United States Patent

Cameron et al.

[15] **3,680,643**

[45] **Aug. 1, 1972**

[54] **FLUID ACTUATED TOOL HAVING REMOVABLE COIL SPRING BIASING MEANS**

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[73] Assignee: **Nitto Kohki Company Limited**

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[21] Appl. No.: **14,475**

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May 28, 1969 Japan.....44/48985
Oct. 14, 1969 Japan.....44/97422

[52] **U.S. Cl.** **173/133,** 29/810, 173/24
[51] **Int. Cl.**.....**B21c 43/00**
[58] **Field of Search**.....173/132, 133; 29/81 D

[56] **References Cited**

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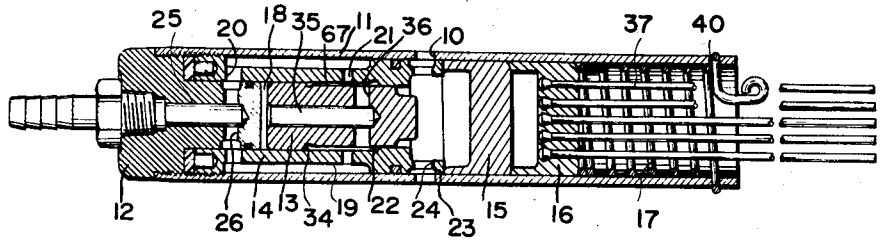
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Primary Examiner—Ernest R. Purser
Attorney—Flynn & Frishauf

[57] **ABSTRACT**

A fluid actuated tool which utilizes a tubular sleeve that is formed independently of the internal tool elements. The tool includes a tubular sleeve, a cylinder mounted within said sleeve, a space between the sleeve and the cylinder being provided which is used as an air-passage, a piston inserted in the cylinder which reciprocates by the pressure imposed by incoming air from the air-passage, a receiving piece provided at the forward end of the sleeve, the receiving piece having a hammer, a needle chisel or other workpiece attached thereto and being moved in correspondence with the movements of the piston. A coil spring, which is removably retained within the sleeve by a projection or a removable cap element, biases the piston and receiving piece rearward.

10 Claims, 20 Drawing Figures



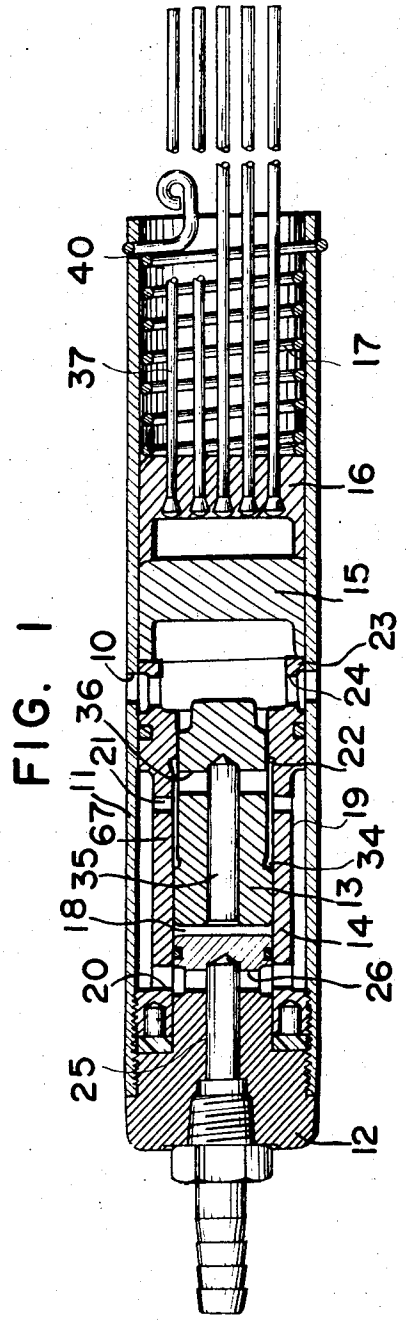

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FIG. 1

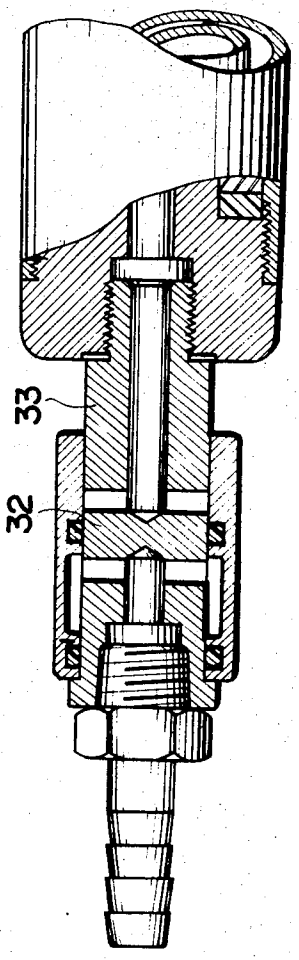

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FIG. 2

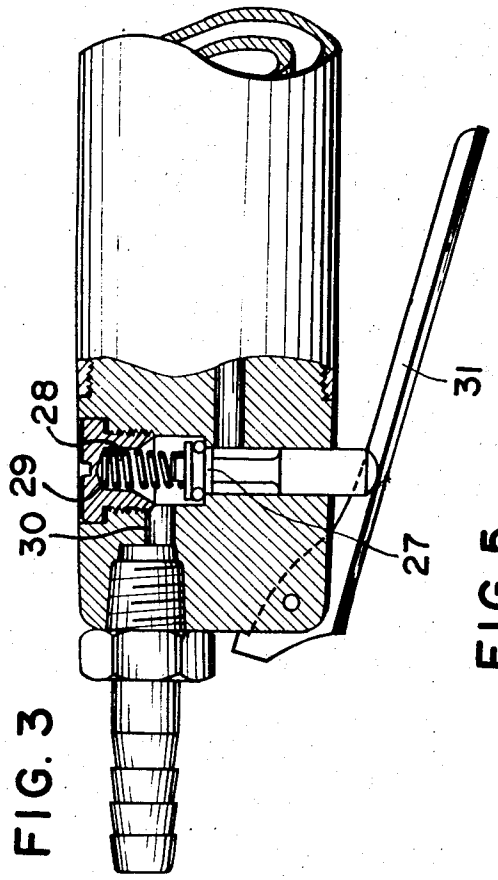


FIG. 3

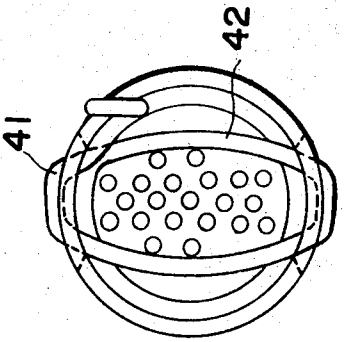


FIG. 5

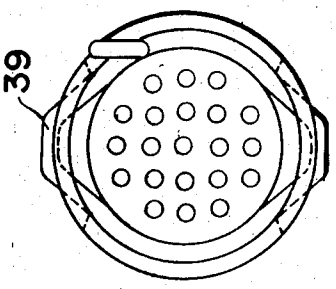


FIG. 4

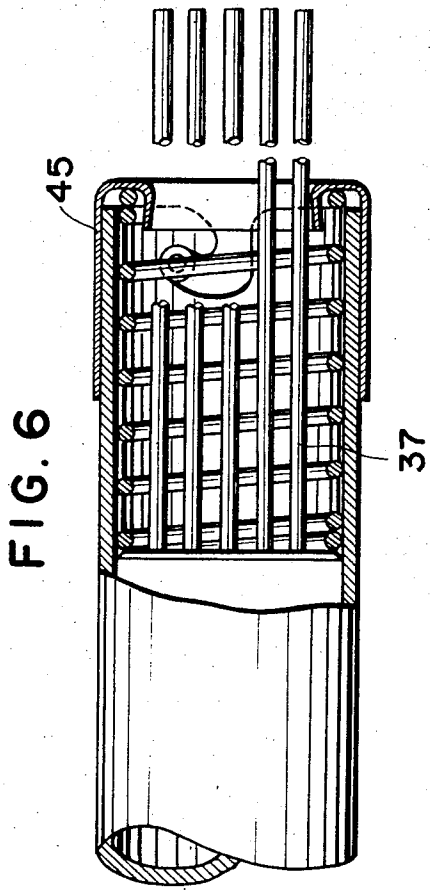


FIG. 6

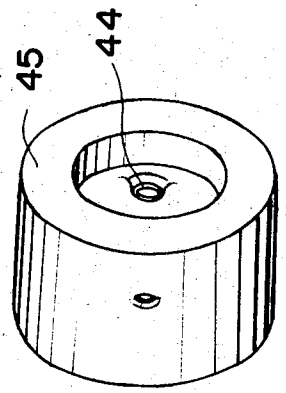


FIG. 8

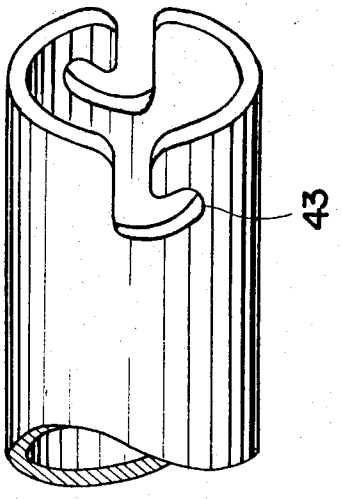


FIG. 7

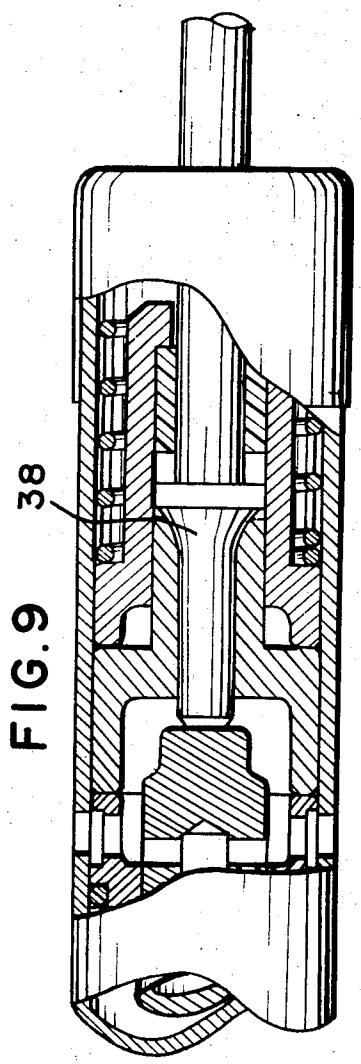


FIG.9

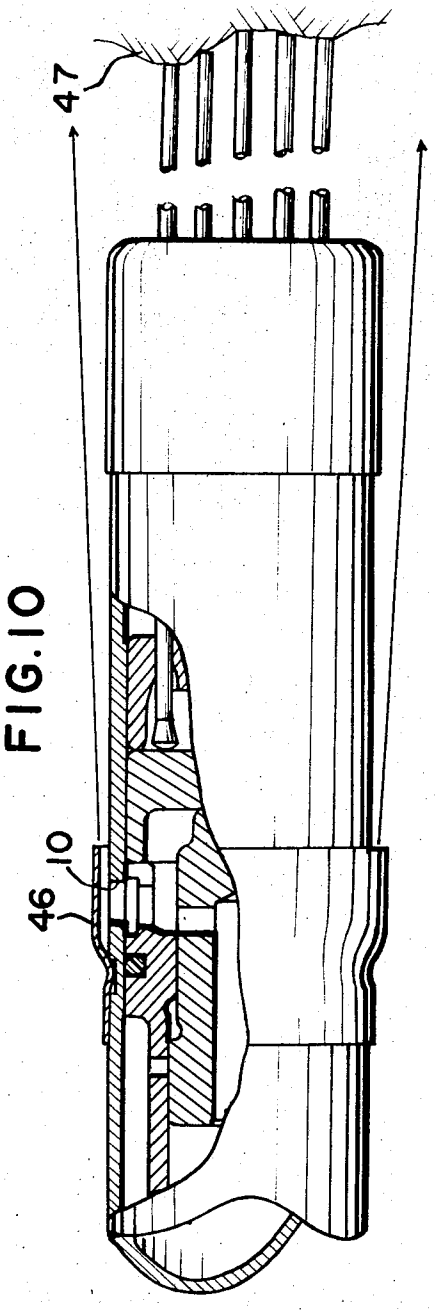


FIG.10

FIG. 12

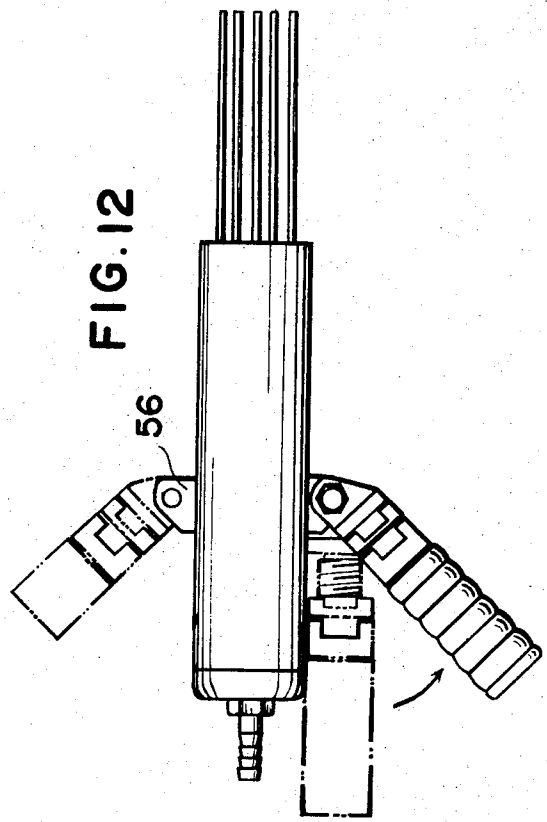
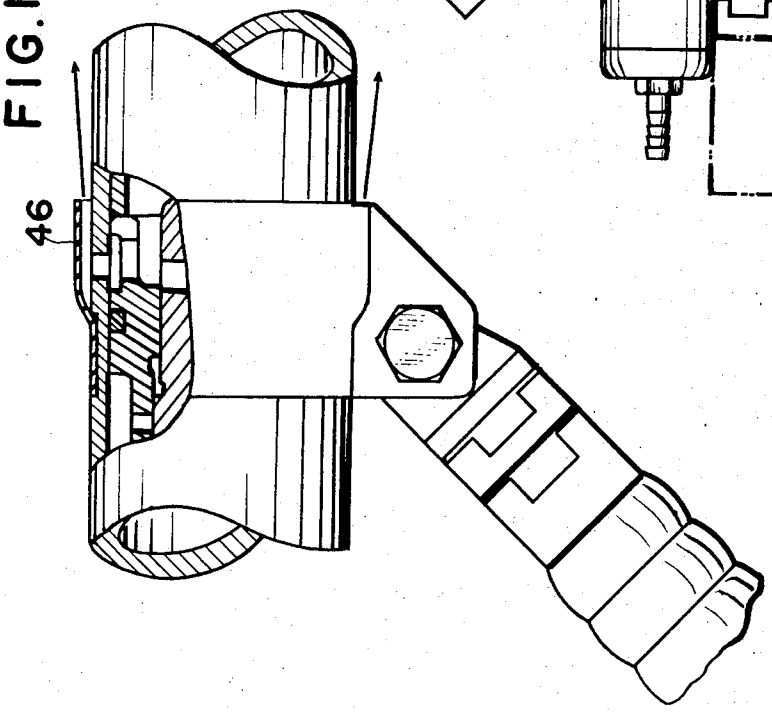


FIG. 11



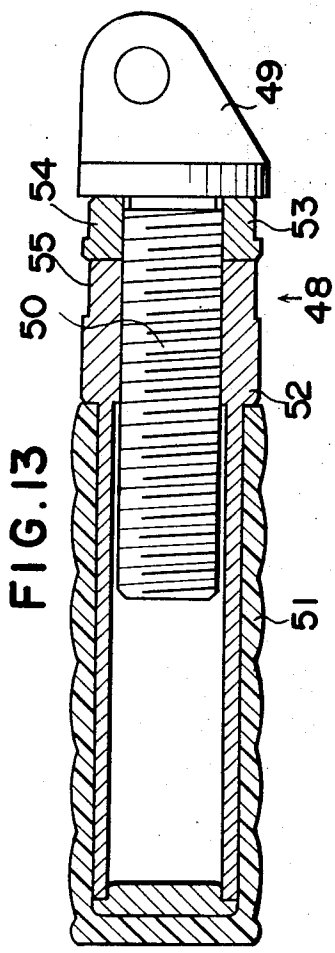


FIG. 13

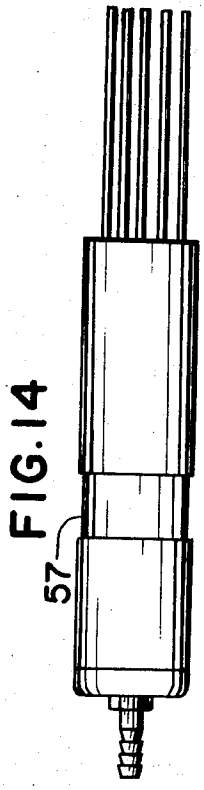


FIG. 14

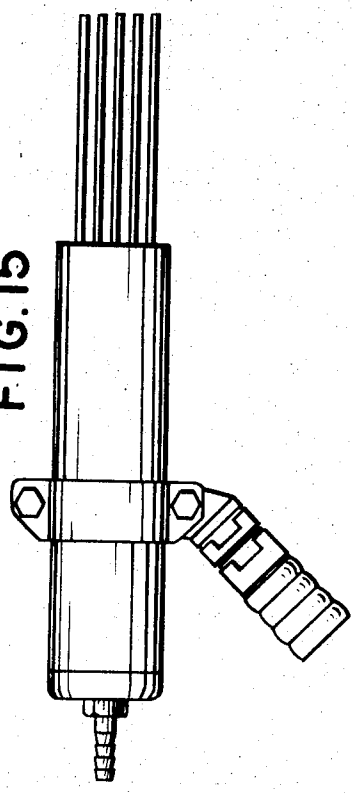


FIG. 15

FIG.16

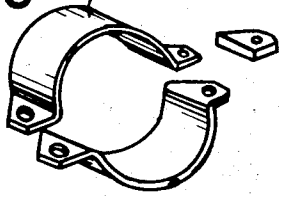


FIG.17

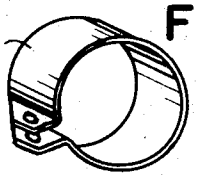


FIG.18

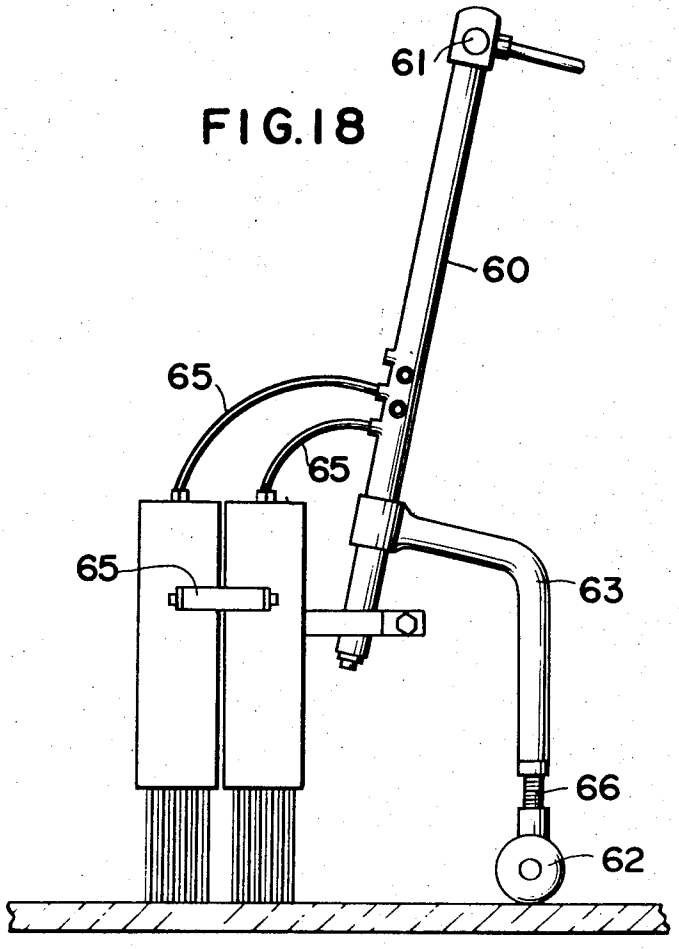


FIG. 19

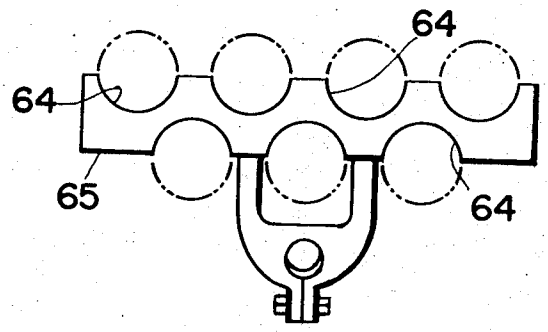
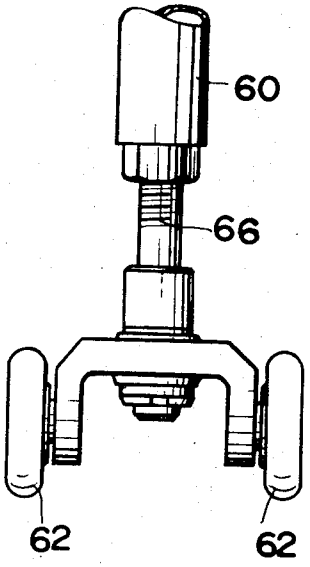


FIG. 20



FLUID ACTUATED TOOL HAVING REMOVABLE COIL SPRING BIASING MEANS

BACKGROUND OF THE INVENTION

There have been a number of inventions which relate to the present invention, (for example U.S. Pat. No. 3,349,461). However, the tools in accordance with previous inventions are first moulded or otherwise formed, and then processed to provide within the tool body air-supply or air-exhaust ports or openings. Since said processing involves delicate machining treatment and requires much time, the manufacture of the tools has been inefficient as well as expensive.

BRIEF SUMMARY OF THE INVENTION

In order to do away with the above mentioned drawbacks, the present invention aims to provide a tool which comprises a tubular sleeve which made separately of the tool parts so as to reduce mechanical processing on the tool body. Said tubular sleeve has mounted therein a cylinder, a piston, an anvil and the like to facilitate the reciprocal movements of the piston, and unique coil spring and spring retaining devices, thereby enabling the tool of the invention to attain its objects.

The present invention provides a fluid actuated too suitable for various purposes comprising a tubular sleeve, a cylinder mounted within said sleeve, a space between the sleeve and the cylinder being provided which is used as an air-passage, a piston inserted in the cylinder which reciprocates by the pressure imposed by incoming air from the air-passage, a receiving piece provided at the forward end of the sleeve, the receiving piece having a hammer, a needle chisel or other workpiece being moved in correspondence attached thereto and with the movements of the piston.

A coil spring, which is removably retained within the sleeve by a projection or a removable cap element, biases the piston and receiving piece rearward.

Another object of the present invention is to provide a fluid actuated tool wherein the tubular sleeve is removably provided with a coil spring in order to bias the piston in a predetermined direction.

Still another object of the present invention lies in the provision of a fluid actuated tool which is capable of regulating the amount of air to be supplied to the air-passage, that is, the space between the tubular sleeve and the cylinder.

A still further object of the present invention is to provide a fluid actuated tool which is provided with a cover and/or grip in order to define the direction of exhausted air.

A still further object of the present invention is to provide a fluid actuated tools unit adaptable for use as an arbitrary number of tools. These and other objects of the present invention will become apparent from the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 illustrates an embodiment in section when a descaling attachment is mounted;

FIG. 2 is a view of the air supplying system having a switching valve;

FIG. 3 is a view of an air supplying system which is a modification of the ones in FIGS. 1 and 2;

FIGS. 4 and 5 are side views of the forward end of the tool body shown in FIG. 1 illustrating one example of the structure of the tool body;

FIG. 6 is a sectional view of the cap to be attached to the forward end of the tool body;

FIG. 7 is an oblique view of said cap in FIG. 6;

FIG. 8 is a view of a modification of the cap of FIG. 6;

FIG. 9 is a sectional view of the forward end of the fluid actuated tool with a hammer for chiselling or rivetting being attached thereto;

FIG. 10 is a view of the air exhaust system as shown in FIGS. 1 and 9 with a cover being provided thereto;

FIG. 11 shows a modification of the arrangement of FIG. 10;

FIG. 12 is a front view of the fluid actuated tool of FIG. 1 with a movable handle grip being attached to the tool body;

FIG. 13 is an enlarged view of the grip handle in section of FIG. 12;

FIG. 14 is a front view of a tool similar to the one shown in FIG. 1;

FIG. 15 is a front view of the tool of FIG. 14 with a grip being attached to the tool body;

FIG. 16 and FIG. 17 are oblique views of grip connecting means;

FIG. 18 shows the tool of FIG. 1 being integrally grouped to form a unit of fluid actuated tools;

FIG. 19 is a plane view of the connecting plate; and

FIG. 20 is a partially enlarged view in section of the leg which supports the operating rod.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the sleeve 11 of the tool is a tubular member circumferentially provided with a plurality of air outlet openings 10. Within this tubular sleeve, there is located at the rearward end of the tool body 12, a piston 13 that is inserted in the cavity 18 of a cylinder 14, an anvil 15, a receiving plate 16 and a spring 17 are mounted in sequence within sleeve 11 forward of the piston 13. One of the characteristics of the present invention lies in the air passage which is actually located between the tubular sleeve 11 and the cylinder 14. Thus, it is not necessary to specially provide the sleeve for the air passage; it only requires such workings as to perforate air outlet openings for air exhausted from the cylinder and to form a cutout part at the forward end of the sleeve to hold the spring. Each part of the fluid actuated tool of the present invention is individually and separately prepared and then assembled; no casting or moulding is necessary. The cylinder 14 can also be easily worked on the outside thereof to provide an annular indentation of reduced diameter 19 and openings 20 and 21. This simplifies the processing and shortens the time thereof, whereby the production cost is greatly reduced and mass production is made possible.

The cylinder 14 is provided with a cavity, i.e., of increased said annular indentation 19, of reduced diameter on its outside; openings 20 and 21 are circumferentially made on both ends of said annular indentation. 22 is a stage at the forward end of said cavity 18 having a shoulder of increased outer diameter 23 wherein an air outlet opening 24 is provided. The cylinder thus constructed is suitably mounted within

the rearward end of the sleeve 11 which is firmly connected to the rearward end portion of the tool body 12. 25 is an air supply opening perforated in the center of said rearward end of the tool body. A valve 27 (FIG. 3) inserted in the opening 26 that is at the right angle to the air passage 26 can be reciprocated in the air passage between the cap 29 by the action of the spring 28. It is also possible to provide an air inlet port 30 to introduce air from an air source (not shown). 31 is the handle to manipulate said valve. As shown in FIG. 2, air may be supplied to an air passage 25 by means of a straight type attachment 33 containing a valve 32 that is to be attached to the rearward end of the tool body 12.

13 is the piston inserted in the cavity 18 of the cylinder; said piston having a connecting part on the outside, an air passage in its inside which opens to the rearward end and which is provided with an air passage 36 at one end of 35.

15 is the anvil slidably interposed in the sleeve. 16 is the receiving piece also slidably inserted in the sleeve; needle-bits 37 or a hammer 38 for rivetting and chiselling (FIG. 9) may be attached to said receiving piece. In order to restore the position of the receiving piece 16, the spring 17 is interposed in the forward end of the sleeve 11 to bias the receiving piece 16 rearward. The spring 17. For instance, the spring 17 may be formed with a projection 39 (FIG. 4) connected to the cut-out portion 40 of the sleeve. The spring 17 may also be formed with an oval shaped part 42 having a projection 41 to act as the connecting means to the sleeve, while the oval shaped part itself will act as the guide for the reciprocal movements of the needle bits 37 and the hammer 38 (FIG. 5). The spring and the sleeve may as well be connected utilizing a cap 45 having a projection 44 which catches with slots or openings 43 circumferentially provided on the sleeve in counter directions (FIGS. 6 - 8).

A cover 46 to regulate the direction of outgoing air (as indicated by an arrow in FIG. 10) may be provided for the air outlet opening 10 of the sleeve; the surface 47 of the workpiece may be cleaned by the pressure of the exhausted air.

A grip 48 will be attached to the sleeve in accordance with the necessity (FIGS. 11 – 17). Said grip comprises a connecting means 49 being attached to a grip rod 50 and a tubular member 51 being inserted with the grip body 52 The grip rod is screwed with a thread. Lock nut is first placed over the grip rod, to which the grip body 52 is screwed on, revolving several times to position it, and the lock nut is fastened to hold the grip body. In the drawings, 54 and 55 are the planes of the lock nut and the grip body, respectively, which facilitate the fastening by a wrench or a spanner Connecting means to attach the grip to the sleeve 11 is not limited: the grip may be movably attached to the sleeve by means of a connector 56 welded on the outside of the sleeve (FIG. 12). It can also be attached to a dent 57 provided on the sleeve by means of a connector 58 in semi-circle or the connector 59 of FIG. 17 (FIG. 14). The grip can be attached directly on the sleeve by a connector (FIG. 15); the dent 57 in this case is not necessary. The cover 46 of the air outlet opening 10 may also be utilized for connecting the grip to the sleeve.

Another characteristics of the present invention lies in the fact that the fluid actuated tools are assembled to form a unit tool. This is explained in the FIGS. 18 – 20.

60 is a tubular operating lever having a grip 61 at its end. 62 is a wheel and 63 is a supporting leg. A connecting board 65 provided with a plurality of semi-circular holes 64 is attached to the lower end of the operating lever 60. To said semi-circular holes, a plurality of fluid actuated tools containing needle bits or a hammer are attached. Pipes for air connect the air supply port of the tools and the hollow of the operating lever 61 so as to enable air from air supply source (not shown) to be introduced to all of the tools simultaneously, thereby utilizing a group of tools as one unit. In this way, even a large workpiece can be uniformly treated with grinding and the like in short period of time by one hand. The wheel 62 is screwed to the operating lever by means of a screw 66; the working position of the operating lever and the tools can be adjusted by the wheel as it is extendably screwed to the lever. The working will be greatly facilitated by the function of the wheel.

The piston of the fluid actuated tool thus described reciprocates in the following manner:

Air is supplied to the annular recess 19 in the cylinder 14 via air passages 25 and 26 of the rearward end of the tool body and the opening 20 provided in the said annular recess of the cylinder 14. Air then proceeds to the space 67 between the stage 22 of the cylinder and the connecting part 34 of the piston 13 via the opening 21 of the annular recess. This is the air supply passage.

As a result of this, the piston is pushed rearward (to the left of FIG. 1). When the piston is pushed to a certain position, the air passing opening 36 in the piston comes in communication with the opening 21 of the cylinder 14. Thereby the air in the space 67 proceeds to the cavity 18 to pressurize the cavity 18 via the opening 36 and 35 of the piston. This is the air filling passage.

As the cavity 18 is pressurized, the piston is caused to rapidly proceed (to the right in FIG. 1) and strike the needle bits or a hammer attached to the receiving piece 16 with the anvil 15 being interposed therebetween. The needle bits or a hammer will then move forward to do the necessary operation, resisting against the spring 17.

As the piston still moves further, the opening 36 thereof will come in communication with the air outlet opening 24 and 10 whereby the air is exhausted outside. This is the air exhaust passage. At this time, the opening 21 of the cylinder is closed by the wall of the piston and thus the pressure in the cavity 18 is reduced to nill. On the other hand, as the air in the space 67 is pressurized, the piston will again be pushed rearward movement (to the left in FIG. 1) in the cavity, the rearward movement being accelerated by the spring. The reciprocal movements of the piston is by repetition of the foregoing.

What is claimed is:

1. A fluid actuated tool comprising:

a tool body including tubular sleeve (11) having a plurality of air outlet openings (10) communicating to the outside thereof;

an air inlet for supplying pressurized supply fluid to the rearward end of the tool;

a cylinder (14) having outlet openings (24) communicating with the air outlet openings (10) of said sleeve (11), and an annular recess (19) on the outer surface thereof, mounted within the rearward end of said sleeve (11), an air passage being formed by said recess (19) between the cylinder (14) and sleeve (11);

a piston (13) slidably mounted in said cylinder (14) to reciprocate therein, an air cavity being formed between the rear of said piston and the rearward end of said tool body, said cavity being in communication with said air passage formed by said recess (19), said piston (13) having an air filling passage (36) formed therein substantially perpendicular to the longitudinal axis of said piston, said air filling passage (36) being selectively in communication with said air passage formed by said recess (19) as the piston (13) moves within said sleeve;

an anvil (15) slideably mounted in said sleeve (11) and coupled to said piston (13) to reciprocate therewith;

a receiving piece (16) slideably mounted in said sleeve (11) and coupled to said piston (13) for reciprocating in accordance with said piston reciprocation and for carrying a working element (37);

a spring engaging recess formed at the forward end of said sleeve (11); and

coil spring means (17) removably mounted within the forward end of said sleeve (11) to bias said receiving piece (16) rearward, said coil spring means (17) having a projection (39,41) removably engaging said spring engaging recess at said forward end of the sleeve;

said air outlet openings in said cylinder (14) and sleeve (11) selectively communicating with the substantially perpendicular openings (36) of the piston (13) as the piston moves forward to relieve compressive pressure tending to move the piston forward with respect to said sleeve (11), said coil spring means (17) biasing said piston (13) and said receiving piece (16) rearward towards their rearmost position.

2. The fluid actuate tool of claim 1 wherein said spring engaging recess includes at least an opening formed through the wall of said cylinder (11).

3. The fluid actuate tool of claim 1 wherein said coil spring means (17) includes an oval shaped portion (42) having projection (41) formed at the end thereof, and said spring engaging recess includes a generally screw-thread shaped recess, said projection screwing to said generally screw-thread recess.

4. The fluid actuate tool of claim 3 wherein said oval shaped spring part guides said working element (37).

5. The fluid actuate tool of claim 1 wherein said spring means (17) includes an extension portion which is grippable for disengaging said spring means (17) from said spring engaging recess in said sleeve (11).

6. The fluid actuate tool of claim 1 including means (56) for attaching a grip means to said tubular sleeve (11).

7. A fluid actuated tool comprising:

a tool body including tubular sleeve (11) having a plurality of air outlet openings (10) communicating to the outside thereof;

an air inlet for supplying pressurized supply fluid to the rearward end of the tool;

a cylinder (14) having outlet openings (24) communicating with the air outlet openings (10) of said sleeve (11), and an annular recess (19) on the outer surface thereof, mounted within the rearward end of said sleeve (11), an air passage being formed by said recess (19) between the cylinder (14) and sleeve (11);

a piston (13) slidably mounted in said cylinder (14) to reciprocate therein, an air cavity being formed between the rear of said piston and the rearward end of said tool body, said cavity being in communication with said air passage formed by said recess (19), said piston (13) having an air filling passage (36) formed therein substantially perpendicular to the longitudinal axis of said piston, said air filling passage (36) being selectively in communication with said air passage formed by said recess (19) as the piston (13) moves within said sleeve;

an anvil (15) slidably mounted in said sleeve (11) and coupled to said piston (13) to reciprocate therewith;

a receiving piece (16) slideably mounted in said sleeve (11) and coupled to said piston (13) for reciprocating in accordance with said piston reciprocation and for carrying a working element (37);

coil spring means (17) removably mounted within the forward end of said sleeve (11) to bias said receiving piece (16) rearward; and

cap means (45) removably engaging the forward end of said sleeve (11) for removably retaining said coil spring means (17) within said sleeve (11);

said air outlet openings in said cylinder (14) and sleeve (11) selectively communicating with the substantially perpendicular openings (36) of the piston (13) as the piston moves forward to relieve compressive pressure tending to move the piston forward with respect to said sleeve (11), said coil spring means (17) biasing said piston (13) and said receiving piece (16) rearward towards their rearmost position.

8. The fluid actuate tool of claim 7 wherein said cap means (45) is generally ring-shaped, said working element (37) extending out from said tool through a central opening in said cap means (45).

9. The fluid actuate tool of claim 7 wherein said sleeve has a cap engaging recess (43) formed therein and said cap means (45) has a projection (44) engaging said cap engaging recess (43).

10. The fluid actuate tool of claim 9 wherein said cap engaging recess (43) is a circumferential re-entrant slot having an opening at the forward end of said sleeve (11), whereby said sleeve (11) and cap means (45) are removably and lockingly engaged together.

* * * * *