

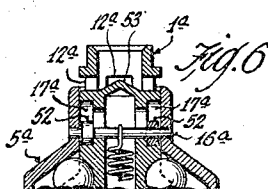
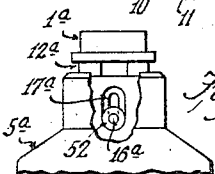
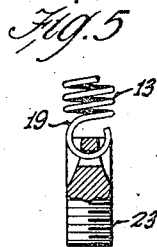
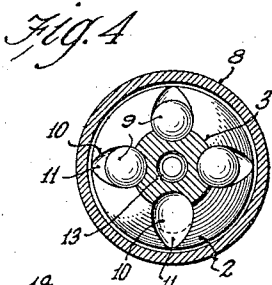
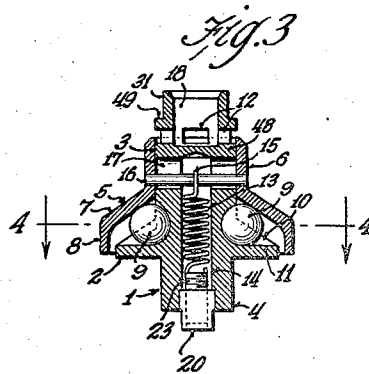
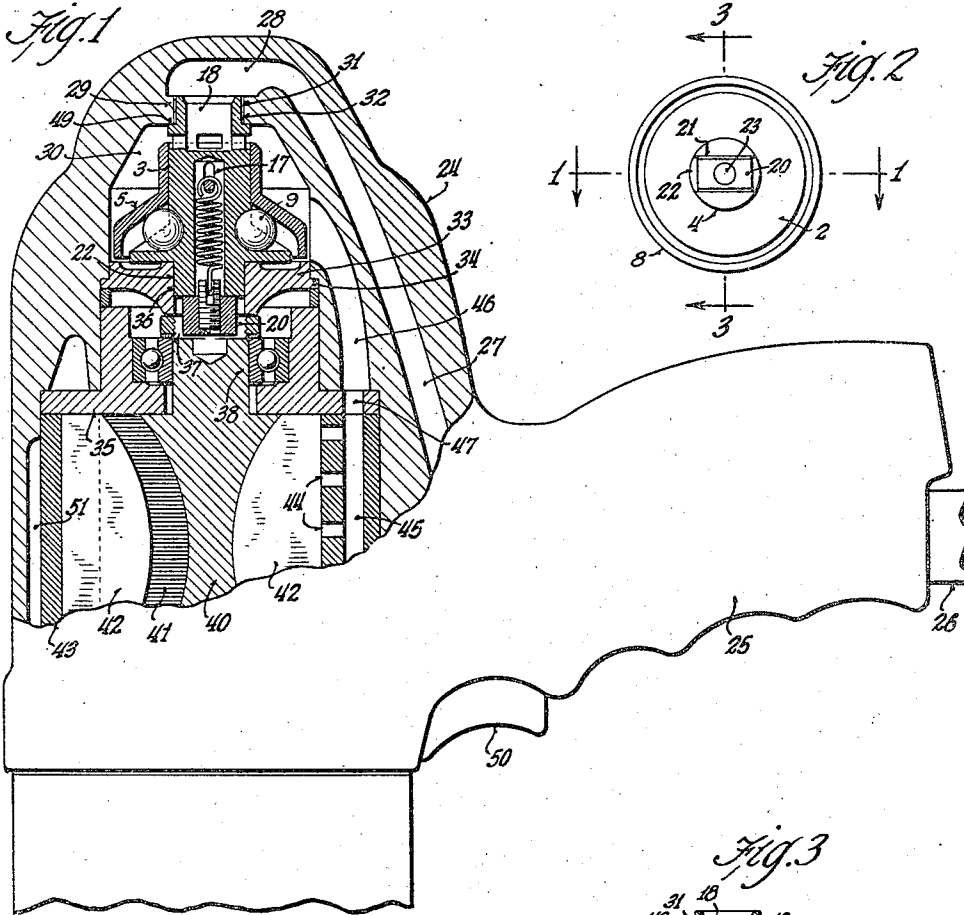
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CENTRIFUGAL GOVERNOR FOR TOOLS

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CENTRIFUGAL GOVERNOR FOR TOOLS

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4 Claims. (Cl. 264-17)

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This invention relates to portable pneumatic tools of the rotor operated type and more particularly to an improved governor device therefor.

Among the objects of my invention are the following:

To provide a centrifugally operated governor device, all parts of which are assembled exterior of the tool as a complete, self-contained, unitary fixture, handled, and insertible and removable as such with respect to the tool to which it is applicable;

To provide a governor device which is simple in construction and easy to manufacture and install in a tool;

To provide a governor device with a valve arrangement controlled thereby and which valve mechanism is a part of the unitary character of fixture and is in axial alignment with the tool rotor with which the governor device is directly connected for rotation thereby;

To provide a governor device in which the outlet ports controlled by the valve mechanism open laterally thereof into a tool chamber extending about the governor device to eliminate the necessity of matching or accurately locating ports in several positions in the tool casing for directing the motive fluid from the governor valve to the tool rotor;

To provide a governor device having a revoluble body member having the fluid passage ports therein and a valve member slidably mounted on the body member for opening and closing said ports and centrifugally responsive elements interposed between and operable on opposed, angularly disposed surfaces on said body and valve members for moving the valve member axially of the body member to close said ports and means normally urging the valve member in the opposite direction to open said ports; and

To provide the specific governor and valve device herein shown, described and claimed.

In the accompanying drawing illustrating said specific embodiment of my invention—

Fig. 1 is a fragmentary side elevational view, partly in longitudinal section, of a portable pneumatic tool equipped with a combined governor and valve device of my invention, the governor and valve device being shown in section taken on line 1-1 of Fig. 2;

Fig. 2 is a bottom plan view of the governor device removed from the tool;

Fig. 3 is a longitudinal sectional view of the governor device taken on line 3-3 of Fig. 2;

Fig. 4 is a transverse sectional view taken on line 4-4 of Fig. 3;

Fig. 5 is a view of the screw-plug and spring assembly of the governor device to be later described;

Fig. 6 is a fragmentary, longitudinal sectional view of a modified form of construction to be later described; and

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Fig. 7 is a side elevational view of the structure shown in Fig. 6.

The governor device of my invention comprises an assembly of parts which when in assembled relation, as shown in Fig. 3, provides a self-contained, unitary governor fixture handled and insertible and removable as such with respect to the tool in which the governor device is used. Among the parts constituting the governor assembly is a body member 1 generally circular in form and having an intermediate, radially extending, table portion 2 from the opposite sides of which extend cylindrical portions 3, 4 of less diameter as shown in Figs. 1 and 3. The cylindrical portions 3, 4 are aligned axially of the body member 1 as shown.

The second part of the governor device is a valve member 5 slidably mounted by its sleeve portion 6 on the cylindrical portion 3 of the body member 1. Said valve member 5 has at the base of said sleeve 6 a canopy portion 7 opposed to the table portion 2 and angularly disposed with respect thereto. The canopy portion 7 has a marginal flange 8 slightly beyond and out of the path of the outer edge of the table portion 2 to retain the ball-like centrifugally responsive elements 9, 9 between the table and canopy portions 2 and 7 as shown in Figs. 1 and 3.

The ball-like elements 9 seat against the table portion 2 in radial, guide ways 10, 10 therein, one for each ball element. In the specific embodiment of my invention shown herein and as detailed in Fig. 4, the ways 10 are four in number and are equally spaced, circumferentially, about the axis of the body member 1. The bottom surfaces 11, 11 of the ways 10 are substantially straight and normal to the governor axis, while the canopy portion 7 or its inner surface is at a downward inclination to the ways. The freely movable ball elements 9 in their outward movement along the ways 10 in response to a centrifugal force on rotation of the body member 1 at a given speed will lift the valve member 5 upwardly, axially of the body member 1 to close fluid passage ports 12, 12 with which the body member 1 is provided for the valve sleeve 6. The ball elements 9 act against the angularly opposed surfaces of the table and canopy portions 2 and 7 and lift the sleeve 6 as just described. The ways 10 are deep enough to retain the ball elements 9 against circumferential displacement of the body and valve members 1 and 5.

Also part of the governor device is a spring element 13, preferably helical in form, and located within a bore 14 provided within the body member 1, as shown in Figs. 1 and 3. The looped upper end 15 of the spring 13 is engaged about a cross-pin 16 which extends through, aligned, lateral, slots 17, 17 in the body portion 1 in its sleeve bearing portion as shown in Fig. 3. The opposite ends of the pin 16 fit apertures in the

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sleeve 6, and have movement therewith in the operation of the device. Said pin holds the valve member 5 from rotation on the body member 1, but coacting with the sides of the slots 17 guides the valve member 5 in its sliding movements.

The slots 17 are elongated sufficiently axially of the body member 1 to limit the valve member 5 in its sliding movement to positions fully opening and fully closing the ports 12, respectively, the pin contacting ends of the slots 17 at said respective positions. At the lower limit of its sliding action, as shown in Figs. 1 and 3, the valve member 5 opens the ports 12, while at the upper limit of its sliding action the valve member 5 closes the ports 12 as will be apparent from the showing in Figs. 1 and 3. The ports 12 connect with an inlet passage 18 in the upper end of the body member 1 and through which compressed air or other motive fluid is supplied to the tool motor to which the governor device is connected and rotated. The valve member 5 through its sleeve 6 controls the amount of compressed air furnished to the tool motor for regulating its rotative speed in respect to the load thereon.

The spring 13 has its lower looped end 19 engaged with an anchor member in the form of a non-circular block 20 extending cross-wise of the bore 14 and fitting in a similarly shaped slot 21 provided in the lower end of the body member 1. Said slot 21 intersects the bore 14 as shown in Fig. 2 and the block 20 is normally seated therein against its bottom surface 22 by the spring 13. The slot 21 holds the block from accidental rotation with respect to the spring 13 and the body member 1.

Screwed into a tapped opening in the block 20 is a screw-plug or equivalent member 23 to which the lower looped end 19 of the spring 13 is connected as shown in Fig. 5. As there shown, the connection mentioned includes an aperture and slot arrangement in the screw-plug 23 to locate the connection within the bore 14 of the body member 1. The spring 13 by its tension normally holds the valve member 5 against the ball elements 9 and urges the valve member downwardly to a port opening position. The cam action which the canopy 7 provides on the ball elements 9 moves the latter inwardly of the ways 10 as the centrifugal force decreases under a load on the tool motor and the valve member 5 descends to open the ports 12 to increase the supply of compressed air to the tool motor as required by the load condition in a drilling or other work operation.

The tension of the spring 13 is adjusted by manually pulling the block 20 out of the slot 21 and turning the block in the required direction relatively to the screw-plug 23. This results in screwing the plug 23 inwardly or outwardly with respect to the block 20 and increases or lessens the spring tension. When the desired tension is obtained the block is located in the rotative position necessary to re-enter the slot 21, the spring 13 resealing the block in the slot. It will be noted that the block 20 in its seated position extends beyond the lower end of the body member 1 for the keying purpose to be presently described and to make the block available for grasping for spring tension adjustment.

With the governor device in unitary form as herein before mentioned and the block 20 accessible for grasping at the lower end of the body member 1, the spring tension may be adjusted while the governor fixture is exterior of the tool,

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The importance of this is that the governor device can be calibrated for a predetermined speed outside the tool and thereby eliminate the necessity of building up a complete machine without the precise knowledge as to the degree of governor control which will be achievable.

The tool in which the governor device herein shown and described is inserted has an outer casing 24 having a side or other handle 25 provided with a main supply passage (not shown) for the compressed air as in tools of the character to which my improved governor device is applicable. The handle member 25 has at its outer end a nipple fitting 26 for the connection with an air supply hose (not shown). The main supply passage in the handle 25 is connected through a throttle valve (not shown) in the handle to a passage 27 in the tool casing 24 and this passage 27 leads to a chamber 28 in the upper end of the tool case above the governor device when located therein as shown in Fig. 1. At this point, the case 24 has a wall portion 29 which divides the chamber 28 from a further chamber 30 which surrounds the inserted governor device. The cylindrical upper portion 31 of the body member 1 extends into an opening 32 in the casing wall 29 with a slight clearance therebetween.

The table portion 2 of the governor device has rotative bearing on a disc member 33 clamped against a shoulder 34 within the tool case 24 by an extension on the upper end plate 35 of the rotor assembly of the tool. The lower cylindrical portion 4 of the governor device has bearing in an opening 36 in the disc member 33 and said portion 4 is connected to the rotor 40 of the tool by the key block 20 which extends into a key slot 37 in the upper trunnion portion 38 of said rotor 40. The latter supports the governor in place and has radial slots or recesses 41 to mount the operative blades 42 of the rotor as in mechanisms of this character.

The blades 42 work against the inner surface of the rotor cylinder 43 dowelled within the tool case 24 and having a plurality of inlet ports 44, 44 serving the blades 42 on their high pressure sides as in motor devices of this design. The inlet ports 44 lead from a supply passage 45 in the rotor cylinder 43 and said passage 45 connects with a supply passage 46 in the tool case, the latter passage opening into the chamber 30 in which the governor device is located as shown in Fig. 1.

The ports 12 of the governor device are arranged about the governor axis, which is in alignment with the rotor axis, and all of the ports 12 open directly into the chamber 30, thus avoiding the necessity of matching and accurately locating ports in the two devices, the governor device and the tool case as apparent. The passage 45 in the rotor cylinder 43 connects with the tool case passage 46 through a port 47 in the upper end plate 35 of the rotor assembly. In the arrangement shown, the passage 46 leads from the chamber 30 directly to the rotor supply passage 45, thereby simplifying the fluid pressure supply system of the tool.

As shown in Figs. 1 and 3, the upper end portion 31 of the body member 1 of the governor device is provided with the fluid flow passage 18 for the ports 12 and this pressure opens through the upper end of the body member 1 directly into the chamber 28 to receive the pressure fluid supply therefrom. This passage 18 is closed below the ports 12 by a cross-wall 48 with which the

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body member 1 is provided to close the ports 12 from the bore 14 in which the spring device 13 is located. The body portion 1 has an external seat 49 to provide a stop for the governor device when inserting it into the chamber 30 and to close chamber 28 to chamber 30 except through ports 12. The governor device is inserted into the tool case through the lower open end thereof before the rotor parts are applied in assembling the tool. The governor device is removed from the tool case in a reverse operation.

In operation of the tool and governor mechanism herein disclosed, compressed air enters the upper end portion 31 of the governor device from the chamber 28 when the throttle valve in the tool handle is opened, an operating trigger block 50 being mounted in the handle to open the throttle valve, as indicated in Fig. 1. When the rotor 40 is not in rotation, the valve member 5 of the governor device is in its lower position fully opening the valve ports 12 and the rotor is supplied with a driving motive fluid to rotate it. As the rotor speeds up the centrifugally responsive mechanism of the governor device functions to adjust the valve member 5 to partially close the ports 12 to run the tool rotor at the desired idling speed when the rotor is not under load. As the working element, such as a drill or the like, is pressed against the work the rotor is placed under load and the centrifugal force decreases, whereupon the valve member 5 is moved downwardly by the spring 13 and the air volume to the rotor is increased as required by the load thereon. The governor action is automatic, as is apparent, and the operation of the rotor 40 is under the control of the governor through its unitary valve device in accordance with the loads impressed thereon.

The air exhausts from the rotor cylinder 43 through exhaust ports therein, an exhaust passage 51 in the tool case 26 being shown in Fig. 1.

In the modified form of structure shown in Figs. 6 and 7, the cross-pin 16a for the slidable valve member 5a mounts rollers 52, 52 in the slots 17a, 17a in the body member 1a of the governor device. The rollers 52 on the cross-pin 16a provide for easier movement of the pin in said slots with the valve member 5a. The slots 17a have the backwall formation as shown in the drawing to prevent displacement of the rollers from the slots, the valve member keeping the roller therein. The rest of the structure shown in Figs. 6 and 7 conforms to that shown in the other figures except that the cross-wall in the body member 1a between the ports and the slots has an air deflector 53 for the air flow towards the ports.

The number of centrifugally responsive ball elements employed in the governor device of my invention will depend upon the speed characteristics to be controlled. In some cases three of such elements will be adequate, while in other cases a greater number will be required. Moreover, the relative angle between the table and canopy portions in conjunction with the spring tension to secure the most satisfactory results with particular ball sizes available is used.

The details of construction and arrangement of parts shown and described may be variously changed and modified without departing from the spirit and scope of my invention, except as pointed out in the annexed claims.

I claim as my invention:

1. A governor device of the character described comprising, a revoluble body member having fluid

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passage ports therein, a valve member slidably mounted on the body member for opening and closing said ports, said members having opposed angularly disposed surfaces, centrifugally responsive elements interposed between said surfaces and acting thereon for moving the valve member axially of the body member to close said ports, spring means normally urging the valve member in the opposite direction to open said ports, and means for adjusting the tension of said spring and serving as a connector for the body member with means which rotates it.

2. A governor device of the character described comprising, a revoluble body member having fluid passage ports and a bore therein, a valve member slidably mounted on the body member for opening and closing said ports, said members having opposed angularly disposed surfaces, centrifugally responsive elements interposed between said surfaces and acting thereon for moving the valve member axially of the body member to close said ports, spring means located within the bore of the body member and connected with said valve member for normally urging the same in a direction to open said ports, and means available at one end of the bore for adjusting the tension of said spring means and serving as a connector for the body member with the means which rotates it.

3. A governor device of the character described comprising, a revoluble body member, an external member mounted on the body member, a cross-pin slidably, but non-rotatably connecting the external member to the body member by having its ends extending into slots in the body member, rollers mounting the ends of the pin within said slots, and means for moving the external member along the body member comprising mechanical means for moving the external member along the body member in one direction and centrifugal responsive means for moving the external member along the body member in the opposite direction.

4. A combined governor and valve device in the form of a unitary fixture for pneumatic tools comprising, a one piece, revoluble, body member having cylindrical bearing portions at its opposite ends to rotatably support the body member in the tool casing, said body member having a bore and a pressure fluid passage therein, both extending axially of the body member with the bore opening through one end of the body member and the passage opening through the opposite end of the body member, said body member having an integral wall portion dividing the passage from the bore and the body member having laterally opening ports for the outflow of pressure fluid from said passage adjacent to said dividing wall, a valve member in the form of a sleeve slidably mounted on the body member for opening and closing said ports, said body and sleeve members having laterally extending table and canopy portions having opposed, angularly disposed, surfaces, centrifugally responsive ball-like elements interposed between said surfaces and acting thereon for moving the valve member axially of the body member to close said ports, and spring means located within said bore and connected at one end with the valve member adjacent to said dividing wall and at the other end with said body member adjacent to the outer end of the bore for normally urging the valve member in a direction to open said ports.

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