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POWER TOOL

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FIG. 1

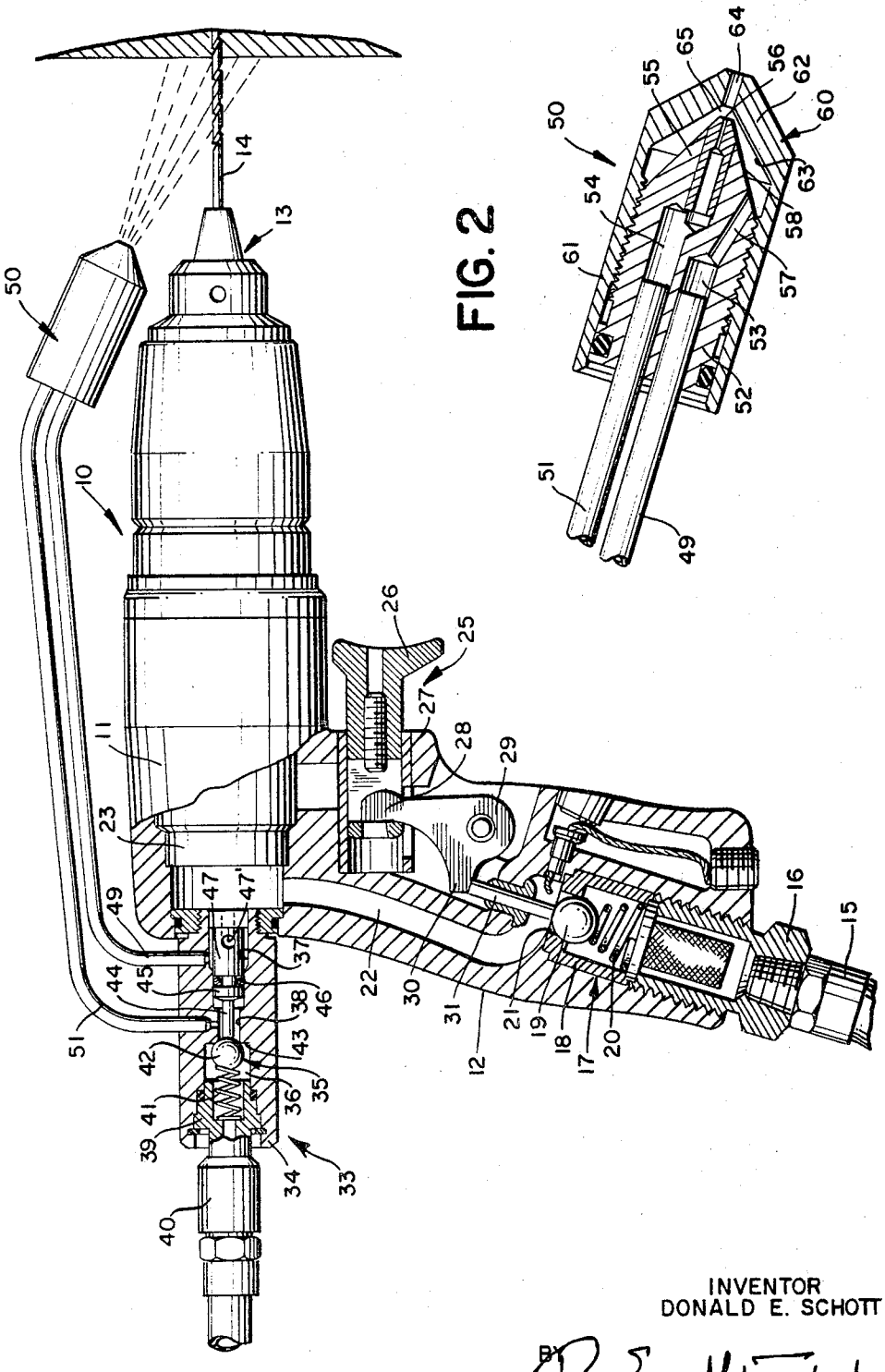


FIG. 2

INVENTOR
DONALD E. SCHOTT

By Pennie, Edmonds, Morton, Taylor & Adams

ATTORNEYS

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POWER TOOL

Donald E. Schott, Emerson, N.J., assignor to Thomas C. Wilson Inc., a corporation of New York

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ABSTRACT OF THE DISCLOSURE

This disclosure relates to an improvement in power tools used for the performance of cutting actions in that it includes means in the power tool for spraying fluid or atomized fluid to the cutting area during the cutting action and to a nozzle assembly constructed to adjust the amount of fluid dispensed from the nozzle.

In the use of power tools, such as saws or drills performing a cutting or drilling action where precision tolerances, smooth working surfaces and increased tool life are desired, the practice is to spray a cooling and lubricating fluid on the cutting surface continuously during the cutting operations. Depending upon the type of cutting being performed, it is desirable to spray the fluid as either a solid stream or as an atomized spray. It is the purpose of the invention to provide means in a power tool for effecting this spraying action during the normal operation of the tool.

Broadly stated, the invention is in a power tool for use in performing cutting actions which has means for cutting and a body member supporting the cutting means. The improvement in the combination is in fluid spray means which includes a first valve means for receiving air under pressure and fluid from respective sources and a nozzle assembly positioned adjacent the cutting means for spraying fluid in the cutting area and interconnected with said first valve means for receiving air and fluid from the first valve means. A second valve means is included in the nozzle for regulating flow of fluid and air so that fluid or atomized fluid can be sprayed from the nozzle. The fluid spray means is particularly adaptable for use with air powered tools since the air source is then readily available.

The nozzle assembly preferably has a nozzle body which includes an outlet through which fluid is dispensed, fluid inlet means entering the nozzle body and connected to the body outlet, and air inlet means entering the assembly adjacent the body outlet. A nozzle cap having a cap outlet is mounted on the nozzle body and is movable with respect to the body to a first position wherein the body and cap outlets are directly connected and prevent air flow through the cap outlet, and to a second position where the outlets of the body and cap are spaced from each other and open to the air to atomize the fluid as it flows from the cap outlet.

A preferred embodiment of the invention is described hereinbelow with reference to the drawing wherein:

FIG. 1 is a side elevation partly in section of an air powered drill incorporating the fluid spray device; and

FIG. 2 is an enlarged section of the nozzle assembly of the fluid spray device.

An air power drill **10** is shown having a motor housing assembly **11**, and integral handle assembly **12**, and a chuck **13** extending from the housing assembly and holding a drill bit **14**.

In this embodiment, the drill is air driven and therefore an air hose **15** is threaded into the base of the handle assembly **12** and attached thereby to a suitable thread connector **16**. The thread connector **16** opens into a ball valve assembly **17**. The ball valve assembly **17** is comprised of a valve seat insert **18** which contains a ball **19** and a spring **20** which biases the ball toward the outlet opening in the valve seat and thereby normally maintains the opening in the valve seat closed. An air inlet channel **22** extends from the valve seat opening **21** to the air powered motor **23** in the motor housing assembly.

Extending from the handle assembly **12** in the normal position is a trigger assembly **25** which in this embodiment comprises a trigger **26** slidable in a trigger insert **27**. Extending into the trigger insert **27** is a first portion **28** of a bell crank **29** which is pivotally mounted so that a second portion **30** of the bell crank contacts a valve pin **31** which is mounted for abutment against the ball **19** in the ball valve assembly. By this arrangement, when the trigger **26** is squeezed it displaces the bell crank and valve pin and opens the ball valve assembly for air flow to drive the motor.

Mounted on the back end of the motor housing assembly **11** is a first air and fluid valve assembly **33**. This assembly is comprised of a generally tubular valve body **34** which has a stepped diameter bore **35** extending axially through the valve body. The bore **35**, by the change in diameter, is divided essentially into a fluid chamber **36** at one end of the body and an air chamber **37** at the opposite end of the body which is joined by an intermediate linking chamber **38** positioned therebetween. The valve body is connected adjacent its air chamber to the rear end of the motor housing **11** and is open to the air inlet chamber **22**. Connected to the fluid chamber **36** at the opposite end of the valve body by means of a swivel connector **39** is a hose **40** carrying fluid from its source.

Positioned in the fluid chamber **36** and seating on the swivel connector **39** is a spring **41** and a ball **42** which provides ball valve assembly with the ball seating against a shoulder portion **43** defined by the reduction in diameter from the fluid chamber to the intermediate chamber **38**. Abutting the ball **42** and extending axially through the intermediate chamber **38** is a piston rod **44** which has an integral piston **45** slidable in the air chamber **37** and positioned at the end thereof opposite to the end contacting the ball **42**. The piston **45** has a suitable seal **46** mounted on the side thereof opposite to the extension of the piston rod **44** and a stepped diameter cylindrical tubular member **47** extends axially toward the motor housing and has a bore **47'** extending axially into the member **47** from the channel **22** and opens radially outwardly of this member. The air chamber **37** is defined by an enlarged diameter portion adjacent the open end and opening into this enlarged portion is an air outlet tube **49** which extends through the wall of the valve body and forward of the motor housing to connect to a nozzle assembly **50** adjacent the chuck **13**. Opening into the intermediate chamber **38** is a fluid tube **51** which also extends outwardly through the valve body to the nozzle assembly **50**.

The nozzle assembly **50** is comprised of a nozzle body **52** which has an axially extending air chamber **53** and axially extending fluid chamber **54** into which the ends of the air and fluid tubes **49** and **51** extend and are secured to the nozzle body. The nozzle body has a generally conically shaped forward portion **55** with a reduced aperture **56** extending from the apex of the conical end portion. The aperture **56** is connected to the fluid chamber **54** and serves as the outlet for the fluid. The second larger aperture **57** opens out of the conical wall **58** of the nozzle body and it serves as the outlet for the air from the air chamber **53**. Threaded to the nozzle body is a nozzle cap **60**. The nozzle cap has a generally cylindrical portion **61** and a forward conically shaped portion **62** with the angle of the conical portion of the nozzle body relative to the axis of the assembly being less than the angle of the inner

wall **63** of the conical portion **62** of the nozzle cap relative to the axis of the assembly. Extending substantially axially through the apex of the conical portion **62** of the nozzle cap is an outlet **64** which is coaxially aligned with the aperture **56** in the nozzle body. Thus, by the relative configuration of the nozzle assembly, a second fluid and air valve assembly is provided.

In operation, squeezing of the trigger **26** will activate the ball valve assembly **17** causing air under pressure of about 90 pounds p.s.i. to enter into the motor housing and drive the air powered motor causing the drill to be activated. The first air and fluid valve assembly **33** is simultaneously activated by the air entering the air chamber **37** and causing the piston **45** to be axially displaced rearwardly toward the fluid chamber **35**. While some air forces the piston rearwardly, other air is allowed to travel through the air tube **49** and to the nozzle **50**. Upon displacement of the piston **45** rearwardly, the piston rod unseats the ball **42** from its valve seat **43** and allows a lubricating and cooling fluid to pass into the intermediate chamber **38** and outwardly through fluid tube **51** to the nozzle **50**.

Referring now to FIG. 2, when the forward end of the nozzle **55** is spaced from the nozzle cap **62**, air can flow through chamber **53** and out the air outlet **57** for mixture with fluid flowing through the fluid chamber **54** and out the fluid outlet **56**. The space defined between the inner wall **63** of the nozzle cap and the forward end of the conically shaped nozzle body will then function as a mixing chamber **65** and the fluid passing through the nozzle cap outlet **64** will be entrained in the air and be sprayed from the cap as atomized fluid.

If the nozzle cap **60** is threaded back on the nozzle body **52** so that forward end of the nozzle body is in contact with the inner wall **63** of the nozzle cap, no air will flow through the outlet **64** in the nozzle cap and a solid stream of fluid will be sprayed from the nozzle **50**. Since there is a differential between the pressure of the fluid and the pressure of the air, as the nozzle cap is moved forward on the nozzle **55** so that the nozzle **55** is only slightly backed away from the inner wall **63** of the nozzle cap, the air pressure flowing out the nozzle cap outlet actually reduces the resistance to fluid flow from the nozzle or creates a partial vacuum which causes maximum fluid to be dispensed from the nozzle and entrained in the air as atomized fluid. Further movement of the nozzle cap away from the nozzle **55** so that the inner wall **63** of the nozzle cap is substantially spaced from the nozzle outlet **56** begins to cause a back pressure at the fluid outlet **56** of the nozzle which impairs fluid flow from the nozzle, thereby reducing the amount of fluid entrained in the air to permit more economical use of the fluid when less volume is required.

When the trigger is released and the tool stopped, the air flow also ceases and the first valve assembly closes and prevents any fluid passage or air passage to the nozzle **50** thereby permitting the most economic use of the fluid.

I claim:

1. In a power tool for use in performing cutting actions having means for cutting and a body member supporting said cutting means, the improvement in fluid spray means in combination therewith comprising first valve means for receiving air under pressure and fluid from respective sources, a nozzle assembly interconnected with the first valve means for receiving air and fluid from the first valve means, said nozzle assembly positioned adjacent the cutting means for spraying fluid in the cutting area, and a second valve means in the nozzle for regulating flow of fluid and air so that fluid or atomized fluid can be sprayed from the nozzle.

2. A tool according to claim **1** wherein it is air powered.

3. A tool according to claim **1** wherein said nozzle assembly comprises a nozzle body having an outlet through which fluid is dispensed, fluid inlet means entering the body and connected to the body outlet, air inlet means entering into the assembly adjacent the body outlet, a nozzle cap having an outlet and mounted on said nozzle body, the cap movable with respect to said body to a first position wherein the body and cap outlets are directly connected and prevent air flow through the cap outlet and a second position where the outlets of the body and the cap are spaced from each other and open to the air to atomize the fluid as it flows from the cap orifice.

4. A tool according to claim **3** wherein the outside of said nozzle body tapers toward said body outlet and the inside of said cap tapers toward the cap outlet with the angle of the tapered portion of the body relative to the axis of the assembly being less than the angle of the tapered portion of the cap relative to the axis of the assembly and thereby defining a chamber between the inside of the cap and the outside of the nozzle into which the air inlet opens.

5. A tool according to claim **4** wherein the air inlet extends through the body member and opens into the chamber.

6. A tool according to claim **1** wherein said first valve comprises a valve body, a first air chamber in said body having an inlet from an air source and an outlet to the nozzle assembly, a second fluid chamber in said body having an inlet from a fluid source and an outlet to the nozzle assembly, and a valve movable in said fluid chamber to open and close the fluid outlet in response to air flow in the air chamber.

7. A tool according to claim **6** wherein said valve in said fluid chamber is movable by a piston member located in said air chamber, said piston being responsive to changes in air pressure in said first chamber and to open and close the valve upon respective increase and decrease in air pressure.

8. A power tool according to claim **3** wherein said first valve comprises a valve body, a first air chamber in said body having an inlet from an air source and an outlet to the nozzle assembly, a second fluid chamber in said body having an inlet from a fluid source and an outlet to the nozzle assembly, and a valve movable in said fluid chamber to open and close the fluid outlet in response to air flow in the air chamber.

9. A tool according to claim **7** wherein said tool is air powered, and actuating the power tool opens the valve to permit fluid flow through the nozzle.

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FRANCIS S. HUSAR, *Primary Examiner.*