

Dec. 20, 1966

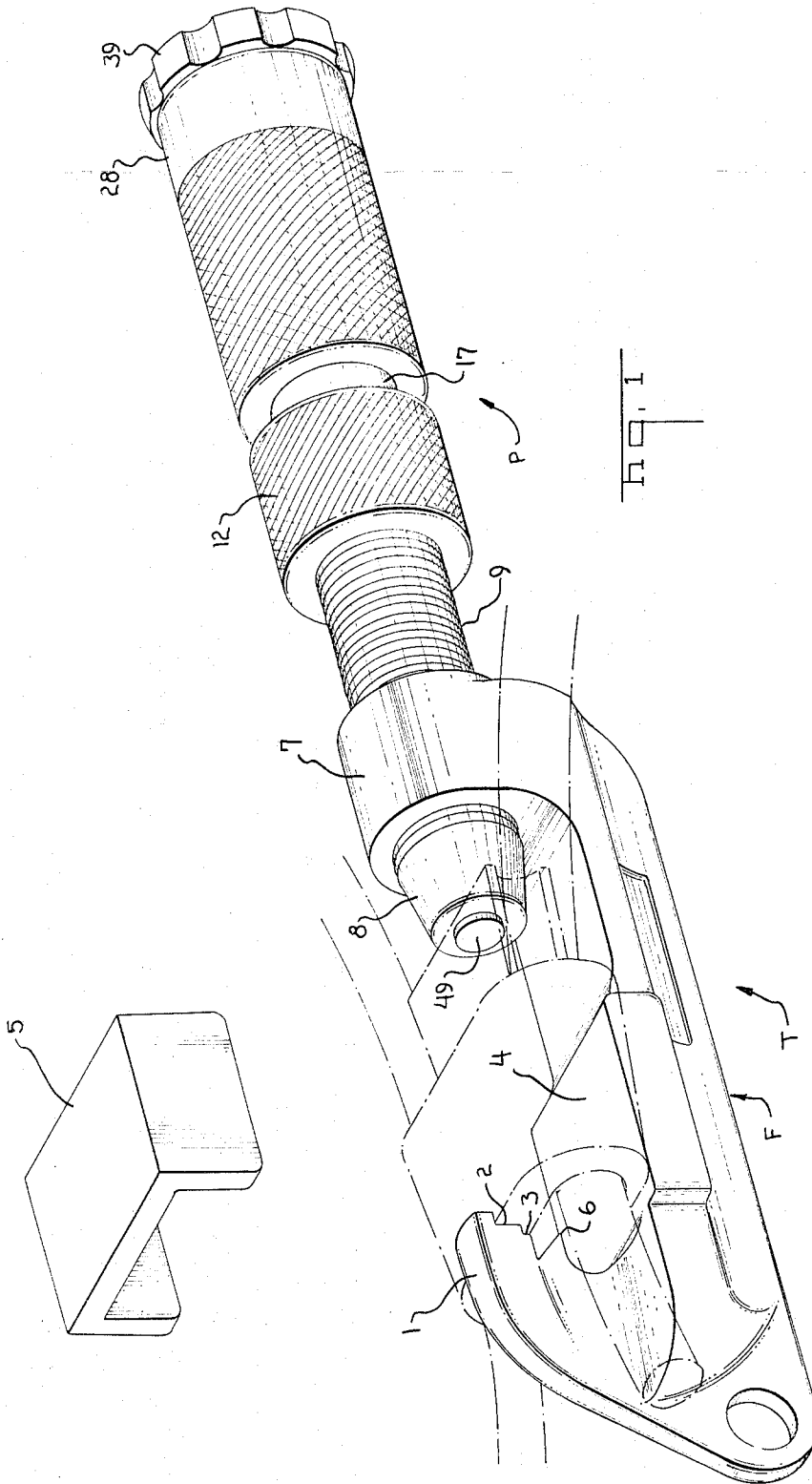
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EXPLOSIVELY-OPERATED TOOL

Filed Jan. 30, 1964

2 Sheets-Sheet 1



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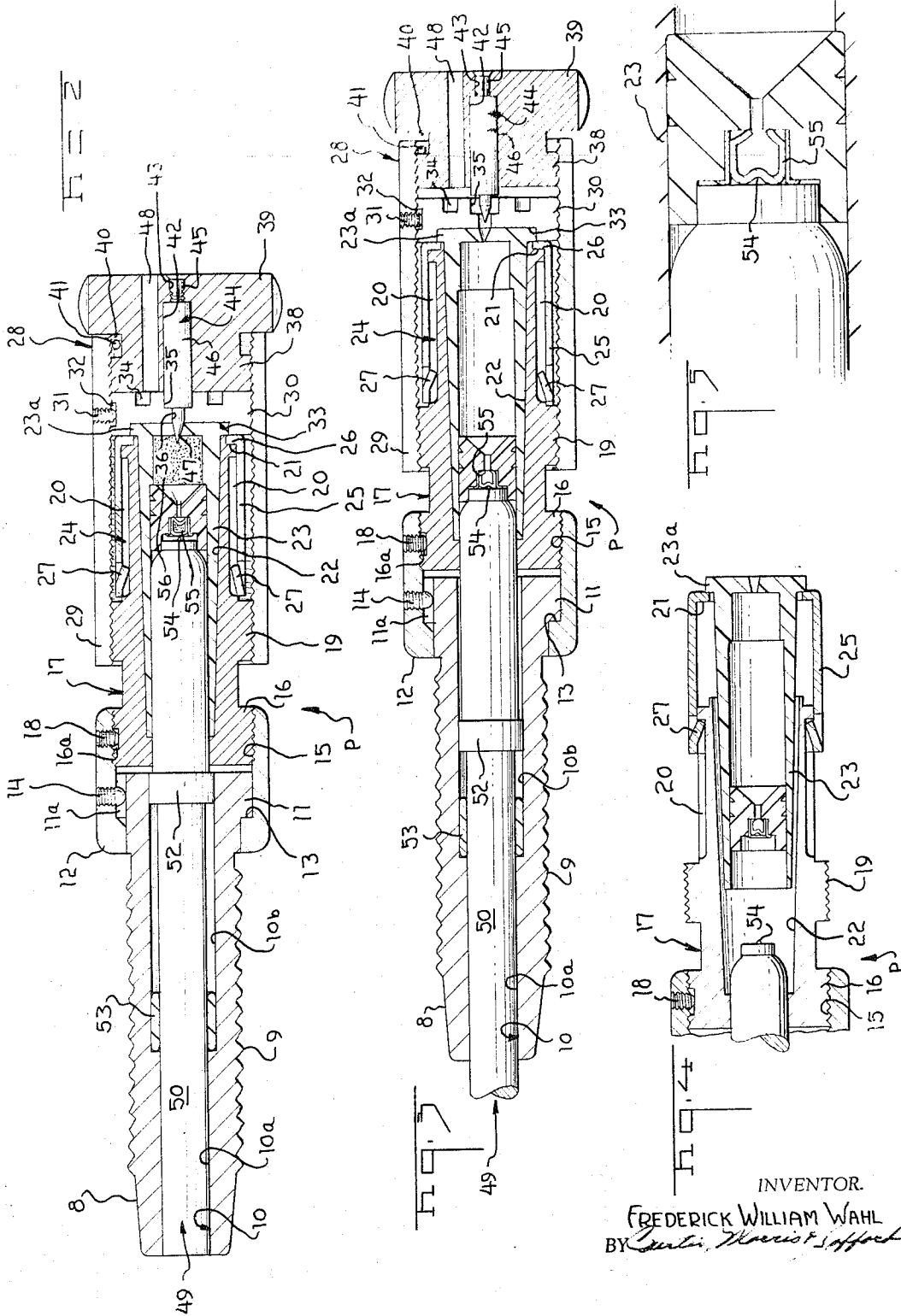
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2 Sheets-Sheet 2



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**EXPLOSIVELY-OPERATED TOOL**

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Filed Jan. 30, 1964, Ser. No. 341,232  
1 Claim. (Cl. 60—26.1)

This invention relates to an explosively-operated industrial tool in which there is provided a gas release and shell ejection means.

It has been found that when an explosively-operated tool of the type disclosed in U.S. patent application, Serial No. 215,562, filed August 8, 1962, or U.S. Patent No. 2,968,043, has been fired, the cap member closing the end of the firing chamber in which the shell has been detonated is difficult to remove due to the fact that the firing chamber is a closed chamber which causes a tremendous pressure to occur therein after the shell has exploded. In addition, particles from the explosion mixture in the shell adhere to and subsequently build up on the threaded portion of the barrel and cap member. After the cap member had been removed, it was also found that the exploded shell was always difficult to remove from the firing chamber; mainly because as a result of the explosion, the body of the shell had expanded against the surface of the firing chamber causing the shell to adhere thereto.

It is, therefore, an object of the present invention to provide an explosively-operated tool having a gas release means therein.

Another object of the present invention is to provide a shell ejection means for an explosively-operated tool.

A further object of the present invention is to provide an explosively-operated tool that is easy to operate.

A still further object of the present invention is the provision of a means on the ram of the power unit to prevent the escape of gases from the closed chamber.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purposes of illustration and principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a perspective view of a tool incorporating the present invention;

FIGURE 2 is a longitudinal cross-sectional view of the power unit for the tool of FIGURE 1 showing the gas release and ejection means in an inoperative position;

FIGURE 3 is a view similar to FIGURE 2 after the power unit has been operated showing the gas release means in an operative position;

FIGURE 4 is a view similar to FIGURE 3 showing the ejection means in operation; and

FIGURE 5 is an enlarged fragmentary view of the ram and plug containing the detonating means.

Turning now to the drawings, there is shown a tool T including a C-shaped frame F and a power unit P.

One leg of frame F includes an engaging section 1 having a stepped portion 2 against which a C-shaped connector body C engages. Another stepped portion 3 is disposed downwardly from stepped portion 2 and is engaged by a smaller size C-shaped connector body (not shown). Frame F has a flat surface 4 on which the legs of the large connector body rests. In order that the small connector body engages stepped portion 3, a C-shaped

platform 5 is slipped onto flat surface 4 on which the legs of the small connector body rest.

Spaced downwardly from stepped portion 3 is a pointed projection 6 defining a swaging means against which the front surface of wedge W forcefully engages in order to strike or swage upwardly a portion of the front surface of the wedge so as to provide a locking surface that maintains the wedge within the connector body. A more detailed explanation of the operation of providing a locking surface in the wedge will be found in U.S. patent application, Serial No. 341,223, filed January 30, 1964.

The other leg of frame F comprises an internally threaded section 7 which accommodates a coupling member 8 of power unit P. Coupling member 8 has external threads 9 mating those of section 7 and a bore 10 which includes an outer section 10a and an inner enlarged section 10b. Adjacent the opening of section 10b is a flange 11 having a slot 11a therein.

A sleeve 12 fits over the end of coupling member 8 having flange 11 and contains an inner shoulder 13 which engages flange 11. A pin 14 is secured in sleeve 12 and extends within slot 11a to prevent sleeve 12 turning with respect to coupling member 8 but allowing sleeve 12 to move longitudinally thereto. Sleeve 12 also includes an internally threaded section 15 which mates with externally threaded section 16 of breech member 17. A set screw 18 is threadably disposed in the threaded section of sleeve 12 in order to engage a slot 16a in section 16 to lock the sleeve and section together. The exterior surface of sleeve 12 is preferably knurled.

Breech member 17 also includes another externally threaded section 19 spaced from section 16, diametrical grooves 20, a recessed portion 21 and a conically-shaped cartridge chamber 22. A cartridge 23, such as disclosed in U.S. patent application, Serial No. 239,618, filed November 23, 1962, is placed within chamber 22.

A cartridge ejection means 24 is movably mounted on breech member 17 over grooves 20. Cartridge ejection means 24 includes a sleeve 25 having a flange 26 which fits within recessed portion 21 so that flange 26a of cartridge 23 overlies flange 26 of sleeve 25. Securing means 27 are on sleeve 25 which are disposed within grooves 20 in order to maintain sleeve 25 secured on breech member 17. As can be discerned, securing means 27 comprise depressed portions in sleeve 25 which extend into respective grooves 20 and which are located toward the end of sleeve 25 opposite flange 26 in order to allow sleeve 25 to move longitudinally relative to breech member 17 and not rotatively thereto. Of course, securing means other than the depressed portions may be utilized, such as, pins, bolts, etc. The exterior surface of sleeve 25 is preferably knurled to aid in grasping same. It is desirable the flange 26 engages a substantial portion of flange 26a in order to effectively eject same from the cartridge chamber.

A breech-nut assembly 28 is removably mounted on breech member 17 and includes a sleeve 29 having internal threads the entire length thereof which mate with the threads on section 19 to hold sleeve 29 on breech member 17. A stationary plug 30 is threadably disposed within sleeve 29 and is secured therein by a set screw 31 threadably mounted in sleeve 29 which engages a slot 32 in the periphery of plug 30. Slots 16a and 32 provide adjustments for breech member 17 relative to sleeve 12 and plug 30 relative to sleeve 29, respectively.

Plug 30 includes a recessed portion 33 into which flange 26a of the cartridge fits and diametrical holes 34 into which a tool (not shown) fits to screw the plug into and remove it from sleeve 29. Another recessed portion 35 is disposed in plug 30 and coaxial therewith

between holes 34. A hole 36 of smaller diameter than recessed portion 35 extends between recessed portions 33 and 35 and is in communication therewith as well as being coaxial with plug 30.

A movable plug 37 is threadably disposed within sleeve 29 by a threaded section 38. Spaced from threaded section 38 is an engaging section 39 which extends beyond the outer surface of sleeve 29 in order to abut against the end thereof to limit the inner movement of plug 37 thereinto as well as to provide a gripping surface to move plug 37 relative to sleeve 29. The periphery of sections 39 is preferably undulated to aid in the gripping thereof. Between sections 38 and 39, there is a channel 40. A pin 41 is secured to sleeve 29 and lies within channel 40. Plug 37 is movable inwardly until it abuts against plug 30 and the end of sleeve 29 as shown in FIGURE 2 and movable outwardly until threaded section 38 engages pin 41, as shown in FIGURE 3, whereupon sleeve 29 is rotated until it is free from threaded section 19. Breech-nut assembly is then free to be removed from breech 17 to remove a spent cartridge from chamber 22 and place a new one therein.

An opening 42 extends almost the length of plug 37. Opening 42 is coaxial with plug 37 and has the same diameter as recessed portion 35 of plug 30. Another opening 43 is in communication with opening 42 and extends the rest of the way through plug 37. Opening 43 is of less diameter than opening 42 and is coaxial therewith.

A pin 44 has portions 45 and 46 snugly fitting into opening 43, and opening 42 and recessed portion 35 respectively. A pointed section 47 extends outwardly from portion 46 of pin 44 and through hole 36 so that it penetrates through the flanged end of cartridge 23 when plug 37 is in the position shown in FIGURE 2 in order to provide a hole therein through which the explosion gases can escape after the cartridge has been detonated. Pin 44 may be secured in plug 37 by means of a screw (not shown) threadably engaging a threaded hole in the end of portion 45 and countersunk in the end thereof.

A hole 48 extends through plug 37 parallel to openings 42 and 43 in order to allow the explosion gases to escape to the atmosphere when plug 37 has been moved to its outer position as shown in FIGURE 3.

A ram 49 is movably mounted in the power unit and includes a section 50 disposed in bore 10 of coupling member 8 and another section 51 is disposed in chamber 22 of breech 17. Section 50 has a diameter slightly less than section 10a of bore 10. A shoulder 52 separates sections 50 and 51 and has a diameter slightly less than section 10b of bore 10 in which it moves.

A jamming means 53 is disposed at the intersection of sections 10a and 10b in order to lock ram 49 in an inoperative position of the tool is fired accidentally. A more detailed explanation of the operation of the jamming means can be found in U.S. Patent 3,212,535.

Section 51 of ram 49 moves interiorly of cartridge 23 and a projection 54 extends outwardly from the inner end thereof which engages a detonating means 55, such as, a primer in plug 57 located in cartridge 23 in order to detonate explosive powder 56 therein when the end of plug 37 is hit with a tool, such as a hammer. A complete and detailed explanation of plug 57 can be found in U.S. patent application, Serial No. 206,767, filed July 2, 1962. This causes breech-nut assembly 28, breech 17, cartridge 23 and sleeve 12 to move relative to coupling member 8 and ram 49 until the end surface of breech 17 engages the adjacent end surface of coupling member 8.

As can be discerned, from FIGURE 5, the end of the ram containing projection 54 has a cylindrically-shaped section 58 which fits within legs 59 of plug 57. At the time of firing, section 58 abuts flange 60 of the primer to prevent escape of explosion gases from the cartridge

thereby maintaining even operating pressures from one cartridge to the next. Another important concept of section 58 is that it eliminates deformation of the inner part of the ram containing detonating projection 54.

The diameter of shoulder 52 is larger than section 51 so that it engages the end of breech member 17 adjacent thereto in order to limit the inner movement of ram 49 within power unit P. After cartridge 23 has been placed in chamber 22 and after it has been fired, section 51 engages the interior surface of the cartridge to form a closed chamber so long as plug 37 remains in its closed position as shown in FIGURE 2. The exterior surface of sleeve 29 is preferably knurled at least to set screw 31.

*Operation.*—Conductor members CM are placed within a connector body C and a wedge W is also placed therein. A hammer or similar tool is used to force the wedge into the connector body a small distance in order that the connector body, wedge and conductor members remain temporarily together.

Plug 37 is moved outwardly until it engages pin 41 whereupon further rotation of plug 37 causes sleeve 29 to move and this is continued until sleeve 29 is free of threaded section 19. Breech-nut assembly 28 can then be removed from breech member 17.

A cartridge 23 is then placed within chamber 22, breech-nut assembly 28 is replaced on breech member 17, and plug 37 is screwed into abutting relationship with the end of sleeve 29 and plug 30 whereupon pointed section 47 of pin 44 penetrates through the flanged end of the cartridge to provide a hole for the escape of explosion gases therefrom.

Ram 49 is pushed into position within the power unit if it is sticking out of coupling member 8. Power unit P is moved outwardly from section 7 so that the connector body and wedge can be placed within frame F. The connector body is brought into engagement with the appropriate stepped portion 2 or 3 with the legs thereof on surface 4 or platform 5 depending on the size of the connector body. The power unit is then moved inwardly until the end of coupling member 8 engages the wedge.

The end of plug 37 is struck with a hammer or suitable means whereupon breech-nut assembly 28, breech 17, cartridge 23 and sleeve 12 move inwardly toward coupling member 8 and ram 49. Projection 54 engages detonating means 55 which causes power 56 to explode thereby driving ram 49 outwardly with sufficient force to drive wedge W into connector body C to secure them and conductor members CM together to provide an excellent mechanical and electrical connection therebetween. In addition, the end of the wedge opposite the one engaged by the ram, engages pointed projection 6 thereby swaging upwardly a portion of this end of the wedge in order to provide a locking surface that maintains the wedge within the connector body.

The power unit is backed off and the connection is removed from the tool. Plug 37 is moved outwardly against pin 41 as shown in FIGURE 3 causing the explosion gases within expended cartridge 23 to escape through the hole in the flanged end thereof that was made by pointed section 47, through hole 36, recessed portion 35 and hole 48 into the atmosphere. Further movement of plug 37 causes sleeve 29 to be removed from breech member 17.

After the breech-nut assembly has been removed, sleeve 25 is grasped and moved rearwardly which causes flange 26 to forcefully engage flange 23a of the cartridge thereby ejecting the spent cartridge as shown in FIGURE 4.

As can be discerned, there has been disclosed a novel gas release means and cartridge ejection means for use in an industrial tool; however, such means can be used in conjunction with any device using an explosively-operated power unit.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved;

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however, it should be emphasized that the particular embodiment of the invention, which is shown and described herein, is intended as merely illustrative and not as restrictive of the invention.

I claim:

In a power unit of an explosively-operated device, breech means having a chamber therein to receive an explosive cartridge therein, said explosive cartridge having a hollow portion and a plug member provided with primer means therein, extension means on said plug member extending outwardly beyond said primer means, ram means movably mounted in said breech means including a section for disposition in said hollow portion and along therewith defining an enclosed chamber, means on said section of said ram means for disposition within said extension means and including a flat surface perpendicular to a longitudinal axis of said chamber, said flat surface being at least coextensive with an exterior surface of said primer means to maintain said primer means in snug engagement with said plug member during movement of

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said plug member to prevent escape of explosion gases from said enclosed chamber, and means on said means for disposition within said extension means to engage and actuate said primer means.

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