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Crabtree, Jr.

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[54] **POWER CONTROL FOR POWDER-ACTUATED TOOL**

[75] Inventor: **Robert W. Crabtree, Jr.**, Rochester, N.Y.

[73] Assignee: **Olin Corporation**, New Haven, Conn.

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[52] **U.S. Cl.** **227/10**, 227/9, 227/142

[51] **Int. Cl.** **B25c 1/14**

[58] **Field of Search** 227/8, 9, 10, 11, 227/142; 173/115

[56] **References Cited**

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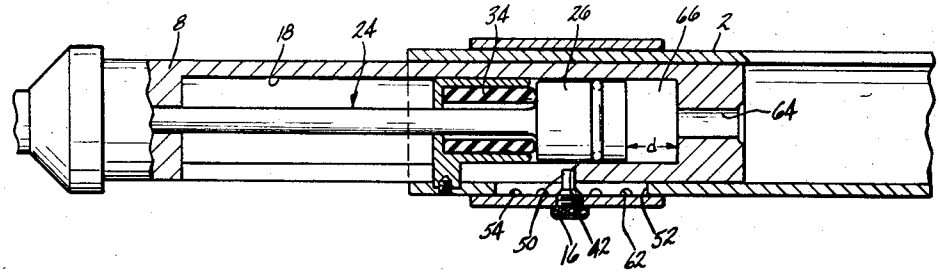
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Primary Examiner—Granville Y. Custer, Jr.
Assistant Examiner—Harold P. Smith, Jr.
Attorney—Donald R. Motsko, William W. Jones et al.

[57] **ABSTRACT**

A powder-actuated tool utilizing a ram for driving a fastener into a supporting surface. The tool includes means for varying the power output of the ram. A stop lug is mounted on the tool housing and movable longitudinally thereon. The lug engages a complimentary stop surface on the tool barrel which is slidable within the housing. Engagement of the stop lug and barrel stop surface limit forward movement of the barrel which movement is operative to return the ram from a driven position to a driving position.

2 Claims, 4 Drawing Figures



2 Sheets-Sheet 1

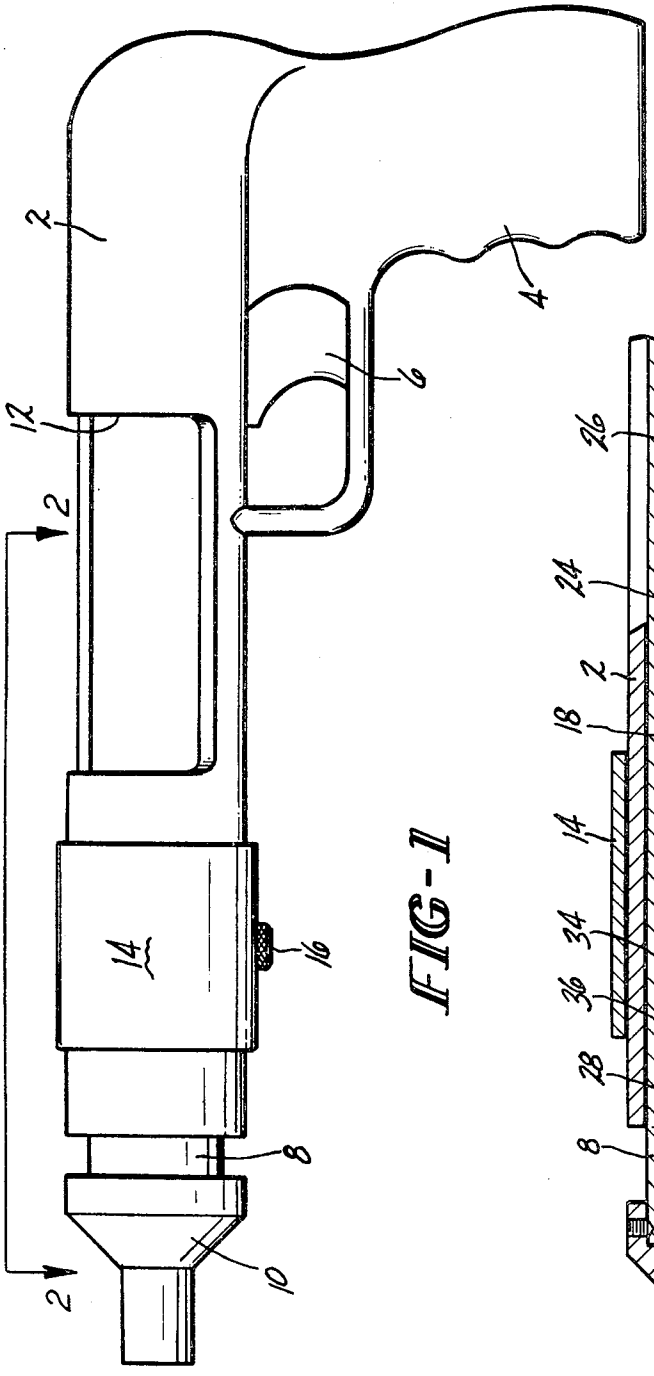


FIG-1

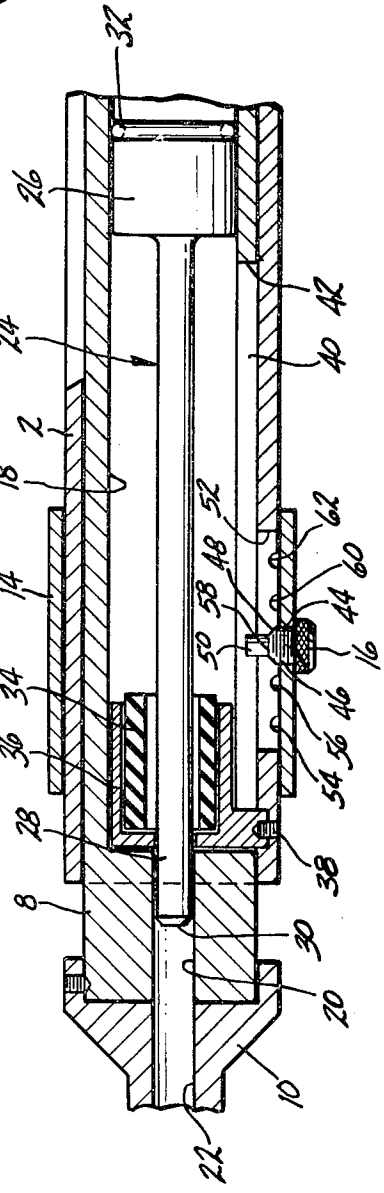


FIG-2

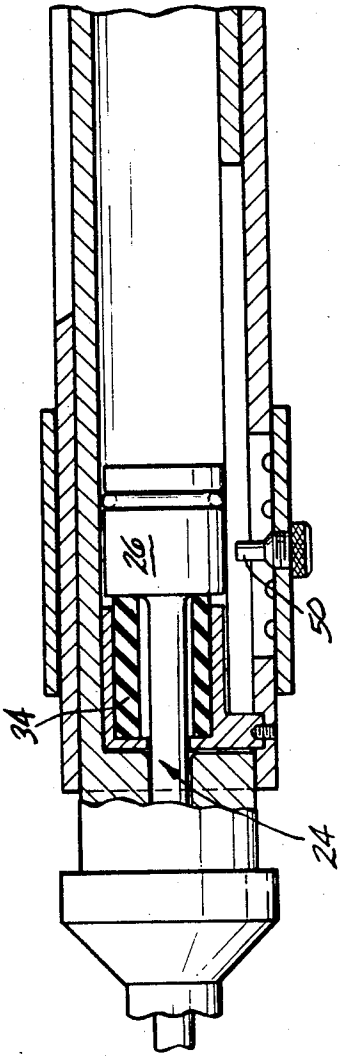


FIG-3

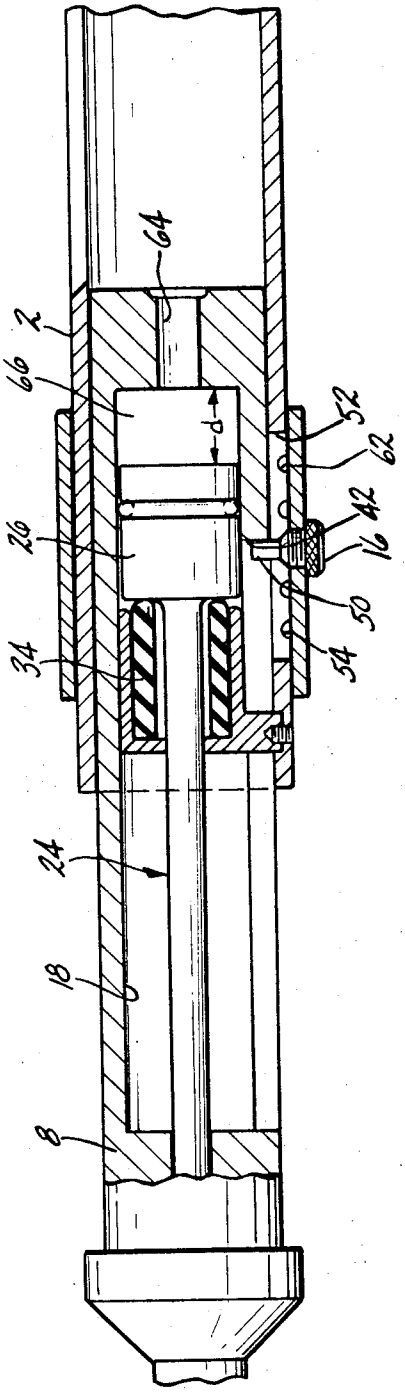


FIG-4

POWER CONTROL FOR POWDER-ACTUATED TOOL

This invention concerns a powder-actuated tool having means for varying the power output of the tool, the tool being of the type which utilizes a ram for driving a fastener into a supporting surface.

Powder-actuated tool utilizing a ram to drive a fastener into a support surface are known generally in the prior art. The ram is housed in a barrel member on the tool and is propelled from a driving position to a driven position by expanding combustion gases created by firing a propellant charge into the barrel. The tool is then returned from its driven position to its driving position by sliding the barrel forward on the tool housing, there being a pawl connected to the tool housing which contacts the ram when the barrel is slid forward thereby causing the ram to move rearwardly relative to the forwardly moving barrel. Provisions are also contained in the prior art for varying the power output of such a tool. This power output variation is accomplished by returning the ram to a number of different firing positions which are spaced apart different distances from the firing chamber. This causes a change in the free volume between the firing chamber and the ram head, thus providing a greater space into which the combustible gases can expand by acting upon the ram head. The greater the free volume between the firing chamber and the ram head, the lower the power output of the tool will be. Ram-type power-actuated tools of the prior art also generally include a buffer member at the muzzle end of the barrel which is utilized to absorb excess energy from the driven ram. In certain of the prior art devices of this nature variation of the power output is accomplished by providing the pawl which contacts the ram for return thereof with a side ram-contacting surface which is circumferentially cut so as to provide a number of circumferentially adjacent steps each of which is offset from the pawl axis a different distance. In such an arrangement the pawl is rotated so as to bring a particular ram-contacting surface or step into position to contact the ram. In this manner, a surface which is further from the axis of the pawl, when brought into contact with the ram, will return the ram closer to the firing chamber than will a similar surface which is closer to the axis of the pawl. This type of arrangment has proven useful for providing a tool with a limited number of power output possibilities. However, it is apparent that the number of faces which can be cut into the side surface of the pawl are limited and the difference in maximum spacing between the ram and firing chamber is governed by the diameter of the pawl. Furthermore, the pawl, since it contacts the ram, must be positioned so as not to be struck by the ram when the latter is moving through its work stroke lest the pawl be sheared off by the ram. This requirement necessitates positioning of the pawl either below the ram buffer or in some manner camming the pawl to one side when the tool is fired so that the ram will not strike the pawl during its work stroke.

An additional arrangement for varying the power output of a ram-type powder-actuated tool involves the use of a drum member which is rotatably mounted on the tool housing and which includes an end surface which is cut so as to form a number of longitudinally spaced apart steps. Each of the steps can be moved into a position for contacting a stop member on the barrel.

When the barrel stop member and the drum step are brought into contact by forward movement of the barrel, such forward movement of the barrel then stops. Thus the extent of forward movement of the barrel can be changed by rotating the drum to bring a preselected stop into position for contacting the barrel stop. This type of arrangement affords a greater variety of possible settings than the pawl-type arrangement referred to above, however, the drum is a rather heavy member and thus adds undesirable weight to the tool.

This invention concerns the provision of means for varying the power output of a ram-type powder actuated tool which provides a great variety of possible settings and adds very little weight to the tool. Return of the piston from its driven position to its driving position is accomplished by providing a member which is positioned within the barrel bore and fixed to the tool housing. This member is preferably the ram buffer. The barrel is moved forward with respect to the housing so as to in effect slide the buffer rearwardly through the barrel bore thereby sliding the ram which the buffer contacts rearwardly through the barrel bore. A stop member is formed on the barrel, the stop member being preferably the end wall of a slot cut into the barrel. A further stop member is mounted on the housing and is movable axially of the housing between a number of different positions. The further stop member is preferably in the form of a lug which is threaded into a lightweight sleeve slidably mounted on the housing. The lug passes through a slot in the housing and terminates in the barrel slot. The housing slot is preferably provided with a series of axially offset notches and the lug has formed thereon a complimentary bulbous surface which can be seated in any of the housing slot notches. Once the bulbous surface on the lug is seated in the housing slot notch, the lug is tightened on the sleeve so as to be fixed into the notch and held therein. Since the lug projects into the barrel slot, forward movement of the barrel is limited by contact between the lug and barrel slot end wall. In this manner movement of the lug through the housing slot toward the firing chamber will decrease the power output since forward movement of the barrel will be stopped sooner and the ram will be stopped further away from the firing chamber. Positioning of the lug further away from the firing chamber results in an increase in the power output of the tool. A great number of power settings is thus possible since the axial dimension of the housing slot can be as great as one desires to make it without affecting the capabilities of the tool. Furthermore, the sleeve can be of sheet metal thickness and the lug can be quite small so as to add very little weight to the tool.

It is, therefore, an object of this invention to provide a powder-actuated tool for driving fasteners into a supporting surface which tool has the capabilities of providing a number of power outputs for a single propellant charge.

It is a further object of this invention to provide a tool of the character described wherein a substantial number of possible power settings can be achieved.

It is yet another object of this invention to provide a tool of the character described wherein the power output control adds very little weight to the overall weight of the tool.

It is still another object of this invention to provide a tool of the character described wherein the power

output control is of simple construction and yet is reliable and durable.

These and other objects and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment of the invention taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevation view of a preferred embodiment of the tool of this invention;

FIG. 2 is a vertical sectional view taken along line 2—2 of FIG. 1 showing the power setting when a medium power output is desired and showing the ram in its driving position;

FIG. 3 is a vertical sectional view ismilar to FIG. 2 but showing the ram in its driven position; and

FIG. 4 is a vertical sectional view similar to FIGS. 2 and 3 but showing the barrel being moved forward to return the ram to a driving position providing a medium power output.

Referring now to the drawings, a preferred embodiment of the tool of the invention is shown in FIG. 1. The tool includes a housing member 2 to which is fixed a handle 4 to be gripped by the operator during use of the tool. A trigger member 6 is mounted on the housing and is operative when pulled to actuate a conventional propellant firing mechanism (not shown) which is mounted in the housing 2. A barrel member 8, shown in its breech-closed position, is slidably mounted in the housing and projects from the forward end thereof. A muzzle bushing 10 is secured to the forward end of the barrel member 8 and is conventionally adapted to receive a fastener to be fired into a supporting surface. The housing also includes a port 12 through which fired cartridges may be removed from the firing chamber and fresh cartridges may be loaded thereinto. A lightweight sleeve 14 is mounted adjacent the muzzle end of the housing 2, the sleeve carrying a threaded stud 16 used to vary the power output of the tool.

Referring now to FIGS. 2–4, it will be noted that the barrel 8 includes a bore having an enlarged portion 18 and a reduced portion 20, the latter of which is coaxial with and opening into a muzzle bushing bore 22. A ram member 24 is slidably mounted within the barrel bore, the ram including an enlarged head portion 26 positioned within the enlarged barrel bore 18 and a reduced stem portion 28 positioned within the reduced barrel bore 20. The forward end surface 30 of the ram acts as the driving surface for a fastener when the ram is fired from a driving position shown in FIG. 2 to a driven position shown in FIG. 3. A sealing ring 32 is mounted on the ram head 26 to form a gas seal with the enlarged barrel bore 18. A buffer member 34 of polyurethane, or the like, is mounted in a buffer container 36 which is positioned at the forward end of the enlarged barrel bore 18 and which is secured to the housing 2 by a set screw 38. The buffer 34 has an annular configuration and surrounds the ram stem 28. A slot 40 is formed in the side wall of the barrel 8 and opens therethrough into the enlarged barrel bore 18. The rearward end wall 42 of the barrel slot acts as a barrel stop in a manner which will be more fully described hereinafter. The lug 16 includes a threaded portion 44 which is screwed into a threaded aperture 46 in the sleeve 14. Adjacent to the lug threads 44 there is formed on the lug a bulbous or curvilinear surface 48. A cylindrical portion 50 of the lug 16 extends beyond the bulbous surface 48 and projects through a slot 52 formed in the housing 2 and overlying the barrel slot 40. The cylindrical portion of the lug 16 thus projects into the barrel slot 40 but not into the enlarged barrel bore 18. The side wall of the housing slot 52 is provided with a plurality of axially offset notches 54, 56, 58, 60 and 62. The notches 54, 56, 58, 60 and 62 are sized so as to snugly receive the bulbous portion 48 of the lug 16. As shown in FIG. 2, the bulbous portion 48 of the lug 16 is locked into the central-most notch 58 in the housing slot 52 by tightening the threaded portion 44 of the lug into the threaded sleeve aperture 46. This arrangementt will provide a medium power output for the tool.

As noted in FIG. 3, when the ram 24 has moved to its fired position, the lug cylinder 50 is offset from the ram head 26 and will not be touched thereby in its fired position, and the ram head 26 rests against the buffer 34. In order to return the ram 24 to its firing position, the barrel 8 is grasped and pulled forward away from its breech-closed position and through the housing 2 as shown in FIG. 4. Since the buffer 34 is immobilized with respect to the housing 2, forward movement of the barrel 8 will cause the buffer 34 to move relatively rearwardly through the enlarged barrel bore 18 and will, in turn, cause the ram 24 to move rearwardly through the enlarged barrel bore 18 and toward its firing position. Forward movement of the barrel 8 will stop when the lug cylinder 50 contacts the barrel slot end wall 42. Thus relative movement between the ram 24 and barrel 8 will stop and the ram head 26 will be spaced apart from the firing chamber 64 a distance which is shown in FIG. 4 as *d*. In this manner free space 66 or expansion chamber in the form of a cylinder having a height equal to *d* will be interposed between the ram head 66 and the firing chamber 64. Propellant gases are free to expand into the free space 66 before acting upon the ram head 26. It will be readily appreciated that energy from the expanding combustion gases will be dissipated during filling of the free space 66 thereby, with the result that the greater the volume of the free space 66, the lower the velocity which will be imparted to the ram 24 by the combustion gases. Furthermore, it is apparent that the volume of the free space 66 is directly proportional to the value of the distance *d* between the ram head and the firing chamber. It will be noted that if the lug 16 is locked into the rearwardmost notch 62 in the housing slot 52 the lug cylinder 50 will contact the barrel slot end wall 42 sooner than would occur were the lug 16 locked into any of the other notches. This arrangement would provide *d* with its largest value and also provide a free space 66 with its greatest volume. Therefore, the power output of the tool would be at its lowest value were the lug 16 locked into the notch 62. Conversely, when the lug 16 is locked into the notch 54 *d* will be much smaller and the value of the free space 66 will also be much smaller and the power output of the tool will be at its greatest value.

Thus, by moving the lug longitudinally through the housing slot and locking it in a number of preselected notches in the housing slot, the power output of the tool can be varied. A greater number of possible power outputs can be realized by increasing the length of the housing slot or by increasing the number of notches formed in the housing slot. In this manner the versatility of the tool can be greatly increased. Furthermore, the power output control adds very little weight to the overall weight of the tool since the sleeve can be of rel-

atively thin sheet material and the lug can be a relatively lightweight member. The power output members could even be formed of some lightweight material such as aluminum or the like since they are not subjected to high stresses during operation. It will be readily appreciated that the power control of this invention is quite simple in construction and relatively inexpensive to provide.

Since many changes and variations of the described embodiment of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. A powder-actuated tool for explosively driving a fastener into a supporting surface, said tool comprising:

a. housing means;

b. barrel means carried by said housing means and movable with respect thereto toward and away from a breech-closed portion;

c. firing chamber means opening into said barrel means;

d. ram means slidably mounted in said barrel means and movable between a firing position and a fired position;

e. means providing an expansion chamber between said firing chamber means and said ram means, the volume of said expansion chamber being proportional to the distance between said ram means and said firing chamber means, and the power output of the tool being inversely proportional to the volume of said expansion chamber;

f. ram-engaging means secured to said housing means and disposed for engagement with said ram means to move the latter from its driven position to its driving position when said barrel means is moved away from said breech-closed position; and

g. power output control means including stop means mounted on said housing means and axially movable therealong and securable thereto between a plurality of offset positions spaced apart different distances from said firing chamber means, said stop means being operative to stop movement of said barrel means away from said breech-closed position with the extent of movement of said barrel means away from said breech-closed position being determined by the axial position of said stop means, whereby said ram means is positioned closer to said firing chamber means the further from said firing chamber means said stop means is positioned, said power output control means including first axial slot means in said housing means, and second axial slot means in said barrel means, said second axial slot means underlying said first axial slot means, said second axial slot means having an end wall providing a further stop surface for engaging said stop means mounted on said housing means to stop movement of said barrel means.

2. The tool of calim 1, wherein said stop means is mounted in said first axial slot means, and said offset positions are defined by offset notches in said first axial slot means to which notches said stop means is securable.

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