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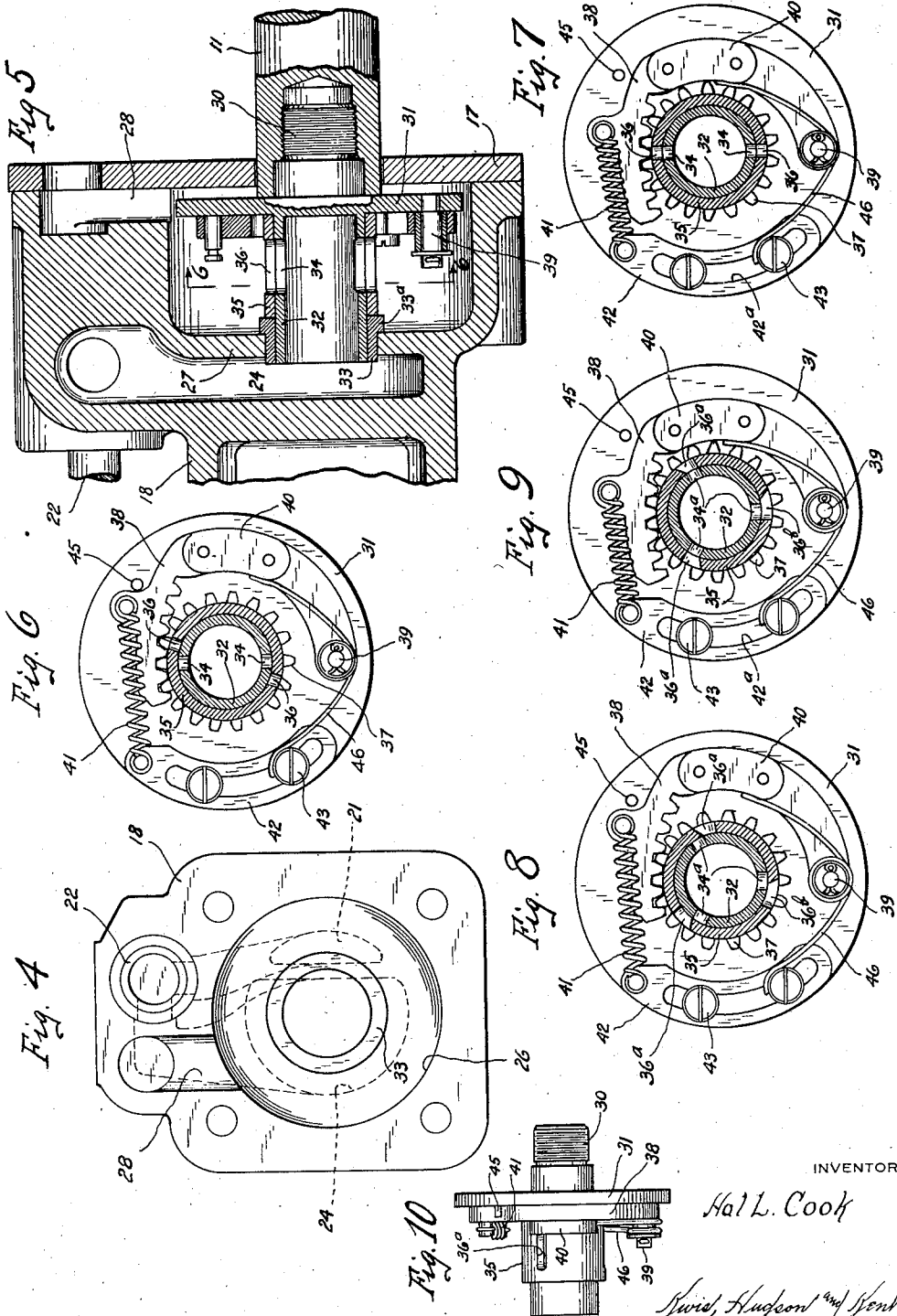
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GOVERNOR FOR FLUID PRESSURE MOTORS

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GOVERNOR FOR FLUID-PRESSURE MOTORS

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This invention relates to governors adapted particularly for fluid operated motors such as portable hand tools and this application is an improvement on the subject matter of my prior application Serial No. 282,311, filed June 2, 1928, now Patent No. 1,729,030.

The main object of the invention is to provide a governor which has long life and which is satisfactory in operation, which is sensitive to changes of speed, which is so constructed as to be substantially free from leakage, and is not likely to leak air by reason of wear or otherwise.

A further object of the invention is to provide a port controlling weight actuated member which is dampened in its action so as to prevent free and undesirable oscillating movements which, if unchecked, might result in unwarranted and undesired speed changes and vibration.

A still further object is to provide an arrangement of ports such that when the tool is operating under a load motive fluid is supplied through all the ports but when running at its idling speed the motive fluid will be supplied through a single port, this latter port as well as the others, being under control of the governor weight.

The above and other objects are attained by the invention which may be here briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings, Fig. 1 is a longitudinal sectional view of the main portion of a fluid pressure motor equipped with my invention; Fig. 2 is a view partly in section and partly in elevation, showing one of the handles which is applied to the body of the motor and which is formed with a governor chamber, the portion in section being substantially along the line 2—2 of Fig. 3; Fig. 3 is a transverse sectional view substantially along the line 3—3 of Fig. 1; Fig. 4 is an end view of the handle detached from the body of the motor along the line 4—4 of Fig. 1; Fig. 5 is an enlarged view of a portion of the motor shown in Fig. 1, showing

the governor in section on a somewhat larger scale than shown in Fig. 1; Figs. 6 and 7 are sectional views along the line 6—6 of Fig. 5; Fig. 6 showing the ports of the governor closed and Fig. 7 showing them open; Figs. 8 and 9 are views similar to Figs. 6 and 7 showing a slight modification; and Fig. 10 is a side view of the governor detached from the motor spindle.

In this instance I have shown my improved governor applied to a motor similar in construction to that constituting the subject matter of the Van Hamersveld and Cook Patent No. 1,653,748 granted December 27, 1927. As the invention does not reside in the motor per se, the structure of the motor will be only briefly described. It includes a cylinder body 10 having a cylindrical bore extending from end to end therethrough. A motor spindle 11 has keyed or otherwise secured to it two rotors 12 which are eccentrically arranged on the spindle and are disposed 180° apart. Between the rotors there is a ball bearing 13 for the spindle which bearing has a housing held in place by a set-screw 14. The cylinder body has a lateral extension and formed in this from opposite ends are a pair of radial guideways 15 which receive sliding abutment blades 16 whose inner ends at all times engage the peripheries of the two rotors.

The opposite ends of the cylinder body are closed by plates 17 and to these are attached two handles 18 and 19, a portion of the latter only being shown. Any suitable motive fluid, which is generally air under pressure and which for convenience will be referred to as air, is supplied through the handle 18 in a manner hereinafter mentioned. The motor spindle extends through the handle 19, and is journaled in the bearing 13 referred to above and in another bearing, not shown, which is provided near the outer end of the handle 19. To the end of the spindle may be secured a suitable tool such as a grinding wheel or the like.

The air enters the handle 18 at the opening in the bushing 20 and passes by way of a passageway 21 which extends through the handle to a valve 22 arranged in a portion of the handle 18 and controllable by a lever 23

which can be conveniently operated by the hand of the operator grasping the handle 18. From this valve the air passes to a passageway 24 and then through an opening 25 to the governor chamber 26 which is formed in the inner end of the handle 18 adjacent the cylinder body, the opening 25 being in a wall 27 separating the passageway 24 from the governor chamber 26. As will be explained presently, the air enters the governor from the passageway 24 and passes through the governor ports into the chamber 26 and from the chamber it passes by way of a passageway 28 formed in the inner face of the handle 18 through an opening in the end plates 17 into a main air inlet passageway 29 extending from end to end through the lateral extension of the cylinder body, this passageway being shown by dotted lines in Fig. 1. From this passageway the air passes to the cylinder bore opposite each rotor and is then exhausted by other passageways not shown, the inlet and exhaust passageways being preferably arranged as shown in the Van Hamersveld and Cook patent referred to above.

The handle 18 also has a lubricating chamber 18^a from which lubricant passes by way of a port controlled by a needle valve 18^b, into the stream of air passing through passageway 21.

The governor constituting the present invention is located in the governor chamber 26 and is attached to the end of the spindle which projects into this chamber, so as to rotate with the spindle. The governor includes a main or body portion having a threaded stem 30 which is screwed into a threaded opening formed in the end of the spindle. Additionally, the body member of the governor is provided with a disk portion 31 and with a sleeve-like portion 32 which projects from the disk 31 in line with the axis of the spindle and has a running fit in a bushing 33 secured in the opening 25 in the wall 27, this bushing having a shoulder 33^a formed on its inner end and bearing against the inner face of the wall 27 so as to hold the bushing in place. The sleeve 32 forming a part of the governor body is provided with one or more ports 34, Figs. 6 and 7 showing two oppositely disposed ports which are somewhat elongated and terminate a short distance from the disk 31 and from the bushing 33. Surrounding the sleeve 32 is a second sleeve 35 provided with a corresponding number of ports 36, Figs. 6 and 7 showing two oppositely disposed ports which are of the same size and contour as the ports 34 and are adapted to be brought into registration with the ports 34 when the motor is operating under its usual load and to move nearly out of registration with the ports 34 when the motor is running idle.

It will be observed that the outer sleeve

35 is provided adjacent the disk 31 with gear teeth 37 and these are engaged by gear teeth in the nature of a rack carried by a governor arm 38 which is pivoted by means of a bearing stud 39 on the disk 31. The arm 38 serves as a governor weight which is adapted to be moved outwardly by centrifugal force and it is preferably provided with a removable portion 40 to give it the weight or mass desired for a given speed of the motor. The arm is normally held in its innermost position indicated in Fig. 7 by a spring 41 one end of which is attached to the arm 38 and the other to a support 42 which is preferably in the form of a segment adjustably secured to the disk 31, this segment in this instance having a slot 42^a and being held in place by screws 43 passing through the slot into the disk, the length of the slot being such, as regards the spacing of the screws, that considerable adjustment can be given to the segment in either direction to vary the length or strength of the spring in resisting the outward movement of the weighted governor arm 38.

It might be here mentioned that the idle speed of the motor which brings about the near closing of the ports can be determined or regulated either by increasing or decreasing the weight of the governor arm 38 or by varying the length and therefore the tension of the spring 41 through adjustment of the segment 42 or by utilizing both methods.

It will be observed by reference particularly to Figs. 6 and 7 as well as to Figs. 8 and 9, that the pivotal point of the governor arm 38 and its point of engagement of the toothed portion with the gear 27 are practically diametrically opposite each other with the pivot point of the governor arm near the periphery of the disk 41. This provides a long leverage for the arm 38 giving the outer sleeve 35 a considerable circumferential movement for a relatively small inward or outward movement of the weight 40. This renders the governor exceedingly sensitive to small changes of speed while at the same time it imparts such a movement to the sleeve as to bring the ports from a position of registration to a position more or less out of registration. Furthermore it will be noted that the arm partially encircles the sleeve 35 and is somewhat L-shaped, the movement of the toothed portion of the arm being nearly in a straight line substantially in line with the axis of the spring 41 whose angular position changes very little between the extreme movements of the outer sleeve. Thus the governor arm has a very direct action on the spring adding to the sensitiveness of the governor, it being noted also that the spring is attached to that part of the governor which is at the maximum distance from the pivot point 39 so that the leverage through which the spring acts on the governor arm is also at its maxi-

num. This likewise adds to the sensitiveness of the governor.

Though the rack portion of the governor arm which engages the gear teeth 37 of the outer sleeve 35 meshes with only a section or segment of the gear between the full open and closed positions of the governor ports, nevertheless the gear teeth are preferably extended entirely around the sleeve so that in the event, after a long period of use, the toothed portion which is engaged by the rack of the governor arm becomes worn, it is only necessary to invert or reverse the position of the sleeve 35 by turning it 180° from its original position when the governor has two pairs of ports as shown in Figs. 6 and 7, and 120° when it has three pairs of ports as shown in Figs. 8 and 9 to bring a new set of teeth into position to be engaged by the toothed part of the governor arm.

As previously stated, Fig. 7 shows the ports in registration as when the tool is operating under load, the air then passing freely from the passageway 24 directly into the end of the sleeve 32 and out through the aligned ports into the chamber 26. When the speed increases, as when the load is decreased or removed entirely, the outer sleeve is turned so as to bring the ports more or less out of registration and if there is a sudden increase in speed as when the load is entirely removed the ports may come entirely out of registration as in Fig. 6, and then as the speed decreases the sleeve will move back slightly until small portions of the ports will be in registration so as to allow the passage of a small volume of air to run the motor at its idling speed.

It might be mentioned further that the outer sleeve, the rocking of which brings the ports 34 and 36 into and out of registration, has a full bearing on the inner sleeve 32 so that it is susceptible to very little wear and retains the desired close fit on the inner sleeve over a long period of time so that the governor remains practically free of leakage throughout its life.

The outward movement of the governor arm is limited by a stop pin 45 as shown in Fig. 6 and the inward movement of the arm is limited by the engagement of the arm with the gear teeth of sleeve 35 as shown in Fig. 7.

Generally the number of pairs of ports in the sleeves 32 and 35 will depend upon the volume of air to be supplied to the motor. In some instances a single pair of ports will be sufficient. In other instances two pairs will be desirable as illustrated in Figs. 6 and 7, and in other cases more than two pairs of ports may be advantageously employed.

In Figs. 8 and 9 I have shown three pairs of equally spaced ports, those in the sleeve 32 being designated 34^a and those in the outer sleeve being designated 36^a, 36^b and 36^c. In illustrating these ports I have shown two fea-

tures which are not shown in the construction first described but which may be employed to advantage. It will be noted that the ports 36^a, 36^b of the sleeve 35 are of the same size but the port 36^c is somewhat wider. This last mentioned port is made wider than the other two because it has been found desirable that when the motor is running at its idling speed the motive fluid be supplied through one port only, as illustrated in Fig. 8. When the motor is operating under load the ports will all be full open as shown in Fig. 9 but when running at its idling speed, the relatively wide port 36^c will slightly uncover the associated port 34^a, the other two ports 34^a at that position of the sleeve 35 being still entirely closed. This feature may be employed whenever two or more pairs of ports are employed, the result being a better and more sensitive control of the idling speed of the motor. It might be stated that when the sleeve 35 is in the position shown in Fig. 8, i. e., when the motor is running idle, the sleeve is under the control of the governor arm. The flow of motive fluid is shut off entirely and all ports are closed when the governor arm is moved to its outermost position against the stop pin.

It will be noted also that in these figures one side of each of the three ports of the sleeve 35 is beveled off. This beveling is on the side opposite the direction of rotation and is for the purpose of decreasing the resistance to the flow of air through the ports. This feature also may be employed regardless of the number of ports.

It has been found that in some governors there is an unstable action or condition due to a tendency of the governor weight and the member which it controls to undergo too rapid changes in position resulting in a vibratory action and in an unsteady motor speed. This makes it desirable to provide in such governors a dampening action which may be accomplished in different ways but in this instance by the provision of a relatively weak spring 46 which acts on the arm 38 in opposition to the main governor spring 41. This spring 46 as illustrated is a wire spring which is coiled around the pivot stud 39 for the arm 38 as shown in Figs. 6, 7, 8, 9 and 10, one end of the spring bearing against the arm 38 and the other, in this case, bearing against one of the screws 43. This spring being much weaker than the spring 41 does not prevent the latter moving the arm 38 inward but it dampens and slows its action sufficiently to prevent undesirable oscillations as have occurred before and therefore undesirable changes in speed of the motor and vibrations in the tool itself by reason thereof. This dampening or dash pot effect may be employed advantageously regardless of the number of pairs of ports in the sleeves and in fact is not necessarily confined to a governor of the specific type herein illustrated.

I do not desire to be confined to the precise details and arrangements illustrated but aim in my claims to cover all modifications which do not depart from the spirit and scope of the invention.

Having thus described my invention, I claim:

1. A governor for a fluid pressure motor comprising a governor body adapted to be connected to the motor spindle and having a ported sleeve-like portion, a ported sleeve mounted exteriorly thereon, a governor arm carried by the governor body and having a connection with said sleeve so as to turn it, and means for dampening the action of the governor arm.

2. A governor for a fluid pressure motor comprising a governor body adapted to be connected with the spindle of the motor and having a ported sleeve-like portion, a ported sleeve mounted exteriorly thereon, a governor arm carried by the governor body and having a toothed connection with the sleeve, and means for dampening the action of the governor arm.

3. A governor for a fluid pressure motor comprising a governor body having a hollow ported sleeve-like portion, a ported sleeve mounted thereon, a governor arm pivoted on the body on one side of the sleeve-like portion and having on the opposite side thereof a connection with the sleeve, and means for dampening the action of the governor arm.

4. A governor for a fluid pressure motor comprising a governor body having a hollow ported sleeve-like portion, a ported sleeve mounted thereon, a governor arm pivoted on the body and having a connection with the sleeve so as to turn it to vary the relative positions of the ports, a spring connected to the arm, the latter having a portion which has a substantially straight line movement substantially in line with the spring, and a second spring acting on the arm in opposition to the first-named spring.

5. A governor for a fluid pressure motor comprising a governor body having a hollow sleeve-like ported portion, a ported sleeve mounted thereon, a governor arm extending part way about the sleeve and connected therewith so as to turn it to vary the relative positions of the ports, a spring connected with the governor arm, the pivot for the arm and the connection with the ported sleeve being on opposite sides of the latter, and means acting on the arm to dampen the action of the arm and spring.

6. A governor for a fluid pressure motor comprising a governor body having a hollow sleeve-like ported portion, a ported sleeve mounted thereon having a toothed portion, a governor arm extending part way about the sleeve and having a toothed portion engaging the toothed portion of the sleeve, a spring connected with the arm, and means

for dampening the action of the arm and spring.

7. A governor for a fluid pressure motor comprising a governor body having a hollow sleeve-like ported extension, a ported sleeve mounted thereon and having a toothed portion, an angular governor arm having a pivot point on the governor body and having a toothed portion substantially diametrically opposite the pivot point and engaging the toothed portion of the sleeve, a spring connected to the governor arm, and means for dampening the action of the arm and spring.

8. A governor for a fluid pressure motor comprising a governor body having a hollow sleeve-like ported portion, a ported sleeve mounted thereon, a governor arm pivoted to the governor body and extending part way around the sleeve, a spring connected to the arm and located on one side of the sleeve opposite the pivot point and serving to oppose the outward movement of the arm, and a second spring acting on the arm in opposition to the first named spring.

9. A governor for a fluid pressure motor comprising a governor body having a hollow sleeve-like ported portion, a ported sleeve mounted thereon, a governor arm pivoted to the governor body and extending part way around the sleeve, a spring connected to the arm and located on the side of the sleeve opposite the pivot point, an adjustable support for the spring mounted on the governor body, and a second spring acting on the arm in opposition to the first named spring.

10. A governor for a fluid pressure motor comprising a governor body having a hollow sleeve-like ported portion, a ported sleeve mounted thereon and having a toothed portion, a governor arm pivoted on the governor body on one side of the sleeve and extending part way around the sleeve to the opposite side thereof where it has a toothed portion engaging the toothed portion of the sleeve, a spring also located on the last mentioned side of the sleeve and connected with the arm, and means for dampening the action of the spring and arm.

11. A governor for a fluid pressure motor comprising a governor body with a movable port controlling member, a weight for shifting said member, a spring for opposing its movement, and means acting in opposition to the spring for dampening the action of the weight and spring.

12. A governor for a fluid pressure motor having a ported sleeve-like portion, a ported sleeve associated therewith and movable with respect thereto, a weighted governor arm connected with said sleeve, a governor spring for opposing the movement of the arm, and means acting in opposition to the spring for dampening the action of the arm and spring.

13. A governor for a fluid pressure motor having a ported sleeve-like portion, a ported

sleeve associated therewith and movable with respect thereto, a weighted governor arm connected with said sleeve, a governor spring for opposing the movement of the arm, and a relatively light spring also connected to the governor arm in opposition to the governor spring.

14. In combination with a fluid pressure motor having a spindle, a governor having a sleeve-like portion, a sleeve associated therewith and movable with respect thereto, and a spring-opposed weight for shifting the sleeve, the sleeve-like portion of the governor and the sleeve having a plurality of pairs of ports arranged so that in one position they are in substantially full registration and in another position when the motor is idling the motive fluid for the idling speed is supplied through one port only.

15. In combination with a fluid pressure motor having a spindle, a governor having a sleeve-like portion, a sleeve associated therewith and movable with respect thereto, and a spring opposed weight for shifting the sleeve, the sleeve-like portion and the sleeve having a plurality of pairs of ports arranged so that when the weight is in its outermost position all ports are closed by the sleeves and when the weight is moved inwardly one port only will first be opened for the idling speed and on further inward movement the remaining ports are opened.

In testimony whereof, I hereunto affix my signature.

HAL L. COOK.