19.

The forward end of sleeve 102 is joined to a second tubular member having a rear portion or barrel extension sleeve 193 which encircles the forward end of barrel 10, and a forward portion or barrel extension 194, which is of reduced exterior and interior dimensions. The bore of part 194 is substantially equal to the bore of barrel 10 and in firing position (Fig. 3) acts as an extension of the barrel bore. In said firing position, said barrel 10 engages an O-ring 21 of compressible heat resistant material, said O-ring lying on a shoulder 22 at the junction of barrel extension and barrel extension sleeve, and sealing off powder combustion residues from the mechanism to be described.

Comparing Figs. 1, 2, and 3, it will be seen that firing is possible only when the barrel 10 is fully advanced within the fire control assembly 19 (comprising the integrated parts 191, 192, 193, and 194), as shown in Fig. 3. The barrel is normally moved to firing position by pressing the end of barrel extension firmly against the work, whereupon further movement of the tool toward the work will advance the barrel relative to the fire control assembly 19. The present invention contemplates means which prevent full advance of the barrel to firing position unless the entire circumference of the end of barrel extension 194 is solidly supported by the work. The embodiment of these means shown in the drawings is described as follows:

In the exterior surface of barrel extension 194 are formed a plurality of longitudinal grooves, six being illustrated, substantially equally circumferentially spaced. In each groove is a feeler 23, adapted to project outwardly beyond the end 195 of the barrel extension, as seen in Figs.

2 and 4. The several feelers and parts associated respectively therewith being identical, one only will be described. Each feeler **23** comprises an outward offset **231** adjacent the junction of barrel extension **194** and barrel extension sleeve **193**, and beyond said offset occupies a longitudinal groove **196** in the periphery of said barrel extension sleeve. The inner end of each feeler **23** is in contact with a shoulder **242** of a blocking member **24** which occupies a widened extension of the groove **196** occupied by the feeler. Each blocking member **24** is urged toward its associated feeler **23** by suitable means such as a spring **25** which abuts the end of the groove **196** and may be partially received in a recess in its block **24**.

Associated with each blocking member **24** is an aperture **26** through the wall of barrel extension sleeve **193**. Each aperture is so placed with respect to its blocking member **24** as to be covered by the blocking member when the blocking member and its feeler **23** are thrust forward by the spring **25** (Fig. 2), and uncovered when pressure against the free end of feeler **23** maintains feeler and blocking member in the Figs. 1, 3 and 5 position, compressing spring **25**. It is again noted that there are a plurality of feelers **23**, blocking members **24**, springs **25** and apertures **26**, and that each set of one of each of these elements is a unit which is entirely independent of any element of any other such unit.

In the outer surface of barrel **10** is a peripheral recess **101**, terminating in sloping or arcuate cam surfaces **102**, **103**, said recess preferably being of such length and so positioned that cam surfaces **102** and **103** traverse and pass beyond the set of apertures **26** in either direction as the barrel moves from normal (Fig. 1) position to firing (Fig. 3) position. Within each aperture **26** is a ball or roller **27** having a transverse dimension greater than the depth of the aperture, that is, the diameter of the ball or roller is greater than the thickness of the wall of the barrel extension sleeve **193** at the location of apertures **26**. Thus, each ball or roller must either lie partially within the barrel recess **101** or partially within the barrel extension sleeve recess **196** in front of its associated blocking member **24**. Any ball or roller **27** lying partially within the sleeve recess **196** blocks movement of its member **24** to thrust feeler **23** forward, and any ball or roller lying partially within the barrel recess **101** blocks movement of the barrel to firing mechanism releasing position (Fig. 3), as will now be more fully explained.

It will be remembered that barrel extension sleeve **193** is joined to and supports the firing mechanism unlocking bar **191**. Fig. 1 shows the condition of the tool as it is removed from the work after firing. The contact with the work necessary to enable firing holds all feelers **23** in a rearward position, bringing their free ends substantially flush with the end **195** of the barrel extension. As the tool is withdrawn from the work, the thrust of relatively heavy spring **20** maintains the fire control assembly **19** against the work as the barrel is retracted. Each of the feelers is thus held in a rearward position as the barrel retracts and each of the balls or rollers **27** is cammed outwardly by the terminal cam face **103** of barrel recess **101**, placing each ball in blocking position in front of its associated blocking member **24**. Balls or rollers **27** are held in this position by their engagement with the unrecessed periphery of barrel **10**, as clearly seen in Fig. 1. Thus, when the tool is not in use the slender feelers **23** are retracted, housed and protected against damage.

Consider now that an attempt is made to manually retract the fire control assembly to firing position without engaging the tool with a work face. A relatively short movement of the fire control assembly brings barrel recess **101** opposite balls **27**, whereupon said balls move into said recess, such movement being insured by their cam contact at **241** with blocking members **24**, which members are now thrust forward by their springs **25** and project feelers **23** outward, as seen in Fig. 2. Rearward movement of the fire control assembly can be continued until balls or rollers **27** engage the terminal cam **102** of barrel recess **101** at which point it ceases, outward movement of balls or rollers **27** being blocked by blocking members **24**.

If now the tool is pressed against an adequate work face in such a manner that all the feelers **23** and blocking members **24** are fully in rearward position, thus not blocking all apertures **26**, each ball is cammed outwardly in front of its associated blocking member **24** and the movement of the barrel necessary to enable firing can be completed. However, if any one of the feelers fails to find and be maintained in a rearward position by a work face (Fig. 4), or if the tool is tilted with respect to the work face so that any one or more feelers are not in a most rearward position with respect to housing **194**, movement of the fire control assembly remains blocked by the ball **27** associated with the incompletely displaced feeler.

A suitable sleeve **28—29** surrounds the barrel extension **194** and barrel extension sleeve **193**, serving to hold the feelers **23** in place in their grooves. Preferably, a muffler **30** surrounds and is secured to the first control assembly as shown, access from the bore to the muffler chamber being had through gas ports **31** in the barrel extension sleeve, preferably located forward of the O-ring **21** and aligned apertures in sleeve **29**.

A cycle of operation of the tool will now be described. With the elements of the tool in their normal relation as shown in Fig. 1, the end **195** of the barrel extension is pressed against the work surface. If all of the circumferentially spaced feelers **23** are supported by engagement with the work surface, continued pressure will cause barrel **10** to move downward in barrel extension sleeve **193**, overcoming the resistance of spring **20**, until the muzzle end of barrel **10** contacts the O ring **21** as shown in Fig. 3. Since the balls or rollers **27** are free to regress completely into housing **193** by reason of the blocking members **24** being maintained out of blocking position by the feelers **23**, no obstruction is presented to movement of the barrel **10** to the firing position shown in Fig. 3.

As previously set forth, movement of the barrel relative to housing **193** causes the sear lock **18** to be pressed back relative to sear **16** by engagement with bar **191**, and as the barrel reaches firing position the sear is freed for subsequent operation by pressing the trigger.

If, in the just described cycle of operation, one or more of the feeler rods **23** is not supported by a portion of the work surface, that unsupported feeler will project in advance of end **195** and the associated blocking member **24** under the urging of spring **25** will move behind ball **27**, causing the ball to protrude into peripheral recess **101** where it engages terminal cam **102** blocking advance of the barrel to firing position. It will be seen that each of the feelers must engage with a portion of a work surface before the tool may be fired.

What is claimed is:

1. In a powder actuated tool having a barrel and breech assembly, means on said assembly for firing a cartridge in said barrel and means normally locking said firing means, the invention consisting of a fire control member surrounding said barrel and having a work engaging end in advance of said barrel muzzle, said barrel and breech assembly being reciprocable in said member from a normal retracted position to a predetermined advanced firing position, means on said member for disabling said locking means when said assembly is in firing position, a plurality of independent latching devices mounted in said member for engagement with said barrel, each of said devices being capable of blocking movement of said assembly to firing position, and a plurality of latch controlling feelers mounted in said member for engagement with a work surface, each of said feelers being independently movable when unsupported by a work surface to release a respective latching device for engagement with said barrel.

2. A tool according to claim 1, in which each of said latching devices comprises a locking element disposed for

radial engagement with an interrupted surface on said barrel, a reciprocable blocking member disposed to displace said element into locking engagement with said interrupted surface at one extent of reciprocation and spring means urging said blocking member towards engagement with said element, one of said feelers supporting said blocking member out of engagement with said element against said spring when said feeler is supported by a work surface.

3. A tool according to claim 2, wherein said interrupted barrel surface comprises a peripheral groove joined to the main barrel circumference by opposed camming surfaces, said groove being disposed to traverse said locking elements when said barrel is reciprocated, whereby in barrel reciprocation each blocking member unsupported by a feeler will force an associated element into locking engagement in said barrel groove, and said camming surfaces will force each of said elements out of locking engagement when all of said blocking members are supported by feelers.

4. A tool according to claim 3, in which said blocking members normally prevent displacement of said locking elements respectively by said cam surfaces, thereby preventing movement of said barrel to firing position.

5. A tool according to claim 4, in which support of each feeler by a work surface to a predetermined position so displaces the associated blocking member as to enable displacement of the associated locking element out of the path of movement of said barrel cam.

6. A tool according to claim 5, in which incomplete displacement of any of said feelers and its associated blocking member is effective to prevent movement of said barrel relative to said fire control member to said firing position.

7. A tool according to claim 6, comprising means associated with said barrel adapted to displace said blocking devices to lock said feelers in retracted position when said barrel is in normal position with respect to said fire control member, and to release said feelers for forward displacement by said spring means respectively when said barrel is displaced from normal position toward firing position.

8. A tool according to claim 1, in which said fire control member comprises a tubular feature surounding said barrel and having a work engaging end disposed in advance of said barrel muzzle, said feelers being mounted in longitudinally extending grooves formed on the exterior surface of said feature.

9. A tool according to claim 8, in which said fire control member comprises a tubular feature having an extension of lesser diameter than said feature extending in advance of said barrel muzzle, said feature and said extension being provided with a plurality of longitudinal grooves to slidably accept said feelers, each of said feelers having an offset intermediate portion substantially equal in length to the difference in radii between said tubular feature and said extension.

10. A tool according to claim 8, comprising a cylindrical cover surrounding said tubular feature and said feelers.

11. A tool according to claim 9, comprising a conforming cover for said tubular feature and said feelers, a muffler mounted on said cover, and access ports between the interior of said tubular feature and said muffler.

12. A tool according to claim 11, in which said fire control means comprises a barrel extension sleeve and a barrel extension of lesser diameter than and joining said sleeve in a shoulder, a sealing gasket on said shoulder adapted when engaged by said barrel to seal the interior of said barrel extension sleeve from the interior of said barrel and said barrel extension, said access ports establishing a passage from said barrel extension to said muffler.

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