Feb. 3, 1953 E. H. SHAFF 2,627,248

PRESSURE FLUID ACTUATED TOOL WITH IMPROVED VALVE ACTUATING MEANS

Filed Nov. 30, 1948 2 SHEETS—SHEET 1

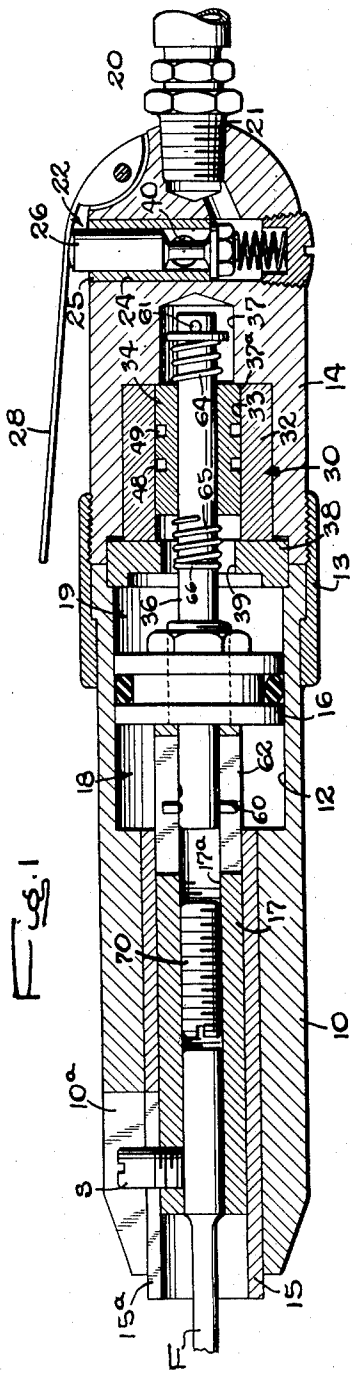


Fig. 1

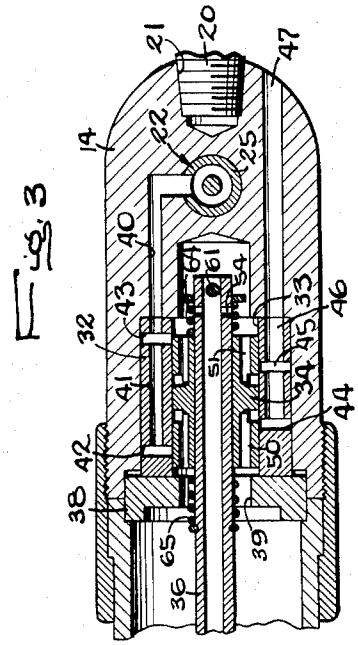


Fig. 3

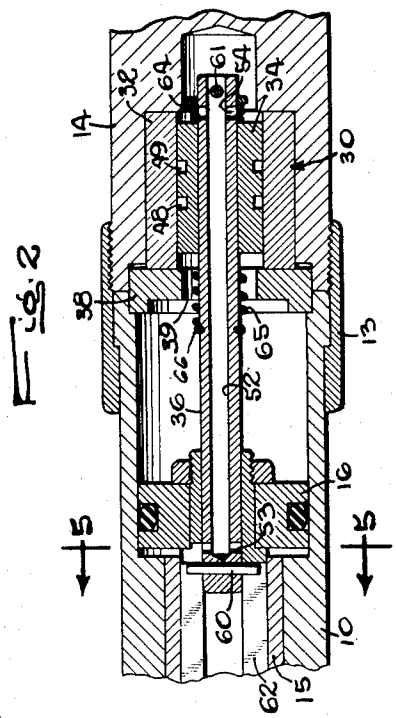


Fig. 2

INVENTOR
Ernest H. Shaff
By Baldwin, Egan, Hartford & Wolfe
ATTORNEY

Feb. 3, 1953 E. H. SHAFF 2,627,248

PRESSURE FLUID ACTUATED TOOL WITH IMPROVED VALVE ACTUATING MEANS

Filed Nov. 30, 1948 2 SHEETS—SHEET 2

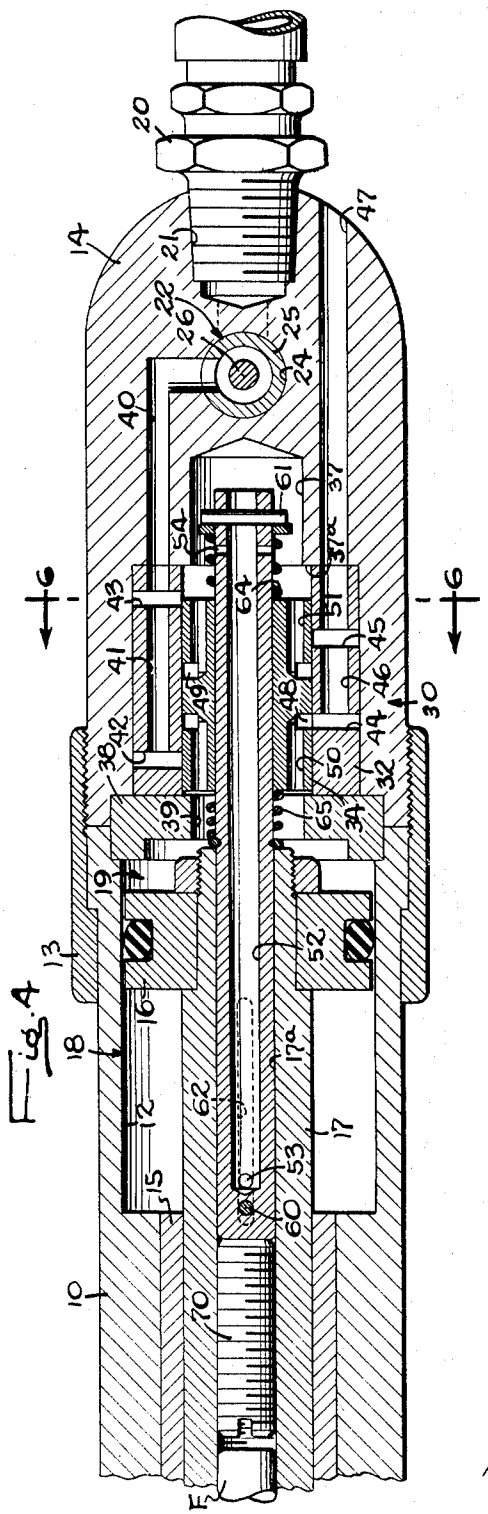


Fig. 4

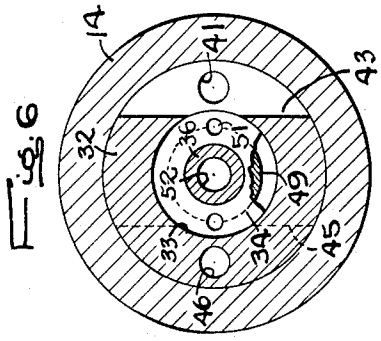


Fig. 6

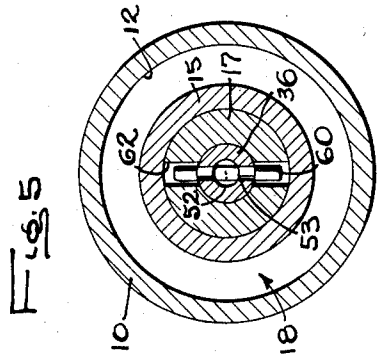


Fig. 5

INVENTOR
Ernest H. Shaff
By Barton, Pilger, Hubbard & Wolfe.
ATTORNEYS

Patented Feb. 3, 1953

2,627,248

UNITED STATES PATENT OFFICE

2,627,248

PRESSURE FLUID ACTUATED TOOL WITH IMPROVED VALVE ACTUATING MEANS

Ernest H. Shaff, Spring Lake, Mich., assignor to Keller Tool Company, Grand Haven, Mich., a corporation of Michigan

Application November 30, 1948, Serial No. 62,674

2 Claims. (Cl. 121—12)

1

The present invention pertains in general to pressure fluid actuated tools and more particularly to such tools embodying a reciprocating member such, for example, as a portable filing tool.

It is an object of the invention to provide in a pressure fluid operated tool having a reciprocating piston or the like, novel valve means for controlling the admission and exhaust of fluid which effectually eliminates stalling of the tool or tendency to stall.

A more specific object is to provide means utilizing movement of the reciprocating member of the tool to initiate movement of a valve element and utilizing the action of pressure fluid to complete such movement.

A further object is to provide novel means whereby the length of the stroke of the reciprocating element can be varied.

Still another object lies in the provision of a novel pressure fluid actuated tool of the aforesaid character which is efficient in operation and permits of economical manufacture.

The objects of the invention thus generally set forth, together with other objects and ancillary advantages are attained by the construction and arrangement shown by way of illustration in the accompanying drawings in which:

Figure 1 is a central longitudinal section through a filing tool embodying the instant invention.

Figure 2 is a fragmentary central longitudinal section similar to Fig. 1 but illustrating different relative positions of the tool components.

Fig. 3 is a fragmentary central longitudinal section taken substantially in the plane of line 3—3 in Fig. 1 but showing still other relative positions of tool components.

Fig. 4 is a fragmentary central longitudinal section similar to Fig. 3 but on an enlarged scale and showing still different component relationships.

Fig. 5 is a transverse section taken substantially in the plane of line 5–5 in Fig. 2.

Fig. 6 is a transverse section taken substantially in the plane of line 6–6 in Fig. 4.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiment, but it is to be understood that it it not thereby intended to limit the invention to the form disclosed, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

The embodiment of the invention shown in

2

the accompanying drawings comprises a portable filing tool. However, it will be readily apparent that the invention can be incorporated in other similar pressure fluid operated tools as well. As shown, the instant tool includes an elongated housing or barrel 10 defining a cylinder 12, the rear end of which is closed by a tool head 14. The latter is secured to the barrel by a collar 13. The forward end of the barrel 10 has a bore therethrough coaxially disposed with respect to the cylinder 12 within which is received a liner 15.

Disposed within the barrel is the reciprocating member of the tool which, in this instance, includes a piston 16 which is received in the cylinder 12 effectually dividing it into forward and rear chambers 18 and 19, respectively, and a piston rod 17. The piston is rigidly secured to the rear end of the rod 17 and the latter extends forwardly therefrom into the liner 15. The piston rod 17 is of tubular form having an axial bore 17*a* therethrough, the outer end of which is adapted to receive the shank of a file F, and a set screw S is provided adjacent the outer end of the piston rod 17 for engagement with the shank to clamp the same in the bore 17*a*. The barrel 10 and the liner 15 are provided with registering slots 10*a* and 15*a*, respectively, for the reception of the head of the set screw. The slots thus serve as a guide for the reciprocating member and the file F secured therein, preventing rotation of the same relative to the barrel 10.

Pressure fluid is supplied to the tool from any suitable source (not shown) by way of a fitting 20 received in a passage 21 in the tool head 14 and is under the control of a throttle valve 22. The throttle valve 22 is disposed in a transverse bore 24 adjacent the rear end of the tool head 14. It includes a sleeve 25 closely fitted in the bore 24, and a spring-biased plunger 26 shiftable axially within the sleeve. The throttle valve is operated by a lever 28 pivoted for engagement with the end of the plunger 26 and conveniently disposed along the tool head for actuation by the hand or fingers of an operator using the tool.

In accordance with the invention, a novel reversing valve mechanism 30 is provided for controlling the admission and exhaust of fluid to the forward and rear cylinder chambers 18 and 19 to produce reciprocation of the piston and which is constructed and arranged so that stalling or tendency of the tool to stall is effectually eliminated. More specifically, the valve mechanism 30 utilizes the movement of the reciprocating member of the tool through the medium of springs to initiate shifting of a movable valving element thereof, such shifting being completed by the ac-

tion of live pressure fluid on the movable valving element.

In the present instance, the valve mechanism 30 includes an annular bushing 32 having an axial bore 33 slidable within which is a sleeve or spool valve 34 and a valve stem 36. To receive the valve mechanism 30 the tool head 14 is provided with a stepped bore 37, the outer end of which is of a diameter to snugly receive the bushing 32, the latter being retained therein by means of an end plate 38. The end plate 38 has a central aperture 39 therein to permit passage of the valve stem 36 but which is of a diameter less than that of the valve 34. Thus, the end plate serves additionally as a forward limiting abutment for the valve 34. The inner end of the stepped bore 37 is also of a diameter less than that of the valve 34; thus, there is provided a shoulder 37*a* which serves to limit rearward valve movement.

Pressure fluid is supplied to the valve mechanism 30 from the throttle valve 22 by way of a passage 40 in the tool head 14 which registers with a passage 41 in the bushing 32. To afford communication with the interior of the bushing, i. e. the bore 33, and hence with the valve 34, the bushing 32 is provided with a pair of transverse slots 42 and 43 which are of a depth to intersect the passage 41 and the axial passage 33 through the bushing. The transverse slots 42 and 43 are equally spaced from the ends of the bushing.

To permit exhaust of spent fluid, the bushing 32 has provided therein a pair of slots 44 and 45 which are located in the side of the bushing opposite the slots 42 and 43, but are disposed in more closely spaced relation. These slots too intersect the axial passage 33 through the bushing and communicate with the atmosphere by way of a passage 46 in the bushing which registers with an exhaust passage 47 in the tool head 14.

The valve 34 is of a length less than that of the bushing 32, such length being determined by the spacing of the slots 42 and 43 to the end that when the valve is in its forward position the slot 43 is fully uncovered and the slot 42 is closed, and conversely, when it is in its rear position the slot 43 is closed and the slot 42 is fully opened. Centrally of its limit positions the valve closes both slots.

Intermediate its ends the valve 34 is provided with two peripheral grooves 48 and 49 which, in turn, communicate with the ends of the valve by way of pairs of passages 50 and 51, respectively. The grooves are disposed so that with the valve in its rearmost position, the groove 49 registers with the bushing slot 45 and the slot 44 is closed. Conversely, with the valve in its forward position the slot 45 is closed and the groove 48 registers with the slot 44.

With the valve 34 in its rearmost position as shown in Fig. 1, pressure fluid is admitted from the supply passages 40 and 41 through the bushing slot 42 into the forward end of the bore 33 and thence by way of the end plate aperture 39 into the cylinder chamber 19 behind the piston 16 to force the piston on its forward stroke. At the same time spent fluid from the chamber 18 ahead of the piston 16 is exhausted. For this purpose, the valve stem 36 is made of tubular form and is extended within the piston rod bore 17*a* through the piston 16. It has a passage 52 therethrough which communicates with the chamber 18 by means of ports 53 adjacent the forward end of the stem 36. The passage 52 is connected with the chamber comprising the inner end of the bore 33 by way of ports 53 disposed adjacent the rear end of the stem. From the latter chamber spent fluid passes by way of the passages 51 and the groove 49 in the valve 34, the slot 45 and the passage 46 in the bushing 32 and thence to the atmosphere through the exhaust passage 47 in the tool head 14.

In carrying out the invention, the piston rod 17 together with the valve stem 36 through the use of springs is utilized to initiate shifting of the valve 34, this initial movement being sufficient to carry the valve through its intermediate or stall position wherein it closes off both the supply slots 42 and 43. To this end the valve stem has fixed therein adjacent its ends laterally extending pins 60 and 61, respectively. The projecting ends of the pin 60 are received in a longitudinally extending slot 62 in the piston rod 17, the length of which is equal to the full stroke length of the tool. Supported by the stem 36 and interposed between the pin 61 and the rear end of the valve 34 is a spring 64. Adjacent the forward end of the valve is a similar spring 65 which is maintained in such position by a snap ring 66, the latter in turn being received in a peripheral groove provided therefor in the stem 36. As the reciprocating member of the tool approaches the limit of its forward stroke, the valve 34 being in the position shown in Fig. 1 and pressure fluid being admitted and spent fluid being exhausted as hereinbefore set forth, the pin 60 is engaged by the rear end of the slot 62 thus moving the stem 36 forwardly. Such motion causes the spring 64 to become compressed until it exerts a force on the rear end of the valve 34 greater than that exerted on the forward end of the valve by live pressure fluid entering from the slot 42. Forward movement of the valve is therefore initiated to close off the slot 42 (Fig. 2) and then partially uncover the slot 43 (Fig. 3). Pressure fluid entering through the slot 43 acts on the rear end of the valve 34 to complete its forward movement.

With the valve 34 in its full forward position, pressure fluid is admitted to move the piston on its rearward stroke by way of the slot 43, the chamber comprising the rear end of the bore 37, the valve stem ports 54, passage 52 and ports 53 into the cylinder chamber 18. Spent pressure fluid is exhausted from the chamber 19 by way of the end plate aperture 39, the valve passages 50 and groove 48, the bushing slot 44 and passage 46 to the exhaust passage 47 in the tool head 14.

As the reciprocating member approaches the limit of its rearward stroke, the pin 60 is engaged by the forward end of the slot 62, thus moving the stem 36 rearwardly compressing the spring 65 until it exerts a force on the forward end of the valve 34 greater than that exerted on its rear end by the action of live pressure fluid entering by way of the slot 43. Rearward movement of the valve is thus begun to close off the slot 43 and then to partially uncover the slot 42. Pressure fluid entering by way of the slot 42 then acts on the forward end of the valve and completes its rearward movement.

The valve 34 is thus again in the position shown in Fig. 1 permitting the cycle of operation, including a complete forward and rearward stroke of the reciprocating member, to be repeated.

Another important feature of the present invention lies in the provision of means for shortening the length of the stroke of the reciprocating member of the tool, thus permitting its use in places where a long stroke tool could not be

used. To this end, the means provided is effective to produce a change of time relation between the reciprocating member and the shifting of the valve mechanism **30**. In other terms, by shortening the length of travel of the reciprocating member relative to the valve stem **36**, the latter is actuated sooner thus initiating an earlier shift of the valve **34**. In the present instance, this is accomplished through the provision of an adjusting screw **70**, which is disposed intermediate the ends of the piston rod bore **17***a* behind the shank of the file F. Normally the screw is positioned so that it terminates just short of the slot **62**, so that full use is made of the available lost motion in the pin and slot connection **60**, **62**. By moving the screw rearwardly, its end becomes positioned to engage the end of the valve stem **37** as the reciprocating member moves on its rearward stroke. Upon its engagement with the end of the valve stem a rearward movement of the stem **36** is produced thereby compressing the spring **65** with the resulting rearward shift of the valve **34** as previously described. The engagement of the screw and the valve stem thus takes the place of the engagement of the pin **60** and the end of the slot **62**.

It will be apparent that this action results in the accomplishment of a complete cycle of operation, a forward and a rearward stroke, in a shorter length of time than with a longer or full stroke length. In other words, with the pressure fluid supply remaining constant, as the stroke length is shortened, the frequency of strokes is increased. Thus the filing speed remains substantially constant, i. e. the same amount of file surface passes over a given point on a workpiece in the same time interval.

From the foregoing, therefore, it can be seen that stalling or any tendency to stall is effectually eliminated in a pressure fluid actuated tool constructed in accordance with the present invention. By utilizing movement of the reciprocating member of the tool, through the medium of springs, the valving element controlling the admission and exhaust of fluid is prevented from coming to rest in a position in which the pressure fluid supply to both ends of the tool's cylinder is interrupted. The provision of means for varying the stroke length of the tool while maintaining a substantially constant filling speed enhances the tool's versatility. And the simplicity of construction and arrangement of its components permits economical manufacture.

I claim as my invention:

1. A pressure fluid actuated tool comprising, in combination, a housing defining a cylinder and a valve chamber coaxially alined with said cylinder, a piston disposed within said cylinder, a piston rod rigid with said piston, a valve including an annular bushing coaxially disposed with respect to said cylinder within said valve chamber and having a supply passage therein for communication with a source of pressure fluid and an exhaust passage therein for communication with the atmosphere and also having sets of supply and exhaust ports therein affording communication betwen said bushing passages and the interior of said bushing, a hollow valving element shiftable within said bushing between limit positions for alternately connecting said sets of ports with said cylinder on opposite sides of said piston to effect reciprocation thereof, a hollow valve stem having one end extending axially through said valving element, a pair of springs supported on said stem on opposite sides of said valving element, and means supported on the other end of said stem and engageable by said piston rod so that as said piston and rod approach the limits of a stroke said means is engaged to move the stem in the direction of motion of the rod to compress one of said springs whereby shifting of said valving element is initiated to close off one of said sets of supply and exhaust ports and partially open the supply port of the other of said sets of ports, pressure fluid admitted through the latter port acting on said valving element to complete its shift into its opposite limit position, said hollow valve stem affording communication between one of said sets of ports and one end of said cylinder.

2. A pressure fluid actuated tool comprising, in combination, a cylinder, a piston disposed within said cylinder, a hollow piston rod rigid with said piston and having a longitudinal slot therein intermediate its ends, a valve including an annular bushing fixed in said tool head bore in coaxially alined relation with said cylinder having a supply passage therein for communication with a pressure fluid source and an exhaust passage therein for communication with the atmosphere, said bushing also having sets of supply and exhaust ports therein affording communication between said bushing passages and the interior of said bushing, a hollow valving element shiftable within said bushing between limit positions for alternately connecting said sets of ports with said cylinder on opposite sides of said piston to effect reciprocation thereof, a valve stem having one end extending axially through said valving element and the other end received in said piston rod, a pair of springs supported on said stem on opposite sides of said valving element, a pin fixed adjacent the other end of said stem and received in said piston rod slot and normally engageable in the ends of the slot as the piston approaches its stroke limits to move the stem in the direction of motion of the rod to compress one of said springs whereby shifting of said valving element is initiated to close off one of said sets of ports and partially open the supply port of the other of said sets of ports, pressure fluid admitted through the latter port acting on said valving element to complete its shift into its opposite limit position, and an adjusting screw supported in said piston rod and movable axially therein to engage the end of said stem prior to the engagement of the end of the piston rod slot and pin whereby the stroke length of the piston and rod can be shortened.

ERNEST H. SHAFF.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
475,776	Johnson	May 31, 1892
869,568	Hiester	Oct. 29, 1907
882,025	Spoelstra	Mar. 17, 1908
1,020,003	Williams	Mar. 12, 1912
1,094,811	Reagan et al.	Apr. 28, 1914
1,767,214	Kelly	June 24, 1930
2,072,445	Erling	Mar. 2, 1937
2,406,747	Davis	Sept. 3, 1946

FOREIGN PATENTS

Number	Country	Date
822	France	Nov. 29, 1887