Sept. 2, 1924. 1,506,862

F. W. PARSONS

GOVERNOR FOR FLUID ACTUATED ROTARY TOOLS

Filed Sept. 3, 1921 3 Sheets-Sheet 1

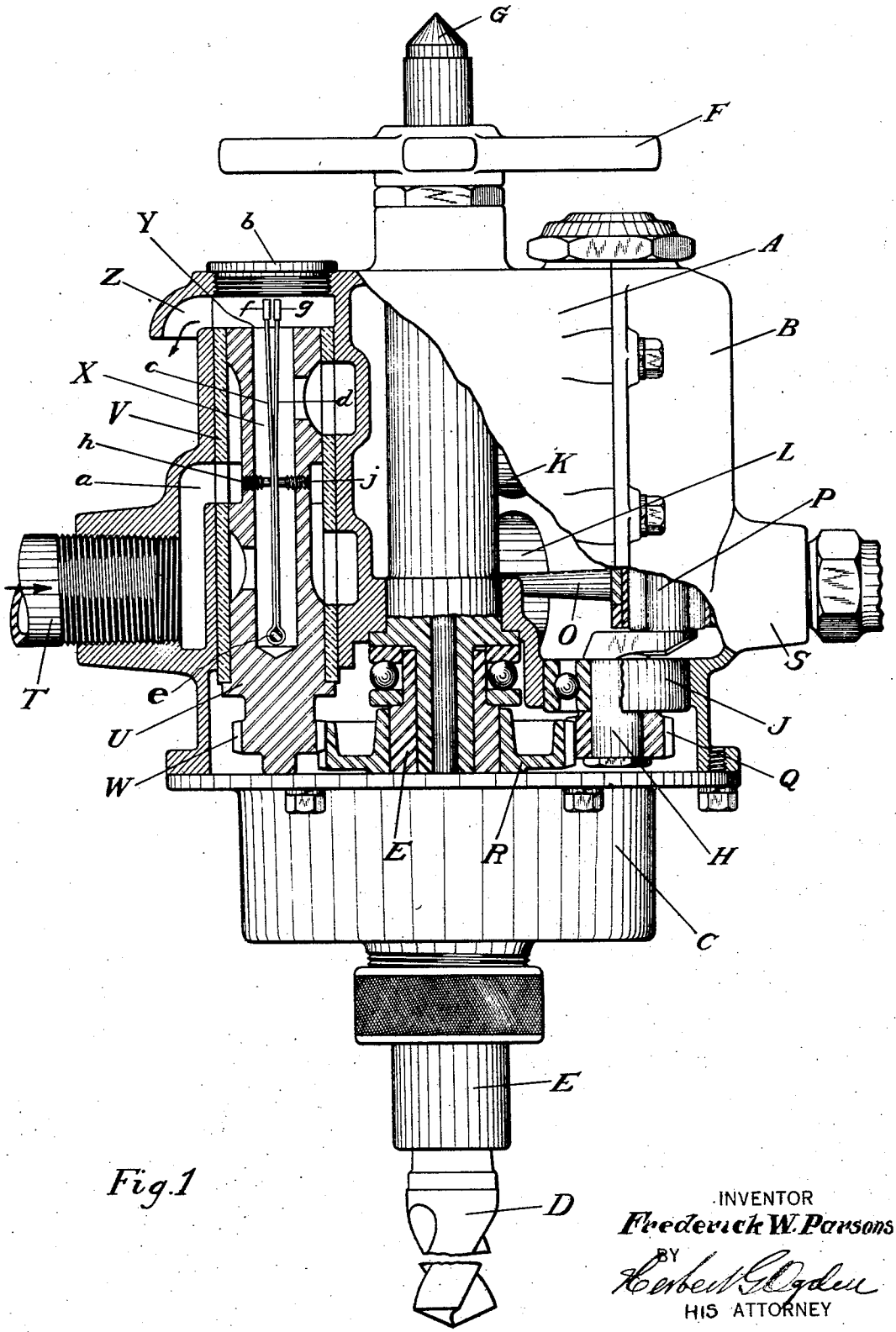


Fig. 1

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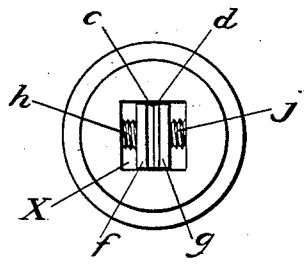


Fig. 3.

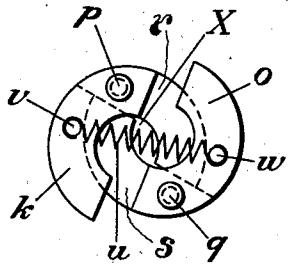


Fig. 7.

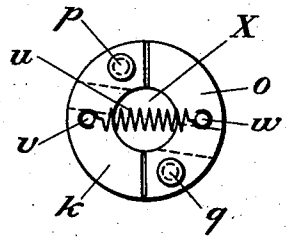


Fig. 6

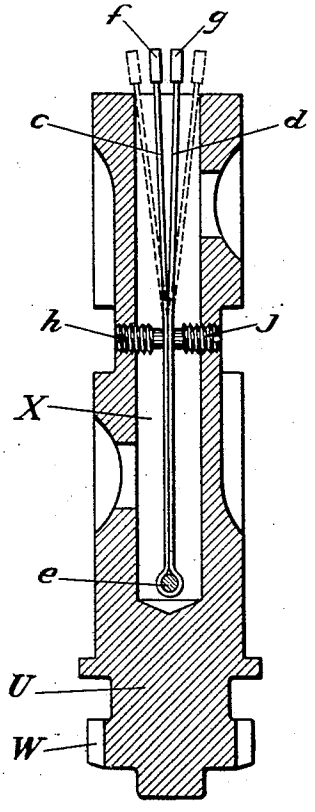


Fig. 2.

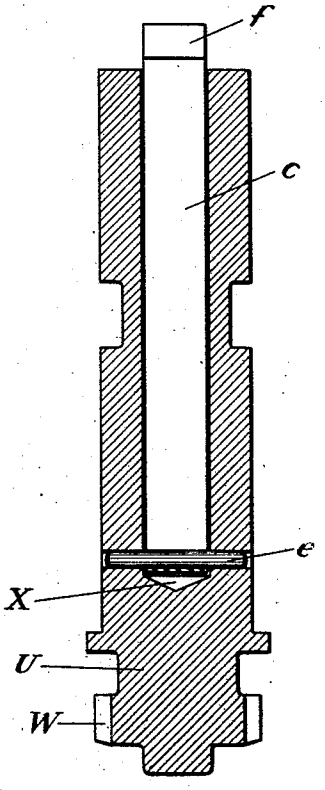


Fig. 4.

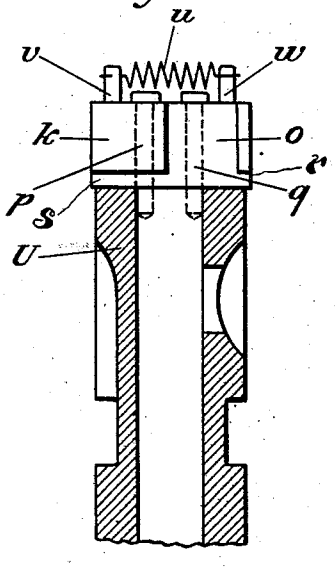


Fig. 5.

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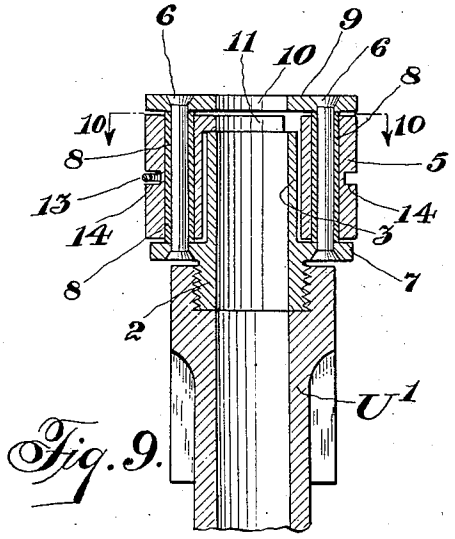


Fig. 9.

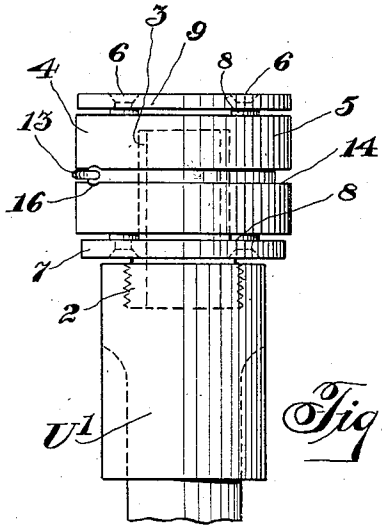


Fig. 8.

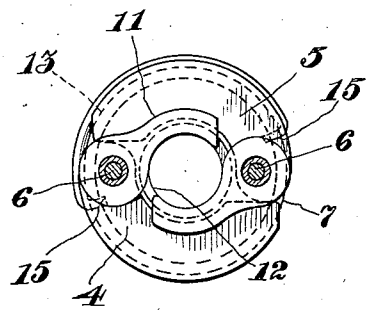


Fig. 10.

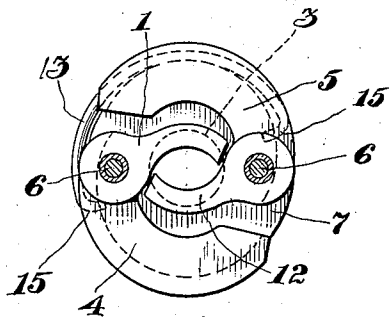


Fig. 11.

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UNITED STATES PATENT OFFICE.

FREDERICK W. PARSONS, OF ELMIRA, NEW YORK, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

GOVERNOR FOR FLUID-ACTUATED ROTARY TOOLS.

Application filed September 3, 1921. Serial No. 498,581.

To all whom it may concern:

Be it known that I, FREDERICK W. PARSONS, a citizen of the United States, and a resident of Elmira, county of Chemung, State of New York, have invented a certain Governor for Fluid-Actuated Rotary Tools, of which the following is a specification accompanied by drawings.

This invention relates to fluid actuated rotary tools, such as drills for example, of the type adapted to be driven by a fluid actuated rotary motor. A pneumatic tool of this type may be used for drilling, reaming, tapping, flue rolling, wood boring, stud setting, bolt tightening, running down screw spikes, setting valves and for various other well known uses.

In drilling or reaming for instance, as well as in other cases, excessive wear on the parts has occurred, and damage has sometimes been done to the tool, due to overspeeding and racing, when the resistance to rotation has been materially decreased or suddenly removed, as when the drill bit or reamer is lifted from the hole being drilled or reamed, with full supply of fluid pressure supplied to the tool.

Such tools are conveniently driven by compressed air, but manual control has usually been depended upon for regulating the machine and the operator may not control the air at the main throttle quickly enough to prevent over-speeding and damage to the machine or at least excessive strain on the parts which should be prevented.

The objects of the present invention are to secure simple and efficient means for automatically regulating and controlling the motive fluid at a predetermined speed of the drill spindle, preferably after maximum horse-power has been developed by the machine, so that over-speeding and racing are prevented upon substantial decrease of resistance to rotation.

Pneumatic tools of the type referred to are relatively small, compact, self-contained machines, in order that they may be portable and readily handled, and a governor for accomplishing the objects of this invention may be incorporated in the tool in various ways. In the accompanying drawings which illustrate the invention, I have shown some of the preferred ways, but the invention is not to be understood as limited to the forms of devices shown, as those skilled in the art may devise equivalent constructions for accomplishing the same purpose, without departing from the spirit of the invention as defined in the appended claims.

In the drawings, Figure 1 is a side elevation of a pneumatic drill partly in vertical section, with the cylinder casing and crank cover partly broken away, only so much of the complete machine being shown as will serve to illustrate the invention, thus simplifying the disclosure;

Figure 2 is a detail longitudinal sectional elevation of the rotary distribution and exhaust valve forming a part of the machine and having one form of centrifugal governor applied thereto for throttling the exhaust as a convenient location for the governor;

Figure 3 is an end view of the valve shown in Figure 2 looking at the exhaust end;

Figure 4 is a longitudinal sectional elevation of the valve with the section taken in a plane at right angles to Figure 2;

Figure 5 is a detail longitudinal sectional elevation of a portion of the same valve having a different form of exhaust governor.

Figure 6 is an end view of Figure 5 showing the governor weights in open position;

Figure 7 is a view similar to Figure 6 showing the governor weights in partially closed position;

Figure 8 is a side elevation of a portion of the valve having a modified form of governor somewhat similar to that shown in Figure 5 and with a different form of spring;

Figure 9 is a longitudinal sectional elevation of Figure 8,

Figure 10 is an end view of Figure 8, with the end plate removed, and

Figure 11 is a view similar to Figure 10 showing the weights in partially closed position.

Referring to the drawings, the case or cylinder casing A having the removable crank cover B and the removable gear case or front head C forms the frame of the machine enclosing and supporting the operating parts for imparting rotation to a drill bit D or other tool carried in the spindle E. The drill bit or other tool is fed forward to its work by suitable feeding devices the details of which are not shown but are adapted to be manipulated by the manual rotary handle F of any suitable form. The usual point

G is shown for engaging an abutment for resisting rearward thrust.

In this instance, and for illustrative purposes, a suitable driven shaft in the form of a crank shaft H is mounted in the ball-bearings J in the case A beneath the crank cover B and adapted to be actuated by a fluid actuated motor of any suitable type, as for instance a multicylinder motor having opposed cylinders, two of the cylinders K and L being indicated in the drawing at one side of the machine and at an angle to the axis, the remaining pair not being shown since they are in that portion of the cylinder casing which has been broken away. One of the piston connecting rods O, in this instance the connecting rod for the cylinder L, is shown suitably connected to the crank P on the crank shaft H with the inter-position of a roller bearing. So much of the driving mechanism has been shown and described in order to indicate that a form of fluid actuated motor is provided for driving the rotary crank shaft H, from which shaft suitable operative connections are provided for driving the spindle E. In this instance a pinion Q on the crank shaft H meshes with a gear R on the spindle for driving purposes, forming a reduction gearing.

The crank cover B may be provided with a suitable handle S shown broken away, and another opposite handle T also shown broken away, on the case A conveniently forms the supply inlet for motive fluid to drive the motor. In the present instance, means for automatically distributing motive fluid under pressure to the motor is shown in the form of a hollow rotary valve U adapted to rotate in the sleeve V and provided with the pinion W meshing with the spindle gear R so that the valve is rotated in unison with the crank shaft H. The hollow central portion X of the valve is open at one end Y and communicates with the exhaust passage Z. Suitable ports and passages are provided in the valve U, the sleeve V and the cylinder casing A for distributing motive fluid under pressure from the supply passage *a* to the cylinders of the motor and in this instance for exhausting said cylinders through the hollow central portion of the valve to the atmosphere, although this valve need not necessarily be a combined inlet and exhaust valve. Such construction is, however, suitable and convenient. The details of the distribution of motive fluid through the different ports and passages need not be further described as they form no part of the present invention.

In accordance with my invention means are provided for automatically regulating and controlling the motive fluid at a predetermined speed of the spindle after maximum power has been developed by the machine and overspeeding and racing are prevented upon a given decrease of resistance to rotation. While a governor of suitable form can be applied to the inlet of the machine, I prefer to provide a governor for throttling the exhaust to prevent overspeeding and racing. This governor need not be of the centrifugal form but I have found that a centrifugal governor may be simply constructed, requires few parts, is not liable to get out of order and is a preferable form for these and other reasons. While a centrifugal governor for throttling the exhaust may be connected to any suitable rotating part of the machine, I prefer to mount the parts of the governor directly upon the rotary valve U, since this forms a simple mode of construction and renders the governor readily accessible by removing a plug *b* provided for closing that portion of the case forming the valve casing. Although I have shown but one rotary controlling valve in the present machine, the invention is equally applicable to a machine having a plurality of valves.

In the form of device shown in Figures 1 to 4 inclusive, spring arms *c* and *d* which may be formed in one continuous piece are suitably secured within the hollow central portion X of the valve U as by means of the pin *e* and provided with weights *f* and *g* at their outer ends. The hollow central portion X of the valve is preferably square or rectangular in cross section as shown in end view in Figure 3. and the spring arms *c* and *d* are preferably of flat sheet metal substantially the width of the side of the square hollow portion X of the valve, so that as the governor weights *f* and *g* fly outwardly to the positions indicated in dotted lines in Figure 2 the exhaust is throttled and when the spring arms *c* and *d* bear against the edges of the opening X as indicated in the dotted position in Figure 2 the exhaust is substantially closed. Adjustable set screws *h* and *j* may be set into the valve to bear against the spring arms in order to limit the flexibility of said arms.

In the operation of the device so far described, let it be assumed that the machine is running at full speed and that a hole is being reamed. When the bit is lifted or withdrawn from the hole, resistance to rotation is removed, and increase of speed beyond a predetermined amount will automatically cause the governor weights *f* and *g* to fly outwardly and throttle the exhaust thus preventing over-speeding and racing.

In the modification shown in Figures 5, 6 and 7, circular weights *k* and *o*, each open at one side, may be pivoted on the pins *p* and *q* on the end of the valve U. These weights as shown have cut-away portions *r* and *s* so

that the weights over-lap and are normally held in retracted position by a coiled spring *u* connected to the pins *v* and *w* on the weights. Under the action of centrifugal force the weights fly outwardly as indicated in Figure 7, thus throttling the exhaust opening X.

In Figures 8 to 11, a preferred modification of the governor is shown, constructed as a unit adapted to be removably secured to the valve U', in this instance the hollow governor body 2 being screw threaded into the end of the valve. The governor body 2 is formed with a tubular portion 3 outside of which the circular governor weights 4 and 5 are pivoted on the pins 6 on the flange 7. The weights should be free to move on their pivots without binding, and for this purpose spacers 8 slightly longer than the thickness of the weights are placed over the pins 6 and an end plate 9 having an aperture 10 substantially equal in diameter to the bore of the inner tubular portion 3 of the body 2, is secured to the pins 6. The heads of the pins may be upset as shown, as a convenient means for holding them in position and securing the parts together. The governor arms 11 and 12 move to and from each other across the end of the tubular portion 3 of the governor body and in this instance a semicircular spring 13 lying in the grooves 14 in the governor weights, is provided with hooked ends 15 engaging notches 16 in the weights.

By carrying the tubular governor body 2 out to a point directly beneath the movable governor arms, 11 and 12, so that said arms move across the end of the tubular body portion 3, for throttling the exhaust, freezing is prevented because the exhaust passes substantially directly to atmosphere.

I claim:

1. In a portable fluid actuated rotary hand tool, the combination of a crank shaft adapted to be actuated by a fluid operated motor, a tool spindle adapted to carry a working tool and connected to be rotated by the said crank shaft, a rotary valve actuated by the said crank shaft for automatically distributing and exhausting motive fluid under pressure in the machine, and a centrifugal governor mounted directly on said valve and adjustable to operate at a pre-determined speed of the valve after maximum power has been developed by the machine for automatically regulating and throttling the exhaust of motive fluid from the machine, whereby over-speeding and racing are prevented upon substantial decrease of resistance to rotation of the working tool.

2. In a portable fluid actuated rotary hand tool, the combination of a crank shaft adapted to be actuated by a fluid operated motor, a tool spindle adapted to carry a working tool and connected to be rotated by the said crank shaft, a rotary valve actuated by the said crank shaft for automatically distributing and exhausting motive fluid under pressure in the machine, the exhaust passing through the said valve, and a centrifugal governor mounted directly on said valve adjustable to operate at a predetermined speed of the valve after maximum power has been developed by the machine for automatically regulating and throttling the exhaust of motive fluid from the machine, whereby over-speeding and racing are prevented upon substantial decrease of resistance to rotation of the working tool.

3. In a portable fluid actuated rotary hand tool the combination of a crank shaft adapted to be actuated by a fluid operated motor, a tool spindle adapted to carry a working tool and connected to be rotated by the said crank shaft, a hollow cylindrical rotary valve rotated by the said crank shaft for automatically distributing and exhausting motive fluid under pressure in the machine, the exhaust passing through the said valve and to atmosphere from the open end of the valve, and a centrifugal governor mounted directly on said valve and controlling the open end of the valve, said governor being adjustable to operate at a predetermined speed of the valve after maximum power has been developed by the machine for automatically throttling the exhaust of motive fluid from the machine, whereby over-speeding and racing are prevented upon substantial decrease of resistance to rotation of the working tool.

4. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, valve operated thereby for admitting and exhausting motive fluid to and from said motor, and means actuated by said valve and automatically operable only at speeds of said motor above a predetermined minimum to throttle the exhaust of said motive fluid.

5. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor having a valve operated thereby for admitting and exhausting motive fluid to and from said motor, said valve being hollow to conduct the exhaust fluid, and weighted members arranged to close one end of said valve upon rotation above a predetermined speed.

6. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a rotary valve operated thereby open at one end and hollow to conduct exhaust fluid from said motor, and weighted members mounted on said valve arranged to close said open end upon rotation of the motor above a predetermined speed.

7. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated

thereby to conduct exhaust fluid from said motor, and open at one end through which the exhaust is discharged, and a member arranged to be rotated with said valve and adapted to close said open end upon rotation of the motor above a predetermined speed.

8. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated thereby to conduct exhaust fluid from said motor and open at one end through which the exhaust is discharged, and means including centrifugally operated arms arranged to close said open end upon rotation of said motor above a predetermined speed.

9. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated thereby to conduct exhaust fluid from said motor and open at one end to discharge the exhaust, and arms mounted on said valve arranged to swing automatically in a direction to close said open end.

10. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated thereby to conduct exhaust fluid from said motor and open at one end to discharge the exhaust, arms mounted on said valve arranged to swing automatically in a direction to close said open end and weights on said arms centrifugally operated upon rotation of said motor only above a predetermined speed.

11. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated thereby to conduct exhaust fluid from said motor, and a governor comprising arms pivotally supported by said valve, and weights to move said arms across the end of said valve upon rotation of said motor above a predetermined speed.

12. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated thereby to conduct exhaust fluid from said motor and a governor comprising a tubular body mounted on said valve, arms pivotally supported by said body, and weights to move said arms across the end of said tubular body upon rotation of said motor above a predetermined speed.

13. In a portable fluid actuated rotary hand tool, the combination of a fluid operated motor, a hollow rotary valve operated thereby to conduct exhaust fluid from said motor, and a governor comprising a tubular body mounted on said valve normally providing an unrestricted escape for such exhaust, arms pivotally mounted on the outside of said tubular body, and weights to move said arms across the end of said body upon rotation of said motor above a predetermined speed.

In testimony whereof I have signed this specification.

FREDERICK W. PARSONS.