Dec. 27, 1966 A. H. FILANDER ET AL 3,294,182

POWER TOOLS

Filed Sept. 23, 1964 3 Sheets-Sheet 1

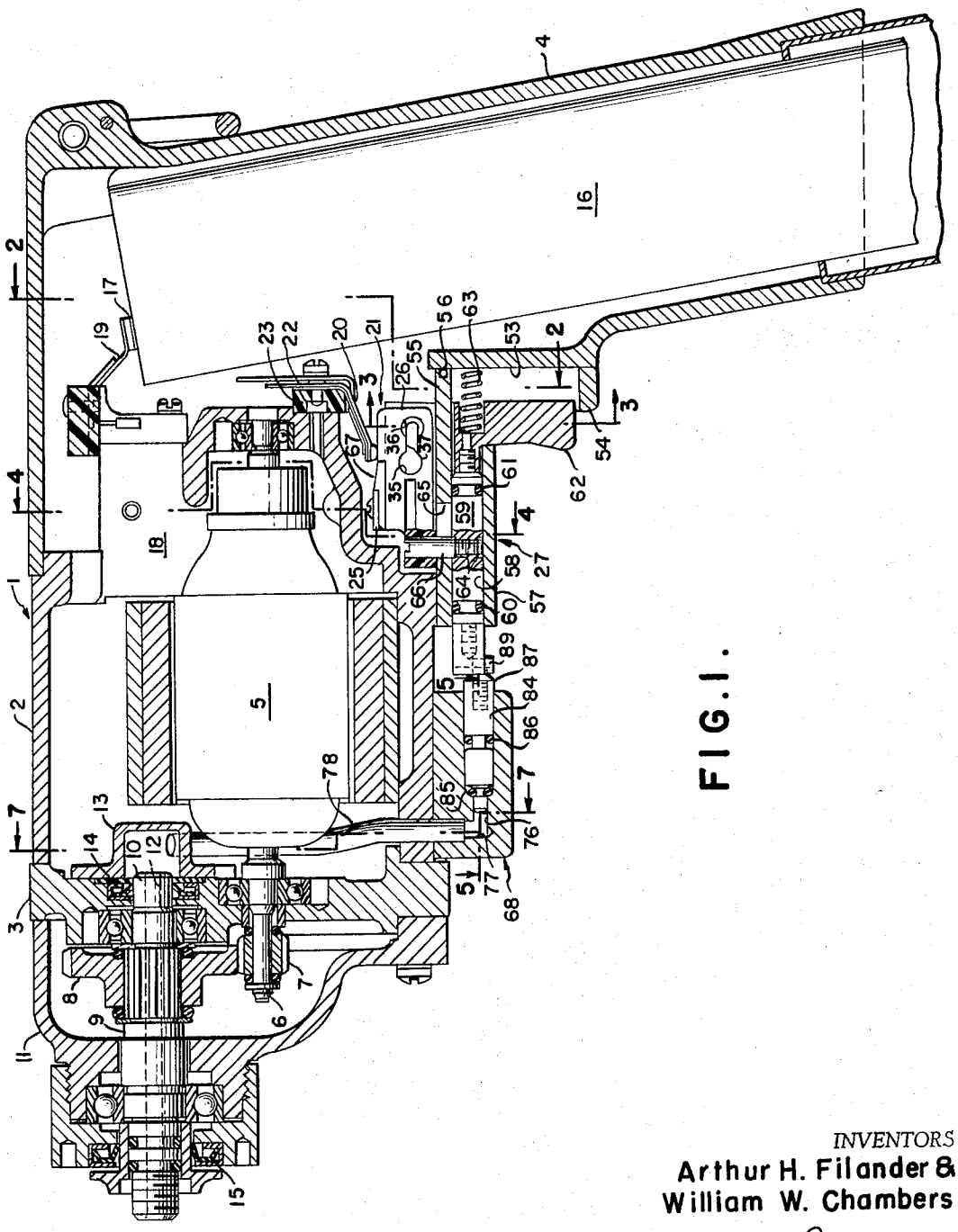


FIG. 1.


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POWER TOOLS

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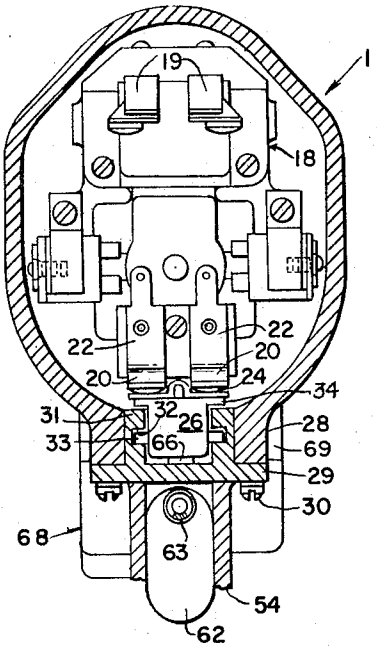



FIG. 2.

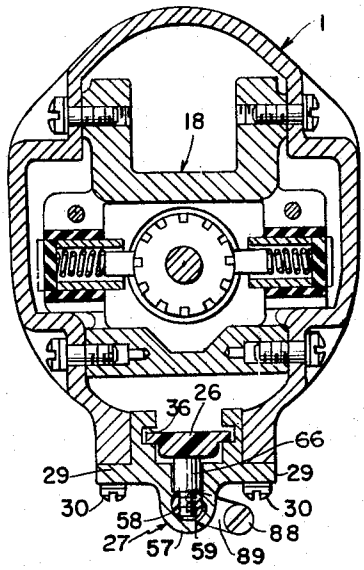



FIG. 4.

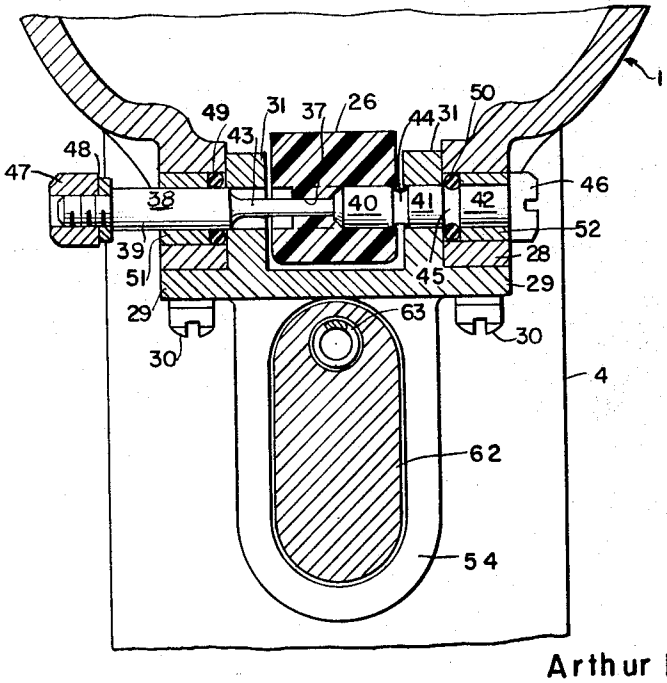



FIG. 3.

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POWER TOOLS

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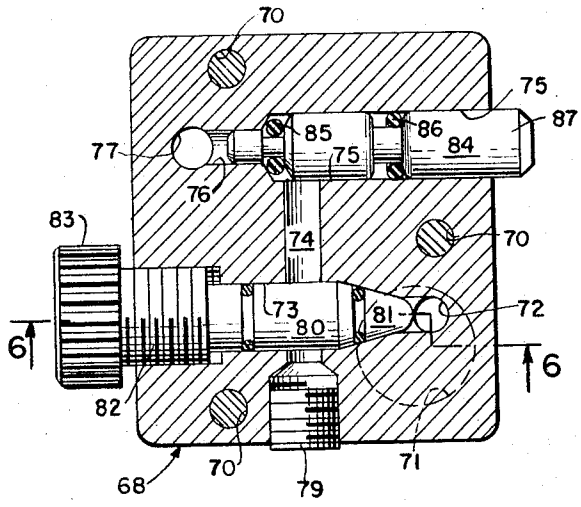



FIG. 5.

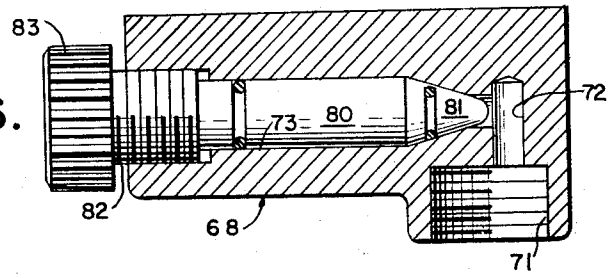



FIG. 6.

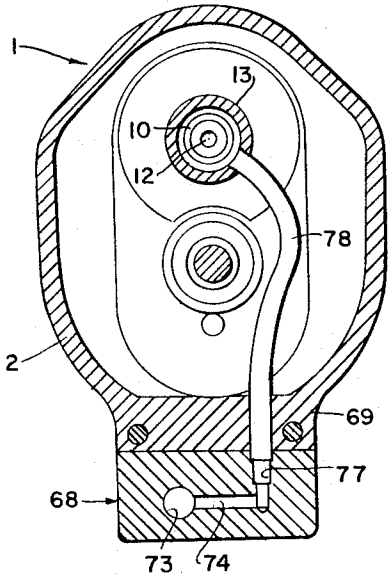



FIG. 7.

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United States Patent Office 3,294,182 Patented Dec. 27, 1966



3,294,182

# POWER TOOLS

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Filed Sept. 23, 1964, Ser. No. 398,611
10 Claims. (Cl. 173—77)

This invention relates to power driven tools and, more particularly, to manually held electric drills and the like equipped with means for supplying a cooling and/or lubricating fluid to the drill bit or like driven element whenever the tool is placed in operation.

Numerous fields of use require that power drills and like tools, whether driven by electric, pneumatic, or other types of motors, be equipped with means providing a continuous flow of fluid, such as water, to the bit or like work element whenever the tool is in operation. Thus, for example, when the tool is to be used to drive a core bit for drilling concrete or the like, it is necessary to supply water or equivalent liquid continuously to the interior of the core bit to serve as a lubricant and coolant at the tip of the bit whenever the tool is in operation, the flow of the water being cut off whenever the tool is stopped. Though the water can readily be supplied under pressure to the tool from an exterior source, problems have been encountered in attempting to devise a simple control mechanism effective to provide concurrent on-off control of both the water flow and the driving motor.

A general object of this invention is to provide, in an electrically driven tool, manually operated control mechanism effective to simultaneously control both the driving motor and the flow of a fluid, such as water, to the bit or other work device driven by the tool.

Another object is to devise such a combination control mechanism wherein a single manually operated control element, such as a trigger, actuates both a switch, for controlling the drive motor of the tool, and a valve, for controlling fluid flow.

A further object is to provide a control mechanism of the type described which is adapted for use under conditions involving a copious flow of water or other liquid, the mechanism being incorporated into the tool in such fashion that seepage of water or other liquid into critical areas of the tool is precluded.

Yet another object is to devise a particularly effective, hand-held, electrically driven tool for drilling and like purposes, equipped with simple and inexpensive means for supplying water or other liquid to the drill bit or other driven work element.

Stated generally, the invention provides, in a power driven drill or like tool structure, a control mechanism which includes a manual operating element, such as a trigger, a control valve, and operating means coupling the trigger to both an operating member for the valve and a separate operating member for actuating the motor switch or other control. Advantageously, the motor switch itself is disposed in the housing, and the operator extends through an opening in the housing, the control mechanism including means for maintaining that opening sealed against entrance of liquid into the housing regardless of the operative position of the elements of the control mechanism. The valve mechanism itself is constructed, and combined with the motor housing, in such fashion that the liquid supplied from the valve mechanism can be conveyed directly to the driven shaft, for example, via conduiting which extends through the housing.

In order that the manner in which the foregoing and other objects are achieved in accordance with the invention can be understood in detail, one particularly advantageous embodiment thereof will be described with reference to the accompanying drawings, which form a part of this specification, and wherein:



FIG. 1 is a longitudinal sectional view of an electrically powered, fluid cooled hand tool embodying the invention;

FIG. 2 is a fragmentary transverse sectional view taken on line 2—2, FIG. 1, with some parts shown in elevation;

FIG. 3 is a transverse sectional view taken on line 3—3, FIG. 1, with some parts shown in elevation;

FIG. 4 is a transverse sectional view taken on line 4—4, FIG. 1;

FIG. 5 is a fragmentary longitudinal sectional view, with some parts shown in elevation, taken on line 5—5, FIG. 1;

FIG. 6 is a fragmentary sectional view taken on line 6—6, FIG. 5; and

FIG. 7 is a transverse sectional view taken on line 7—7, FIG. 1.

Turning now to the drawings in detail, the invention is illustrated as applied to an electrically powered tool which can be used to drive a core bit, for example, as is commonly used for drilling concrete and like materials, The tool comprises a housing structure indicated generally at 1 and including a main body portion 2, closed at the forward end by conventional gear case cover serving as a mounting plate 3, in the nature of a transverse partition, and provided with a dependent pistol grip type of handle 4 at the opposite end. The electric driving motor 5, of any suitable type, is mounted within main body portion 2 of the housing, occupying the space between the mounting plate 3 and handle 4. Motor 5 drives a pinion shaft 6, suitably bearinged in plate 3, shaft 6 carrying a pinion 7 meshed with a gear 8 secured to a hollow output shaft 9. Journaled in a suitable antifriction bearing carried by plate 3, the shaft 9 projects completely through the plate, terminating in an inner end 10.

The housing structure is completed, at the forward end of the tool, by an end cap 11 which serves as a gear case and supports an additional anti-friction bearing through which shaft 9 extends. The front end portion of the shaft 9 projects beyond end cap 11 and is suitably threaded or otherwise adapted for attachment of a chuck, for example, for mounting of the core bit or other element to be driven by the tool. The shaft 9 has an axial through bore 12 forming a conduit or passage means via which water or other fluid can be conducted forwardly to the interior of the core bit. At the inner end 10 of shaft 9, a generally cup-shaped element 13 is fixedly attached to the rear face of plate 3 so as to cooperate with the plate to define a fluid-supply chamber with which the bore of shaft 9 is in communication. A conventional shaft seal 14 is provided at the inner end of shaft 9 to prevent forward passage of fluid around the outside of the shaft. A second shaft seal 15 is provided at the forward end of the front end cap 11, so that fluid cannot enter the end cap via the outside of the output shaft.

In this particular embodiment of the invention, the handle 4 contains a battery pack 16, preferably of the rechargeable type, with its uppermost portion presenting a pair of spaced-apart terminals 17. In an area at the rear of motor 5, housing 1 includes an internal structure, indicated generally at 18, which supports the rear anti-friction bearing for the motor shaft, as seen in FIG. 1, the brushes for motor 5, as seen in FIG. 4, and two spring contact elements 19, FIG. 2, each resiliently urged against a different one of the battery terminals 17.

Internal structure 18 also supports two spring contact blades 20, FIGS. 1 and 2, which constitute the fixed contacts of an on-off switch indicated generally at 21. Each blade 20 has an upper portion 22 which is secured, as by a rivet or other suitable fastener, to the rear face of an insulating block 23 carried by structure 18. Below block

23, blades 20 slant downwardly and forwardly, terminating in free tip portions carrying contact buttons 24. By suitable conductors (not shown), one of the contact blades 20 of the switch is connected directly to one of the contact elements 19, and thus to one of the battery terminals 17. The other of the blades 20 is connected, via the brushes and commutator of the motor, to the other of the contact elements 19, and thus to the other of the battery terminals 17. Accordingly, it will be understood that motor 5 is energized only when switch 21 serves to interconnect the contact blades 20.

Such interconnection is accomplished by a movable contact plate 25 secured to the front end portion of the upper face of a movable insulating member 26. In the area of switch 21, the housing structure is completed by a closure member 27. In this area, immediately in front of handle 4, the main body of the housing structure includes transversely spaced dependent side wall portions 28 having straight bottom edges. Member 27, FIG. 4, has outwardly projecting flanges 29 each secured to a different one of side wall portions 28, as by screws 30. Member 27 includes two upwardly projecting transversely spaced webs 31, FIG. 2, the spacing between and the thickness of the webs 31 being such that each web lies in contact with the inner surface of a different one of the dependent side wall portions 28. Each upstanding web 31 has an inwardly facing groove 32. At each side, member 26 of switch 21 has a lower outwardly projecting flange 33, each of the flanges 33 being slidably engaged in a different one of the grooves 32. The main body portion of member 26 is also provided with a pair of outwardly projecting flanges 34 each engaged over the upper edge of a different one of the upstanding webs 31, as will be clear from FIG. 2.

Member 26 has two longitudinally spaced, transversely extending cylindrical bore portions 35 and 36, FIG. 1, interconnected by a slot 37 which extends transversely completely through member 26 and is of a width materially smaller than the equal diameters of bores 35 and 36. As seen in FIG. 3, the dependent side wall portions 28 and the upstanding webs 31 are provided with aligned transverse bores which accommodate a lock pin 38. Pin 38 includes larger diameter portions 39, 40, 41 and 42, all of equal diameter. Portions 39–42 are capable of being snugly received in the lock bores 35 and 36. Portions 39 and 40 are separated by a portion 43 of distinctly smaller diameter, the length of portion 43 being such that, when the lock pin is so positioned that portion 43 is centered with respect to member 26, portion 43 can extend completely through slot 37. The diameter of portion 43 is slightly smaller than the width of slot 37, so that member 26 can be moved freely relative to the lock pin when portion 43 is centered with respect to slot 37. Portions 40 and 41 are separated by a transverse annular groove 44 of arcuate transverse cross section. Similarly, portions 41 and 42 are separated by a transverse annular groove 45 of arcuate transverse cross section. At one end, the lock pin terminates in a screw head 46. At the other end, a cap 47, substantially larger in diameter than portion 39, is attached to the lock pin, as by screw threads, a lock washer 49 is engaged between the cap 47 and the adjacent shoulder which defines one end of lock pin portion 39.

The length of portion 39 is such that, when the lock pin is moved to the right, as viewed in FIG. 3, to bring washer 48 into engagement with the corresponding dependent side wall portion 28 of the housing, the smaller diameter portion 43 of the lock pin is centered with respect to slot 37, so that member 26 is freed for movement. Assuming that one of the lock bores 35, 36 is aligned with the axis of the lock pin, movement of the lock pin to the left, as viewed in FIG. 3, until screw head 46 engages the corresponding dependent portion 28, will bring large diameter portion 40 of the lock pin into snug engagement with the corresponding lock bore 35, 36.

In each of the lock pin accommodating bores in dependent portion 20 of the housing, there is situated an O-ring, as indicated at 49 and 50, respectively. O-ring 49 is urged against the adjacent face of the corresponding web 31 by a retaining bushing 51. Similarly, O-ring 50 is urged against the adjacent web 31 by a retaining bushing 52. The inner periphery of O-ring 49 engages the plain cylindrical surface of lock pin portion 39, providing a seal between the lock pin and the corresponding dependent side wall portion 28 to preclude entry of liquid at this point. O-ring 50 is engaged in one of the grooves 44, 45, depending upon the adjusted position of the lock pin. It will be understood that O-ring 50 is of resilient material and is capable of riding over the larger diameter portion 41 of the lock pin and then snapping into the appropriate one of the grooves 44 and 45 to provide a liquid-tight seal between the lock pin and the corresponding dependent side wall portion 28, and at the same time to provide a detent snap action for the lock pin 38. The structure and function of the lock pin 38 is described more fully in the copending Filander application Serial No. 252,760, entitled, "Trigger Locking Means for Hand-portable Power-operated Device," and assigned to the assignee of the present invention.

Immediately below the main body portion 2 of the housing structure, the front wall of the hollow handle 4 includes a trigger accommodating housing defined by a flat wall portion 53 which extends transversely of the structure and is exposed forwardly, and a forwardly projecting flange 54. Member 27 includes a flat rear end portion 55 which lies in the common plane occupied by flanges 29, portion 55 having a straight rear edge provided with a groove accommodating a packing or seal device 56. The rear edge of portion of member 27 is directly engaged with the front face of wall 53 of the trigger housing, so that the packing 56 forms a fluid-tight seal between member 27 and wall 53 to prevent entry of liquid into the housing structure at this point.

Member 27 includes a dependent portion 57 which defines a cylindrical bore 58, the axis of bore 58 being parallel to and aligned below the longitudinal axis of shaft 9. Bore 58 accommodates a cylindrical shaft portion 59 having two axially spaced transverse annular grooves which accommodate O-rings 60 and 61. At its end directed toward handle 4, shaft portion 59 is provided with a threaded extension of reduced diameter which is engaged in a threaded, forwardly opening bore in trigger 62. The trigger has a flat rear surface adapted to engage the front face of wall 53 of the trigger housing, the peripheral configuration of the trigger being such that the trigger is slidably received within the confines defined by flange 54. A helical compression spring 63 is provided to bias the trigger forwardly, one end of spring 63 being engaged in a suitable rearwardly opening recess in the trigger, while the opposite end of the spring engages wall 53. At a point between the locations of O-rings 60 and 61, shaft portion 59 has spotfaces or flats, as indicated at 64. In this area, member 27 is provided with a slot 65 which communicates between the interior of the housing structure 1 and the interior of bore 58, slot 65 being elongated axially of bore 58. At its forward end, switch member 26 carries a dependent pin 66 which projects through slot 65 into bore 58, the tip of pin 66 being threadably secured to shaft 59, and the upper flat 64 serving as a seat for the end of pin 66. Pin 66 is thus operative to interconnect switch member 26 and shaft portion 59 so that, when trigger 62 moves forwardly or rearwardly, a corresponding rectilinear motion is imparted to the switch member 26, this movement being allowed by the elongated slot 65. The limits of forward and rearward travel for the assembly comprising trigger 62, shaft portion 59, pin 66, and switch member 26 are determined by the ends of slot 65. The relative positions of lock bores 35 and 36 are such that these bores can cooperate wtih lock pin 58 to secure the switch member 26, and thus trigger 62, in either extreme position of travel.

When member **26** occupies its forward position, to which it is normally biased by spring **63**, the contact buttons **24** of switch **21** engage the upper insulating surface of member **26**, so that there is no electrical connection between the two contact blades **20**. When, upon actuation of trigger **62** toward handle **4**, switch member **26** is moved rearwardly of the tool, contact buttons **24** slide along the upper face of member **26**, coming into engagement with the upper face of movable contact **25** as the trigger reaches its rearmost position. The upper face of member **26** slants forwardly and upwardly, at **67**, so that the spring blades **20** are resiliently deformed, to provide increased contact pressure, as movable contact plate **25** is brought beneath the contact buttons **24**. When buttons **24** engage contact plate **25**, the motor energizing circuit is completed, so that current is supplied to the motor from the batteries **16**. When the operator releases trigger **62**, the biasing action of spring **63** causes switch member **26** to return to its forward position, so that contact plate **25** is removed from engagement with contact buttons **24** and the energizing circuit for the motor is broken.

O-rings **60** and **61** provide fluid-tight seals between shaft portion **59** and the wall of bore **58**, these seals always lying each on a different side of slot **65**, so that entry of liquid into the housing structure via slot **65** is precluded.

At a point spaced forwardly from member **27**, there is secured to the lower portion of housing structure **1** a valve block indicated generally at **68**. As seen in FIG. 7, the main body portion **2** of the housing structure is provided with a dependent portion **69** presenting a flat bottom surface, and the valve block **68** has a flat upper face disposed in flush engagement therewith. The valve block is secured by screws extending through openings **70**, FIG. 5. The valve block **68** is provided with a downwardly opening threaded bore **71**, FIG. 6, to which a water supply conduit is attached. A smaller bore **72** leads upwardly from inlet opening **71** and is intersected by the tapered inner end portion of needle valve bore **73**. A bore **74**, FIG. 5, extends transversely across the main body portion of the needle valve bore **73** and opens into a valve chamber comprising a larger cylindrical bore portion **75** and a smaller, inner cylindrical bore portion **76**, bore portions **75** and **76** being coaxial and parallel to bore **58**, FIG. 1. Comparing FIGS. 1, 2 and 5, it will be understood that the axis of bore portions **75** and **76** is offset to one side of the axis of bore **58**, while the location of the inlet opening **71** is offset to the other side of the axis of bore **58**. Bore portion **76** opens into a bore **77** which opens through the upper face of the valve block **68** and constitutes the outlet opening in the valve block.

A metal tube, or similar conduit, **78** has one of its ends secured in fluid-tight relation within an opening in the side wall of cup-shaped element **13**, the other end of conduit **78** extending through a suitable opening in the wall of main body portion **2** of the housing structure and being secured within the outlet bore **77** of the valve block.

The outer end of transverse bore **74** is closed by a threaded plug **79**, FIG. 5. Needle valve bore **73** accommodates a needle valve body **80** having a tapered tip portion **81** adapted to seat against the tapered end portion of the needle valve bore. The outer end portion of bore **73** is internally threaded to cooperate with external threads on portion **82** of needle valve body **80**. A knurled knob **83** is provided for manual adjustment of the needle valve. At points each on a different side of transverse bore **74**, the needle valve body is grooved to accommodate O-rings for establishing fluid-tight seals with the wall of valve bore **73**.

The larger bore portion **75** of the valve chamber defined in block **68** slidably accommodates a movable valve element **84** which includes a cylindrical main body portion which is longer than bore **75** and has, at one end, a projecting tip of smaller diameter, accommodated by the smaller bore portion **76**. At its inner end, body **84** is provided with a groove which accommodates an O-ring **85** adapted to engage the shoulder provided at the juncture between bore portions **75** and **76**. The cylindrical main body portion of valve element **84** is provided with a second groove accommodating an O-ring **86**, adapted to establish a fluid-tight seal between the valve element and the wall of bore **75** for all operative positions of the valve element.

The outer end portion **87** of valve body **84** projects from valve block **68** and is provided with an axial, threaded bore in which is engaged a screw **88** for securing to body **84** one end of a rigid, transversely extending link **89**, the other end of link **89** is fixedly attached to the forwardly projecting end portion of shaft **59**. Accordingly, any rectilinear motion of shaft **59** in bore **58** is transmitted to valve member **84**. Thus, when trigger **62** is actuated to its rearmost position, so that the switch **21** is closed, valve body **84** is moved rearwardly in bore **75** until the inner tip portion of body **84** is withdrawn completely from bore portion **76**. This movement is effective to open the valve and establish communication between inlet opening **71** and conduit **78**, to allow fluid flow in accordance with the adjusted setting of needle valve body **80**. When trigger **62** is released, and moved to its forward position by spring **63**, valve body **84** returns to its forward position, seen in FIG. 1, with O-ring **85** engaged with the valve seat provided by the shoulder between bore portions **75** and **76**, so that no liquid can flow from opening **71** into conduit **78**.

With both valve body **84** and needle valve body **80** in open positions, fluid supplied via conduit **78** to the space within member **13** finds its way into the bore **12** of output shaft **9** and is thus supplied forwardly to the core bit or other tool element being driven.

The specific embodiment of the invention is illustrated and described herein for use in conjunction with a battery-operated "cordless" electric tool of the type which is described more fully and claimed in the copending Butler et al. application Serial No. 102,819, filed April 13, 1961, entitled, "High-Efficiency Cordless Electric Drill," and assigned to the assignee of the present invention. However, it will be appreciated that the invention herein disclosed may be used with any suitable type of power-driven tool.

Though a single, preferred embodiment of the invention has been illustrated and described, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention, as defined in the appended claims.

What is claimed is:

**1.** In a power driven tool, the combination of
a motor housing;
a motor mounted in said housing;
an output shaft driven by said motor and having passage means for the flow of a suitable fluid;
a manual operating member mounted on said housing for movement between a first and a second position;
control means mounted within said housing,
said control means including a movable actuating member and being arranged to control said motor in accordance with the position of said actuating member;
a valve body carried by said housing and having
an inlet to which a fluid supply conduit can be connected,
an outlet, and
a valve chamber between said inlet and outlet;
a movable valve member disposed in said valve chamber for movement between an open position, allowing flow of fluid from said inlet to said outlet, and a closed position, preventing such flow;
means connecting said manual operating member to said actuating member of said control means and to said movable valve member,
movement of said operating member in one direction causing said movable valve member to move to its closed position and operating said actuating

member to move to a position in which the tool is deenergized, movement of said operating member in the other direction causing said movable valve member to move to its open position, allowing fluid flow, and operating said actuating member to a second position, in which the tool is energized; and

conduit means interconnecting said outlet of said valve body and the passage means of said output shaft.

2. A tool according to claim 1, wherein

said housing has a first and a second opening,

said manual operating member is located outside of said housing and said actuating member extends through said first opening; and

said valve body is located outside of said housing adjacent said second opening, the interconnection of said outlet and said passage means by said conduit means being via said second opening.

3. A tool according to claim 2, wherein

said means connecting said operating member to said actuating member and to said movable valve member comprises

means defining a bore from which said first opening projects laterally,

a shaft member connected to said manual operating member and slidably disposed in said bore, said actuating member projecting into said bore and operatively engaging said shaft member,

means establishing fluid-tight seals between said shaft member and the wall of said bore at two spaced points each on a different side of said first opening, and

means connecting said shaft member to said movable valve member.

4. A power tool in accordance with claim 3 and wherein

said valve chamber comprises a second bore extending parallel to said first-mentioned bore, said bores extending in the direction of movement of said manual operating member.

5. In a power driven tool, the combination of

a motor housing;

a handle projecting from said housing;

a motor mounted in said housing;

an output shaft driven by said motor and having passage means for the flow of a fluid;

control means mounted in said housing and connected to control said motor,

said control means being located adjacent said handle and including an actuating member,

said housing having an opening through which said actuating member projects;

means carried by said housing adjacent said handle and defining a bore extending parallel to said output shaft,

said opening communicating with said bore;

a trigger member mounted on said housing for movement generally axially of said bore between a first position and a second position;

a shaft member connected to said trigger member and slidably disposed in said bore,

said actuating member being connected to said shaft member for movement thereby;

valve means carried by said housing at a point spaced from said trigger member generally axially of said bore, said valve means comprising

an inlet to which a fluid supply conduit can be connected,

an outlet, and

a reciprocating valve member arranged for movement in a direction parallel to said bore for controlling fluid flow between said inlet and outlet, said valve member being coupled to said shaft member for movement therewith when said trigger member is operated; and

conduit means connecting said outlet to said passage means.

6. In a power driven tool, the combination of

a housing;

a motor mounted in said housing;

an output shaft driven by said motor and having passage means for fluid flow;

means carried by said housing and defining two parallel bore portions,

one of said bore portions constituting a valve chamber,

the other of said bore portions having a lateral opening communicating with the interior of said housing;

a reciprocatable unit including a valve member slidably disposed in said one bore portion and a shaft portion slidably disposed in said other bore portion;

a manual operating member movably mounted on said housing and connected to said reciprocatable unit to reciprocate the same;

control means mounted in said housing and connected to control said motor, said control means comprising an actuating member projecting through said lateral opening and operatively engaged with said shaft portion; and

conduiting connected to the passage means of said output shaft to supply fluid thereto under control of said valve member.

7. In a power driven tool, the combination of

a housing having a front end portion, a rear end portion, and a generally dependent handle located at said rear end portion;

a motor mounted in said housing;

output shaft driven by said motor and projecting forwardly from said front end portion of said housing, said output shaft having passage means for the flow of a fluid;

a trigger disposed below said housing and in front of said handle, said trigger being mounted on said housing for movement in a direction generally lengthwise of said housing;

control means within said housing for controlling said motor,

said housing having an opening located in front of said trigger,

said control means including an operating element projecting through said opening;

a movable member mounted on said housing in front of said trigger for rectilinear movement in a direction generally lengthwise of said housing,

said movable member being connected to said trigger for movement therewith,

said operating element being connected to said movable member to be moved thereby to operate said control means when said trigger is operated;

a valve body carried by said housing and located forwardly of said movable member, said valve body having

an inlet to which a fluid supply conduit can be connected,

an outlet,

a valve chamber opening rearwardly toward said handle, and

duct means interconnecting said inlet and outlet via said valve chamber;

fluid flow confining means interconnecting said outlet and the passage means of said output shaft for supply of fluid to said passage means; and

a movable valve element disposed in said valve chamber for reciprocatory movement generally lengthwise of said housing to provide on-off control of the flow of fluid from said inlet to said outlet,

said movable valve element being connected to

said movable member for conjoint movement therewith as said trigger is operated.

8. A power tool in accordance with claim 7 and wherein

said valve body includes a second valve chamber interposed between said inlet and said outlet,

the tool further comprising

a second, manually adjustable valve element disposed in said second valve chamber for controlling the volume of flow of fluid from said inlet to said outlet.

9. A power tool in accordance with claim 7 and wherein

said movable member is a shaft member,

the tool further comprising

a housing portion including said opening and having a bore in which said shaft member is slidably disposed, and

two annular seal members carried by said shaft member and slidably engaging the wall of said bore to seal between said shaft member and the wall of said bore, said seal members being disposed each on a different side of said opening when said shaft member is in any of its operative positions.



10. A power tool in accordance with claim 7 and wherein

said movable member is a shaft member,

the tool further comprising

a housing portion including said opening and having a bore in which said shaft member is slidably disposed,

said trigger including a portion projecting forwardly into said bore and connected to said shaft member.

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