

Jan. 15, 1929.

1,698,970

E. H. SHAFF
PORTABLE TOOL

Filed Oct. 1, 1924

2 Sheets-Sheet 1

Fig. 1.

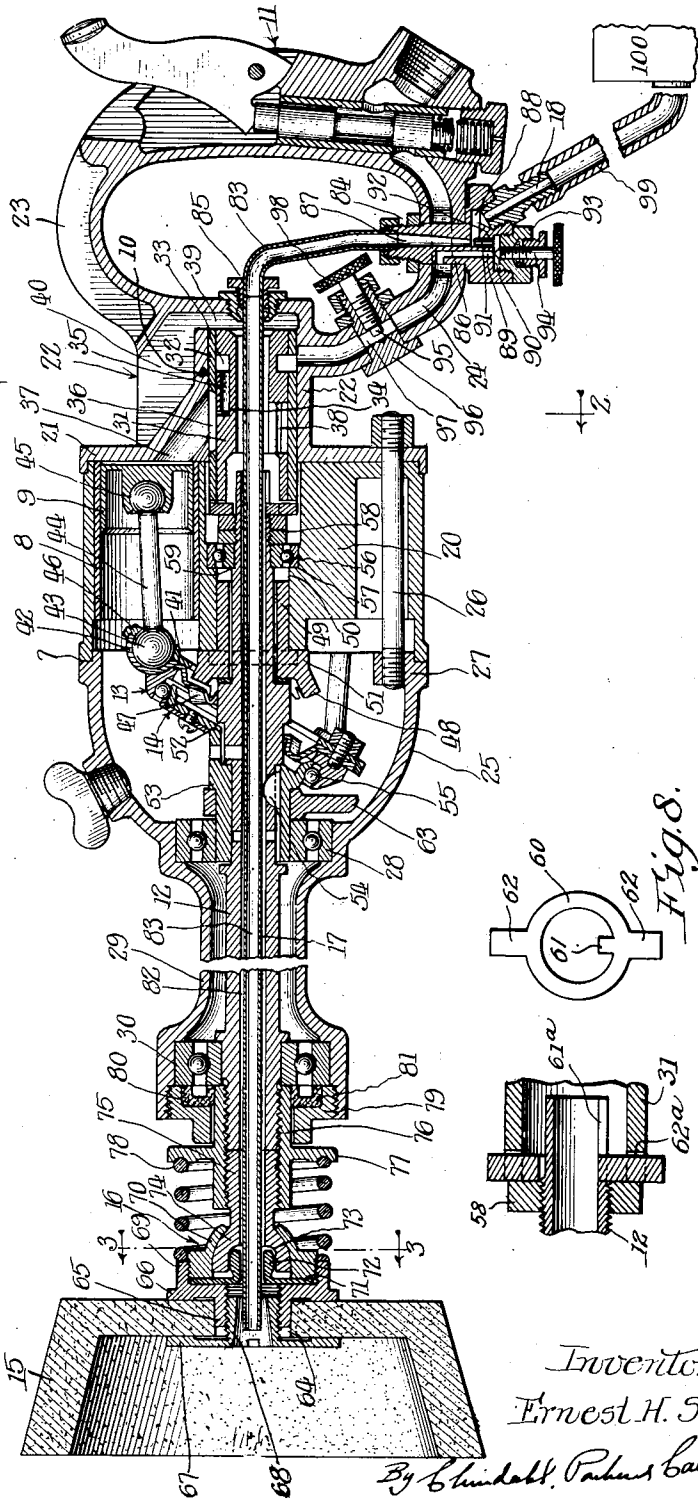
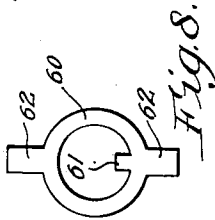


Fig. 8.

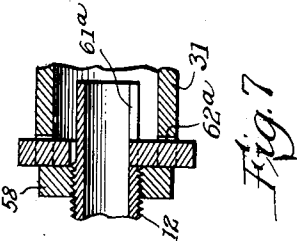


Fig. 7.

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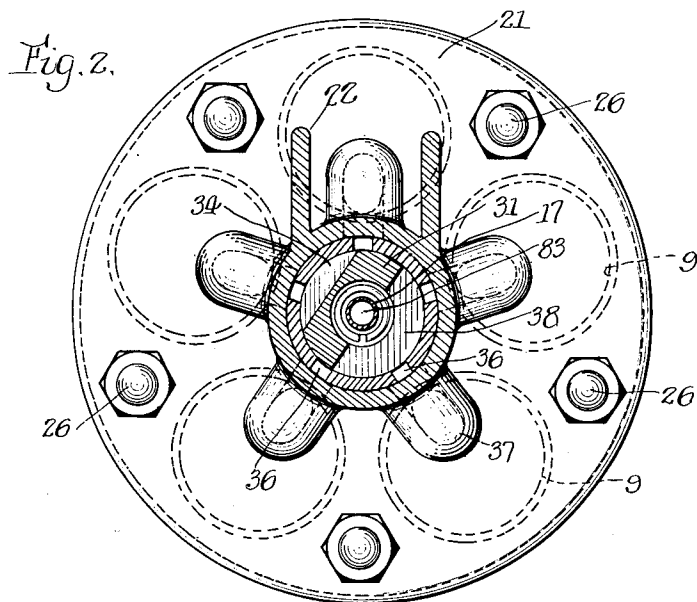
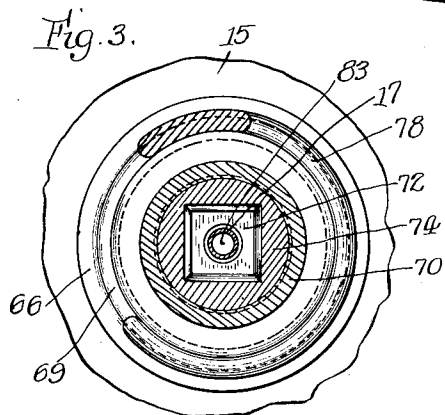
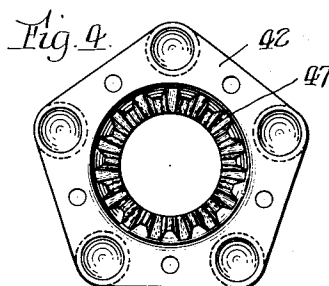
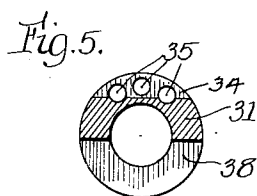
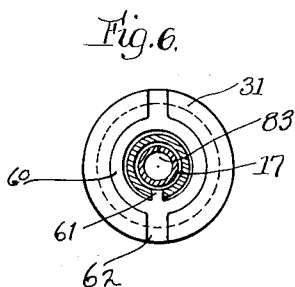
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PORTABLE TOOL

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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PORTABLE TOOL.

Application filed October 1, 1924. Serial No. 741,091.

The invention relates generally to portable tools and more especially to tools for performing grinding, scrubbing, polishing, rubbing and allied operations.

5 While the invention is capable of general application, my improved tool is particularly adapted for use where a liquid such as water is used in connection with the grinding or other operation, as in the case of
10 facing concrete structures. In the instance noted, the use of forms during the building of the concrete structure renders it impossible to produce smooth outer faces, and the common practice is to rub the surfaces after
15 the forms have been removed to reduce the ridges, left by the forms, and other roughness, to produce a smooth surface. In performing this operation it is customary to employ grinding stones which are applied
20 manually, and water is supplied to the surface being ground so that the grinding operation produces a thin cement-like paste which is forced into the pores and leaves a smooth finished surface. This operation,
25 as performed by hand labor, is exceedingly laborious, and hence is very costly, but where the surface of the concrete is to be exposed, as in the case of bridge piers, it is essential for the sake of appearance that the operation
30 be performed.

The primary object of my invention, therefore, is to produce a portable tool which is capable of effectually performing the above and allied operations by the application of motive power, with a resulting elimination of the laborious character of the operation and a great saving in the time consumed and hence in the cost of the operation.

In attaining this object, I have produced
40 a tool of which a special feature is the delivery of water to the grinding wheel, brush or other device, which discharges into or through such working tool so as to be effectually applied to the working surface.
45 Preferably also the motor is of the pressure fluid actuated type and the motive fluid is utilized to actuate an injector which entrains the water and supplies it in the desired volume to the working surface.

50 Another feature of special importance in my device is the provision of a flexible connection between the working tool and the drive shaft or spindle, which greatly facilitates the operation by enabling the operator

readily to hold the tool flat upon the surface 55 being ground.

In the operation of tools of this character, it is found that a high speed is undesirable. Another feature of my invention, therefore, is the provision of adjustable means for
60 limiting the speed of operation.

A general object of the invention is to produce a tool of a thoroughly practical character, of comparatively light weight, and yet having ample power to operate the
65 working tool.

In the accompanying drawings I have illustrated a preferred form of my invention, but it is contemplated that it may be readily be embraced in other structures by those
70 skilled in the art without departing from the spirit and scope of my invention as expressed in the appended claims.

Figure 1 of the drawings is a fragmentary vertical sectional view through a grinder of
75 preferred form.

Fig. 2 is a transverse sectional view taken approximately in the plane of line 2-2 of Fig. 1.

Fig. 3 is a transverse sectional view taken 80 in the plane of line 3-3 of Fig. 1.

Fig. 4 is a detail view of the bearing plate of one of the pressure elements.

Fig. 5 is a transverse sectional view through the main valve member. 85

Fig. 6 is a transverse sectional view illustrating the connection between the valve member and its operating shaft.

Fig. 7 is an enlarged view of a portion of Fig. 1 showing the key connection between, the valve and shaft. 90

Fig. 8 is a view of the key employed in Fig. 7.

For convenience I have hereinafter described my invention as applied to the grinding of concrete surfaces, but as above indicated, it is not to be understood that the invention is thus limited.

The tool in its preferred form comprises generally a motor of the pressure-fluid-actuated type comprising a casing 7 enclosing a plurality of motor units arranged in circular series and each comprising a cylinder 8 and a piston 9. Five such units are herein shown. 100

Motive fluid is supplied to the cylinders 8 under the control of an automatic valve mechanism 10 and a manually operable 105

valve device 11, the valve mechanism 10 being adapted to permit admission of motive fluid to the several cylinders in succession and also to permit of the exhaust of the fluid in a similar order.

Power is delivered by the several units of the motor to a shaft 12 through the medium of relatively slidable pressure elements 13 and 14 which are inclined relative to the axis of the motor and of the shaft 12 so that in the operation of the motor, the pressure elements operate with a wobbling motion.

The working tool is in the present instance in the form of a hollow grinding wheel 15 frusto-conical in form, which wheel is driven from the shaft 12 through the medium of a flexible connection generally designated by the numeral 16. The arrangement is such that a water supply tube 17 may be provided axially of the motor, through the shaft, which tube communicates at its rear end with a source of supply at 18. In the present instance a jet of motive fluid discharged by an injector into said supply pipe at the source of supply of the water to entrain the latter and effect its delivery in the proper volume. Any other suitable method of causing the water to flow may, of course, be employed.

The motor which I by preference employ is similar in all substantial respects to that illustrated and described in an application of Albert Shinkez, Serial No. 513,244 filed November 7, 1921; and the particular valve mechanism which I employ is fully illustrated and described in my copending application Serial No. 743,205 filed October 13, 1924.

The rear end of the casing 7 is in the form of a cylindrical block 20 bored longitudinally to receive bushings constituting the cylinders 8. The rear end of the casing is closed by a plate or head 21 which constitutes the rear wall of each of the cylinders. Rigid with the head 21 is a housing 22 enclosing the valve mechanism 10, and said housing in turn has formed integral therewith a handle 23 providing at its lower portion a passage 24 connected at its rear end with a source of motive fluid supply and controlled by the manually operable valve 11 which may be of any suitable or well known character. Forwardly of the block 20 is a bell-shaped casing section 25 secured to the block by means of bolts 26 passing through the block and anchored in lugs 27 at the mouth of the casing 25. This casing section 25 encloses the operative connection between the motor units and the spindle 12. The latter is mounted at its rear end in the forward end of the casing section 25 through the medium of ball bearings 28, and at the forward end of a tubular extension 29 of the casing section 25, through the medium of a ball bearing 30.

The valve mechanism 10 comprises a rotary valve member 31 rotatably mounted in a casing 32 which latter is enclosed in the housing 22 rigid with the head 21. At the rear end of the valve member 31 is an annular chamber 33 communicating at all times with the passage 24, and leading forwardly from said chamber 33 and communicating with a transverse slot 34 is a plurality of ducts 35. The slot 34 is adapted to communicate successively with a plurality of ports 36 in the casing 32, one for each of the cylinders and connected to the cylinders by means of outwardly and forwardly inclined passages 37. The ports 36 are of relatively large capacity as are also the passages 37, while the slot 34 is formed by a saw-cut and constitutes a restricted passage connecting the ducts 35 and chamber 33 with the ports 36. The valve member also has a transverse slot 38 of substantial width which in the rotation of the valve member communicates respectively with the ports 36. Said slot 38 communicates with the interior of the valve member which is tubular in form and at its rear end discharges into an exhaust passage 39 leading to an exhaust chamber 40 opening to the atmosphere at the upper side of the housing 22. The valve member is rotated in the operation of the grinder in a manner which will hereinafter appear.

The motive fluid thus supplied successfully to the motor units effects the reciprocatory motion of the pistons 9, which motion is transmitted to the shaft 12 as above set forth through the medium of the pressure elements 13 and 14. The element 13 is in the form of a ring having on its forward side a bearing plate 41 shaped to provide sockets 42 to receive balls 43 on the forward ends of piston rods 44 which are connected at their rear ends by ball and socket joints 45 with the pistons. A retaining ring 46 is secured on the forward face of the plate 41 to maintain the balls 43 in their sockets. Centrally of the plate 41 is formed a bevel gear element 47 meshing with a stationary gear element 48 mounted coaxially of the casing, said intermeshing gears thus constitute in effect a universal joint holding the pressure element 13 against rotation but permitting a wobbling motion thereof as it receives the successive impulses of the several motor units. The gear element 48 has a rearward extension 49 which enters a central bore 50 in the cylinder block 20. The rear side of the gear element 48 is provided with diametrically opposite clutch teeth 51 entering grooves in the forward end of the cylinder block so as to hold this element against rotation.

The other pressure element 14 is in the form of an inclined plate 52 having a rigid tubular extension 53 mounted at its forward

end in the ball bearing 28. The shaft 12 fits snugly within the tubular extension 53 and is keyed thereto as indicated at 54 so that rotary movement imparted to the element 14 is transmitted to the spindle or shaft 12.

Between the two pressure elements 13 and 14 are interposed bearing balls 55. These transmit the pressure from the element 13 to the element 14 converting the wobbling motion of the former to rotary motion in the latter.

The shaft 12 extends rearwardly through the pressure elements 13 and 14, and through the gear element 48 and its tubular extension 49 for connection with the valve member 31 to rotate it. The rear end of the shaft 12 is mounted in the cylinder block through the medium of a ball bearing 56 which is held against a shoulder 57 formed in the cylinder block by means of a pair of nuts 58 on the shaft near its rear end. The inner race-ring of the bearing 56 engages a shoulder 59 on the shaft. By this construction the parts are held in assembled relation. The rear end of the shaft is connected to the valve member through the medium of an annular key member 60 (Fig. 8) having an in-turned finger 61 engaging in a slot 61^a (Fig. 7) in the shaft and a pair of out-turned fingers 62 engaging in grooves or notches 62^a in the forward end of the valve member. This connection permits of the easy detachment of the valve member upon a removal of the head 21.

63 is a counterweight mounted on the tubular extension 53 of the plate 52.

The grinding wheel 15 herein shown is frusto-conical in shape and has a central hole 64 therethrough to receive a tubular extension 65 on a plate 66 bearing against the rear face of the wheel. A plate 67 adapted to bear against the forward face of the wheel has a rearward extension 68 screw-threaded into the member 65. The plate 66 has a rearwardly extending flange 69 to which is screw-threaded a member 70 which serves rigidly to clamp between it and the plate 66 a plate 71 having a rearwardly extending head 72. Said head is rectangular in form and fits within a similarly shaped socket 73 in a semi-cylindrical member 74 fitting within the member 70. It will be seen that the members 70 and 74 constitute in effect a socket and ball, and that the ball is connected to the plate 71 through the medium of a universal joint formed by the rectangular head 72 operating in the socket 73. The head 72 for this purpose is rounded so as to be capable of turning in the ball member 74 on intersecting axes. The ball member 74 has a rearward extension 75 which is screw-threaded into a tubular member 76, and the latter in turn is screw-threaded on the forward end of the shaft 12. The tubular mem-

ber 76 carries a radially extending flange 77 between which and the flange 69 of the plate 66 is interposed a coiled expansion spring 78. This spring normally holds the grinding wheel in coaxial relation to the shaft 12 and also serves yieldably to hold the ball member 74 in the socket member 70 while permitting the plate 66 and hence the wheel 15 to flex relative to the shaft 12. Encircling the tubular member 76 and screw-threaded into the forward end of the extension 29 of the casing 25 is a member 79 providing an annular groove 80 in which is enclosed a packing 81 to prevent escape of lubricant from the casing.

It will be seen that the shaft 12 is made tubular in form as are also the axially aligned parts associated therewith, to provide a continuous passage 82 extending through the length of the grinder. In this passage I provide a pipe 83 discharging at its forward end into the interior of the wheel 15 and communicating at its rear end with a source of water supply. I have herein shown the pipe formed in two sections, one extending throughout the length of the shaft and valve, and the other bent downwardly for connection with an injector 84 which is in turn adapted to be connected with the motive fluid supply and also a source of water supply. The rear or bent pipe section is shown as connected to the longitudinal or main section as indicated at 85 to provide a water-tight joint in a well known manner.

The injector 84 comprises a tubular stem 86 mounted in the lower portion of the handle 23 and interposed in the air passage 24 but without cutting off this passage from the source of supply. Said stem has a central upwardly tapering passage 87 communicating at its larger or upper end with the pipe 83 and at its lower end with a chamber 88 to which water is supplied from the source of supply by a nipple 18. The stem 86 also has a duct 89 communicating at one end with the air passage 24 and at its other end with a chamber 90 from which leads a restricted port or jet orifice 91 in a plug 92. Said jet orifice discharges motive fluid at high velocity into the lower restricted end of the passage 87 and thus induces a flow of water to the passage 83. The lower end of the injector 84 is provided with a nut 93 in which is mounted a needle valve 94 adapted to control the flow of air from the passage 89 to the jet orifice 91.

For limiting the speed of operation of the grinder I provide a needle valve 95 mounted in a suitable fitting 96 interposed in the passage 24 leading to the valve mechanism. Said fitting has a port 97 therethrough which is controlled by the needle valve 95, the latter being operable by means of a knurled screw 98.

Assuming that the tool is used for surfac-

ing a concrete wall, the operation is as follows: As soon as the forms have been removed from the wall and while the concrete is still green, the grinder is set in operation by the operation of the valve 11, and wheel 15 applied with pressure to the face of the wall. The maximum speed of operation is determined by the position of the needle valve 95 in the supply passage 24 leading to the valve mechanism, the speed being relatively low for this class of work. The fitting 18 is connected as by means of a flexible connection 99 with a container 100 filled with water or other suitable liquid and this liquid is drawn upwardly into the end through the pipe 83 by the action of motive fluid admitted to the pipe from the passage 24 through duct 89, chamber 90 and jet 91. It will be observed that inasmuch as the liquid is discharged into the interior of the hollow wheel 15 it is distributed by the action of centrifugal force over the entire working surface, effectually moistening it. If the liquid is applied to the surface from the outside of the wheel, much of it runs off and is wasted, and it is very difficult to maintain on the surface a sufficient amount of moisture. If there is a lack of moisture, the grinding operation results in the production of a gummy substance which adheres to the face of the wheel, rendering it ineffectual. On the other hand, with an ample supply of moisture the particles of the concrete removed from the surface of the wall form a cement-like paste which is ground into the pores of the concrete with the result that a smooth and finished surface is produced. A further advantage is that by my method all of the liquid is utilized with the result that a smaller volume is required.

By reason of the flexible connection between the grinding wheel and the shaft, the wheel readily conforms to any depressions and elevations in the surface being ground. At the same time the spring acts to distribute the pressure of the wheel against the wall evenly or uniformly throughout its periphery.

I claim as my invention:

1. A portable tool comprising, in combination, a rotary spindle carrying a hollow grinding wheel at one end and having a passageway therethrough opening into said hollow grinding wheel, a pressure fluid actuated motor comprising a plurality of motor units offset with respect to the spindle and each operatively associated with the spindle to drive it, valve mechanism for controlling the flow of pressure fluid to said motor units, means providing a duct supplying pressure fluid to said valve mechanism, and means communicating with a source of liquid and associated with said pressure fluid duct whereby liquid is drawn from the source of

supply and discharged through said passage in the spindle by the action of pressure fluid supplied from said duct.

2. A portable tool having, in combination, a fluid motor with a spindle extending axially therethrough and having a valve mechanism coaxial with the spindle so as to be actuated thereby, said valve mechanism comprising an annular motive fluid channel, means providing a water supply passage extending through said spindle and said valve mechanism, said passage being located within the annular fluid channel and independent thereof, and means at the rear end of the tool providing a connection between said passage and a source of water supply.

3. A portable tool comprising, in combination, a rotary spindle having a hollow grinding head, a pressure fluid motor operatively connected with said spindle to drive it and including a plurality of motor units arranged in circumferentially spaced relation about the spindle, said spindle having a passageway therethrough arranged to discharge into the hollow head, an injector communicating with a source of liquid and arranged to discharge into the opposite end of said passageway, and means for supplying fluid under pressure to the motor and to said injector.

4. A portable tool comprising, in combination, a pressure fluid actuated motor for driving a working tool, means providing a passage for delivering liquid to the working surface, said motor having a handle with a passage therein for supplying motive fluid to the motor, and a fitting mounted on said handle and communicating with a source of liquid supply, said fitting being a part of said liquid supply means and having a port communicating with the motive supply passage and arranged to admit a jet of motive fluid to the liquid supply means whereby to induce the flow of liquid therethrough.

5. A portable tool having, in combination, a rotary spindle, a hollow grinding wheel on the spindle, a pressure fluid motor for driving the spindle, a handle for the tool having a passageway therethrough for pressure fluid whereby to supply pressure fluid to the motor, said spindle having a passage therethrough arranged to discharge into the hollow grinding wheel, an injector mounted upon the handle and having a discharge port connected with the opposite end of said passageway, a second port communicating with said pressure fluid passage, and valve controlled means for regulating the flow of pressure through said second port to the discharge port including a chamber connected with a source of liquid.

In testimony whereof, I have hereunto affixed my signature.

ERNEST H. SHAFF.