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GOVERNOR FOR PRESSURE FLUID OPERATED TOOLS

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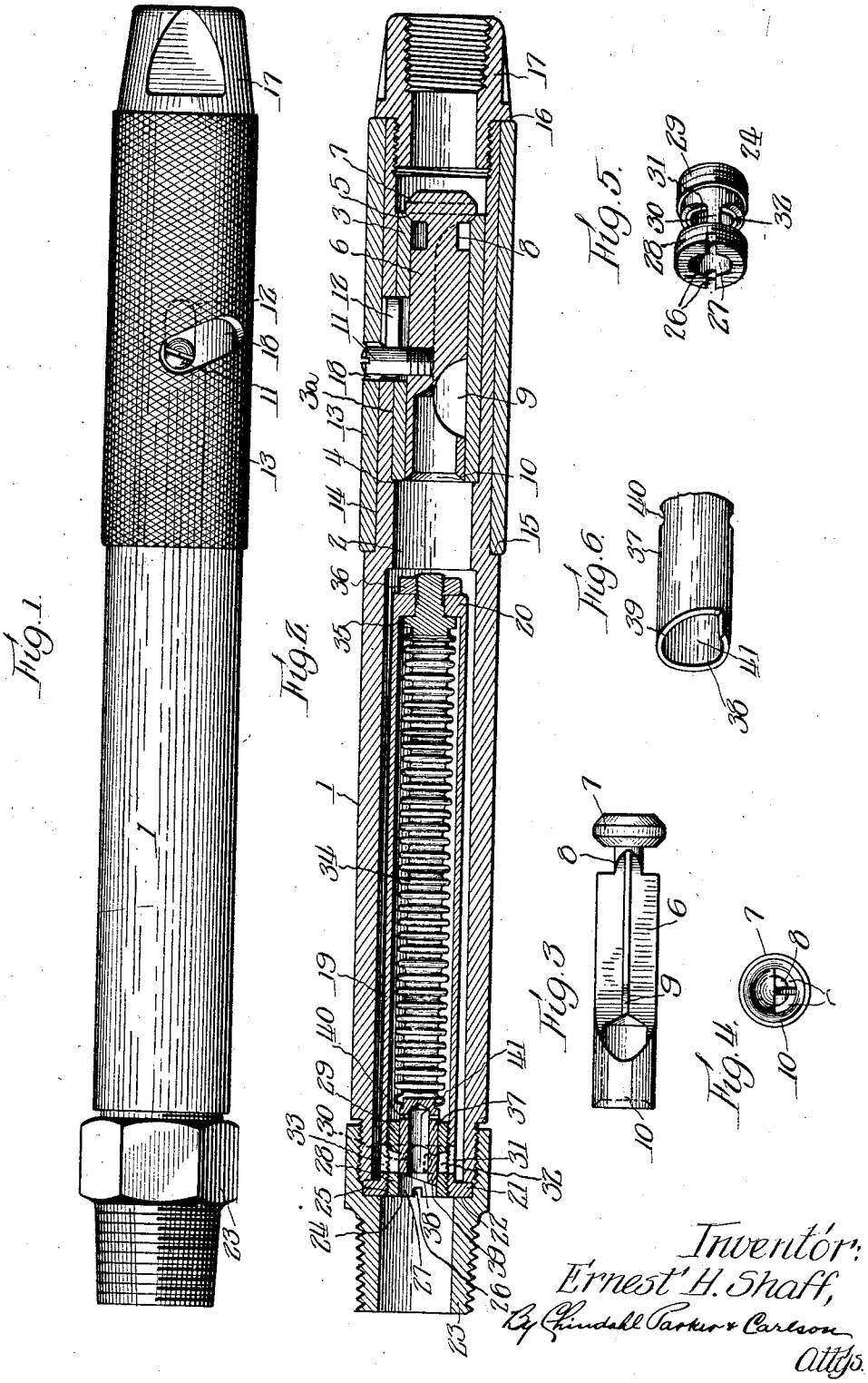


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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## GOVERNOR FOR PRESSURE-FLUID-OPERATED TOOLS

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The invention relates generally to governors and more particularly to a governor adapted to be inserted in a handle through which air passes under manual control.

It is the general object of the invention to provide an improved governor of the type adapted normally to pass a small quantity of pressure fluid to a tool when idling, and which will automatically pass increasing quantities of pressure fluid to the tool as the load on the tool increases.

Another object of the invention is to provide an automatic governor of this type adapted to be incorporated in the handle of a tool, the governor being adapted to fit detachably within a handle of a size readily gripped in the hand.

Another object of the invention is to provide such a governor with automatic valve means adapted to be positioned immediately adjacent the tool end of a handle and as near the load as practical.

Further objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawing in which

Figure 1 is an external view of a tool handle incorporating the preferred form of the invention.

Fig. 2 is a longitudinal central section thereof.

Fig. 3 is a view of the manually operable valve member.

Fig. 4 is an end view thereof.

Fig. 5 is a perspective view of a valve bushing in the governor.

Fig. 6 is a fragmental perspective view of the automatically operable valve of the governor.

While my invention is susceptible of embodiment in many different forms, I have shown in the drawings and will herein describe in detail one such embodiment with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Referring to the drawings, the invention in the exemplary form illustrated is incorporated in a tool handle which comprises a main or unitary tubular casing 1 having a passage 2 therethrough. As viewed in Figures 1 and 2 the governor is positioned at the left hand or tool end of the handle, and valve means manually operable to control the flow of pressure fluid through the passage is carried at the right hand or intake end.

The manually operable valve means comprises a cylindrical sleeve 3 mounted in the outer end of the casing 1, being secured therein by a press fit $3^a$ and against a shoulder 4 in the casing to prevent movement of the sleeve inwardly. The outer end of the sleeve is preferably beveled as at 5 to provide a valve seat. Slidable within the sleeve is a cylindrically shaped member 6, carrying on one end thereof a valve 7 adapted to engage said seat to close the passage 2. This cylindrical member has an annular groove 8 immediately behind said valve and longitudinal ducts 9 leading from said groove to the inner end of the member.

Means is provided to permit of manual reciprocation of the cylindrical member 6 to open and close the passage 2. This means comprises a pin 11 secured to the valve member 6 and extending radially therefrom through a longitudinal guide slot 12 in the sleeve 3 in the casing 1, and a knurled sleeve 13 mounted for partial rotation on a slightly reduced portion 14 of the said casing. This sleeve is retained on the casing between a shoulder 15 formed in the casing and a flange 16 on a coupling member 17 in screw-threaded engagement with the end of the casing, and has a spirally formed slot 18 therein as shown in Fig. 1. This slot 18 is adapted also to admit the pin 11 so that upon rotation of the sleeve 13 the pin 11 is moved longitudinally in the guide slot 12. The valve 7 carried by the member 6 moves with the pin 11 longitudinally of the casing and is thereby operated to open or close the passage 2.

The automatic governing means as herein disclosed cooperates with the above described manually operable valve to regulate the flow of pressure fluid through the handle and is

positioned in the casing 1 between the manually operable valve and a tool (not shown). As illustrated, this governing means comprises an inner casing or tube 19 having a transverse wall 20 closing one end thereof and an annular flange 21 projecting radially outward at the opposite end. The tube 19 is secured detachably in the main casing 1, the flange 21 being herein shown clamped between the end of the casing and a shoulder 22 of a coupling member 23 screw-threaded on the casing. The tube is preferably positioned centrally of the casing.

A bushing 24 (Figs. 2 and 5) is mounted for longitudinal adjustment in the open end of the tube 19 by suitable means such as the screw-threads 25, kerfs 26 being provided therein for engagement by a suitable tool to obtain such adjustment manually. This valve bushing, as shown clearly in Fig. 5 has an axial bore 27, and is cut away at diametrically opposite sides so as to form two spaced annular collars 28 and 29 joined by one or more bars 30. These bars form side wall ports 32 intermediate said collars and are reduced in thickness to form annular shoulders 31 surrounding the bore 27 on the adjacent sides of the collars. The bushing is adapted to be positioned in the tube 19 with the ports 32 adjacent a plurality of ports 33 in the side wall of the tube.

Centrally within the tube 19 is positioned a tubular metallic bellows 34 which is adapted to expand and contract longitudinally with the decrease and increase of pressure within the tube, (the corrugations herein shown being on an enlarged scale for purposes of illustration). This bellows is made of a maximum external diameter less than the internal diameter of the tube 19 and is sealed at both ends. A plug 35 which closes the inner end of the tubular bellows is suitably secured to the end wall 20 of the tube 19 and axially thereof, as, for example, by means of a threaded portion of the plug extending through a hole in the wall 20 and engaging a nut 36. Closing the other end of the tubular bellows and carried thereby is a cylindrical cup-shaped valve 37 adapted to slide freely within the valve bushing 24 to open and close the ports 32 upon contraction and expansion of the bellows. Thus this valve 37 is adapted to control the flow of pressure fluid through the ports 32.

Heretofore difficulty has been experienced in automatically operated valves of this general type with the valve fluttering or chattering as it opens. I have effectively overcome this fluttering movement by means which in the preferred embodiment illustrated comprises a spirally formed free end 38 on the side wall 39 of the valve. This asymmetrical formation permits the pressure fluid to exert a slight side pressure on the valve by exposing a greater surface at one side of the valve. This side pressure reduces greatly the tendency of the freely slidable valve to flutter.

The valve 37 is also provided with one or more apertures 40 therethrough preferably at the base of the side wall 39 to admit constantly, the back pressure fluid in the bore 41 of the valve to the tube 19 to actuate the bellows. Thus I provide a balanced valve which does not move with or against the pressure fluid, but whose movements are governed practically exclusively by the action of the pressure fluid on the bellows.

Assuming a supply of pressure fluid at the right or intake end of the handle as viewed in Fig. 2 and a tool to be operated connected to the coupling 23 at the opposite end, the operation of the preferred form of the invention is as follows:

Manual rotation of the knurled sleeve 13 in a clockwise direction as viewed from the intake end actuates the valve 7 to open the passage 2. Pressure fluid then flows through the passage 2 of the handle through the apertures 33 to the ports 32. Normally the bushing 24 is adjusted so that the valve 37 closes all but a very small portion of the ports 32, this small opening being of sufficient size to pass enough pressure fluid to the tool to operate the tool at a predetermined "running light" or "idling" speed. As the valve 37 is not an air tight fit in the bore 27 of the bushing 24 but is adapted to slide freely therein to prevent "sticking," any leakage past the valve is also utilized in operating the tool.

As the pressure required to operate a tool under such conditions is very low, the pressure beyond the valve 37 and at the tool is comparatively low. This low pressure fluid also enters through the apertures 40 into the bellows chamber within the tube 19 but is insufficient to compress the metallic bellows. If then a load is applied to the tool, the tool slows down and the back pressure on the tool side of the port 32 and in the bellows chamber within the tube 19 builds up. As this back pressure increases the bellows 34 is contracted to withdraw the valve 37 and thereby permit increasing quantities of pressure fluid to flow through the port 32 to the tool. If the load be removed from the tool the pressure on the tool side of the port 32 drops, with the result that the bellows expands and moves the valve to close the port. Similarly if the sleeve 13 be rotated to close the passage 2, the flow of pressure fluid is cut off and the valve 37 assumes its normal position.

From the foregoing, it will be apparent that I have provided an improved governor adapted to be mounted in the handle of a pressure fluid operated tool, the handle being of a size readily gripped by an operator. The invention in the form disclosed is compact and of light weight, features of particular advantage in portable tools of the type contemplated, and its unitary construction adapts it

for ready detachment for purposes of inspection, adjustment or repair.

I claim as my invention:

1. A device of the character described having, in combination, a tubular casing comprising two sections detachably secured together and having a pressure fluid passage therethrough, and a governing device disposed within said casing comprising a tube closed at one end and having at its opposite end an external peripheral flange adapted to be clamped between said casing sections, a bushing mounted for longitudinal adjustment adjacent the open end of said tube, said tube and bushing having a side wall port intermediate said flange and the closed end of the tube, a longitudinally compressible metallic device within said tube having one end thereof secured to said tube and having its opposite end free, a valve carried on said free end of said metallic device and adapted to slide longitudinally in said bushing to control the flow of pressure fluid through said port, and means to admit pressure fluid from the tool side of said port to actuate said compressible device.

2. A device of the character described comprising, in combination, a hollow cylindrical casing having a pressure fluid passage therethrough, a coupling member screw threaded to one end thereof and adapted to connect said casing to a tool, a tube closed at one end and having at its other end an external annular flange adapted to be clamped between the end of said casing and said coupling member, said tube having a port in its side wall forming a part of said passage, a cylindrically formed valve member freely slidable in said tube and adapted to control said port, means to adjust the normal position of said valve relative to said port, a sealed tubular metallic bellows disposed in said tube with one end secured therein and the other carrying said valve member, and means to permit pressure fluid to actuate said bellows.

3. A governor of the character described comprising, in combination, a tubular casing, a bushing disposed within said casing and having an external annular portion abutting the inner peripheral wall of said casing, said bushing also having a side wall port adapted to form a portion of a pressure fluid passage through said casing, a valve asymmetrically formed relatively to said port and freely slidable longitudinally in said bushing to control said port, and pressure fluid responsive means to actuate said valve, said valve being sufficiently free in said bore so that the pressure fluid operating on the asymmetrically formed valve presses it to one side of the bore and normally permits a small amount of fluid to leak past the valve.

4. A handle for pressure fluid operated tools comprising, in combination, a unitary tubular casing of a diameter adapted to be gripped readily and having a pressure fluid supply passage therethrough, a coupling device secured to one end of said casing, said coupling device being adapted to be attached to a pressure fluid operated tool, a tube disposed longitudinally within said casing, said tube being closed at one end and having at the other end an external annular flange adapted to be clamped between said coupling device and the adjacent end of said casing, said tube also having a port therethrough adjacent said flange, a compressible metallic bellows disposed within said tube, one end of said bellows being secured to said tube at its closed end, the other end of said bellows carrying a valve adapted to control the flow of pressure fluid through said part, and means to permit pressure fluid from the tool side of said port to enter said tube to actuate said bellows.

5. A governing device comprising, in combination, a tubular casing closed at one end and of a diameter adapted to be inserted in and to define a portion of the pressure fluid supply passage in a handle for pressure fluid operated tools, said casing having adjacent its open end, a side wall port and an internal annular groove connecting with said port, a cup shaped valve, freely slidable longitudinally within said casing across said groove, means to actuate said valve comprising a sealed compressible metallic device disposed within said casing with one end secured thereto and the opposite end carrying said valve, and means to adjust the normal position of said valve relative to said port.

6. A governor of the character described comprising, in combination, a tubular casing closed at one end and adapted to fit detachably in the pressure fluid passage of a control handle for a pressure fluid operated tool, said casing having adjacent its open end a bushing mounted therein for longitudinal adjustment, said bushing and casing having connecting side wall ports adapted to define a portion of the said passage, a valve slidable in said bushing to control said bushing port, a tubular metallic bellows disposed within said casing with one end secured thereto and the other end carrying said valve, and means to admit pressure fluid from the tool side of said bushing port to actuate said metallic bellows.

7. In a pressure fluid governing device of the character described for portable tools, in combination, a tubular bushing providing a peripheral symmetrical port defining a portion of a pressure fluid passage through said device, a hollow cylindrical valve member freely slidable in said bushing to control the flow of pressure fluid through said port, said valve member having a spirally formed end so that in the operation of the device the said valve member effects a gradual opening and closing of the port and pressure fluid

operated means to operate said valve member.

8. A governor of the character described comprising, in combination, a casing having a pressure fluid passage therethrough and valve means to control the flow of pressure fluid through said passage, said valve means comprising a valve bushing having a cylindrical bore and a side wall port defining a portion of said passage, a cylindrical valve asymmetrically formed relatively to said port and freely slidable in said bore, and pressure responsive means adapted to actuate said valve to control the flow of pressure fluid through said port, said valve being sufficiently free in said bore so that the pressure fluid operating on the asymmetrically formed valve presses it to one side of the bore and normally permits a small amount of fluid to leak past the valve.

9. A governor of the character described comprising, in combination, an outer casing, an inner casing, a valve bushing adjustably mounted in the inner casing having a side wall annular port in communication with the outer casing, a valve controlling said port slidable freely in said bushing, and means in said inner casing supporting said valve operable on back pressure fluid to actuate said valve.

In testimony whereof, I have hereunto affixed my signature.

ERNEST H. SHAFF.