

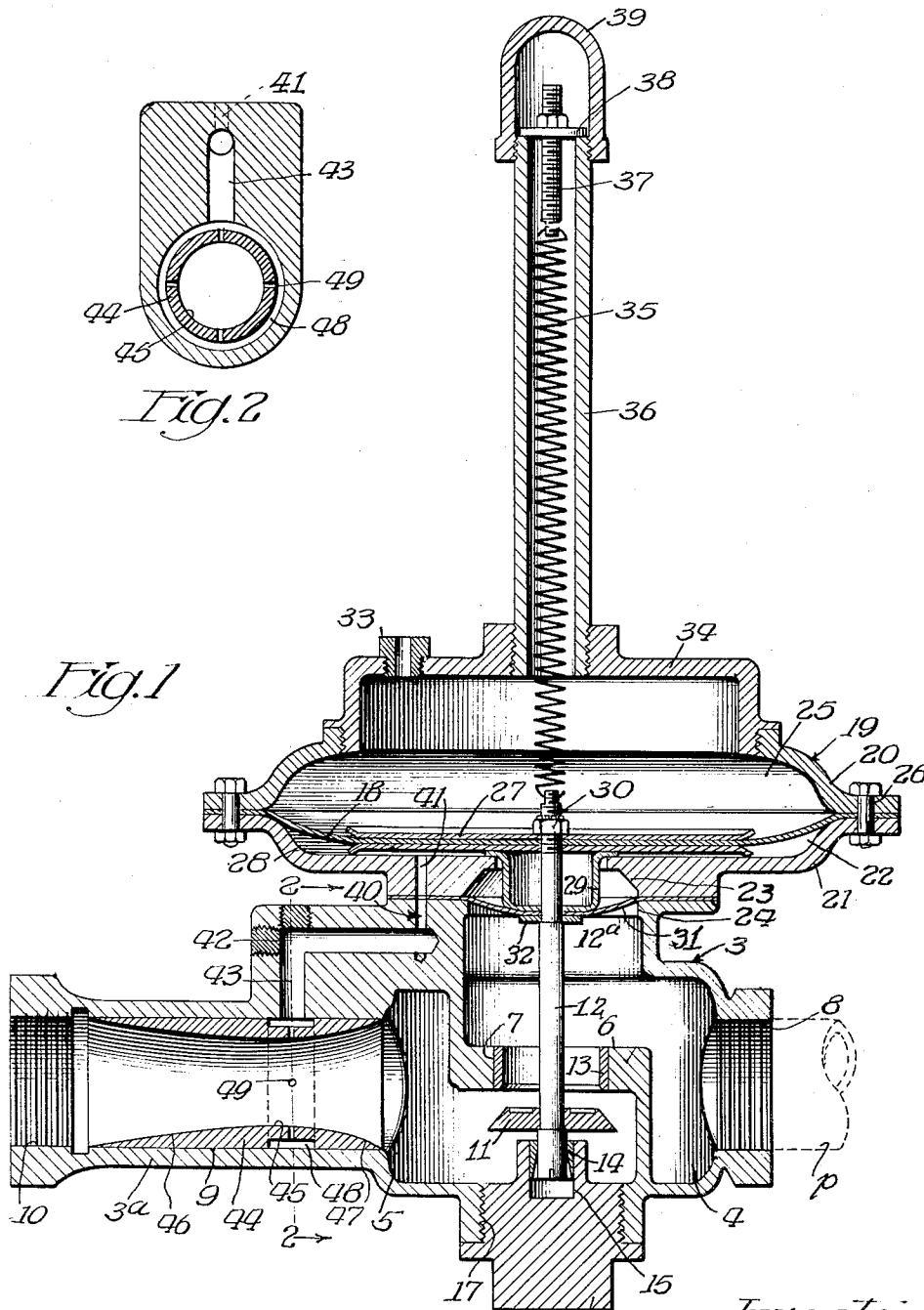
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GOVERNOR

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GOVERNOR

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1 Claim. (Cl. 50—23)

The invention relates generally to governors for reducing the line pressure of gas in a gas supply pipe to zero or atmospheric pressure. More particularly the invention relates to that type of governor which is designed for use in connection with equipment for proportionally mixing gas and air for combustion in furnaces and other gas burning appliances, and comprises (1) a cast metal valve-casing which is provided with a horizontally extending gas inlet at one end thereof and has a horizontally extending gas outlet at its other end for connection to the suction chamber of a proportional gas and air mixer of the Venturi suction T type or to the proportioning valve of a proportional gas and air mixer of the pressure blower type; (2) a stem-equipped valve which is mounted for vertical movement in the casing and serves to control the flow of gas from the inlet to the outlet; (3) a horizontally extending diaphragm which is located above the valve-casing and is connected to the valve stem so that it operates in response to fluctuation or vacillation thereof, to shift the valve; (4) a two-piece housing which surrounds and supports the diaphragm and has an opening in the top portion thereof whereby the space therein above the diaphragm is open to atmosphere and has in its lower portion an equalizing passage which leads to the outlet in the valve-casing so that any pressure in the outlet is transmitted to the space under the diaphragm and causes the diaphragm to shift the valve to a position wherein zero or atmospheric pressure exists in the outlet; and (5) an elongated suspension spring which is connected so as to counterbalance the weight of the diaphragm assembly, the valve stem and the valve.

In practice it has been found that zero governors of conventional or standard design show an increasing minus pressure of the gas at the outlet as the flow of gas through the valve-casing increases. This is due primarily to unavoidable pressure losses and restrictions to flow.

The primary object of the present invention is to provide a zero governor of the type under consideration which is an improvement upon and is more efficient in operation than previously designed governors of like character, and maintains a constant zero pressure at the outlet throughout its entire range of capacity by virtue of the fact that it includes means for compensating for the increasing minus pressure or vacuum which normally occurs at the outlet as the flow of gas through the valve-casing increases. In general, this compensating means consists of a Venturi

sleeve which is mounted in the outlet of the valve-casing and embodies in the throat thereof a plurality of transversely extending ports. The latter lead to, and form the inlet end of, the equalizing passage. When, during use of the governor, the flow of gas increases, a slight suction is created at the throat of the Venturi sleeve. This suction is a function of the rate of flow of gas through the Venturi sleeve and is transmitted to the space under the diaphragm with the result that the diaphragm operates to shift the valve into a further opened position and to bring the pressure in the outlet to zero.

Another object of the invention is to provide a zero governor which is generally of new and improved construction and has greater capabilities of use than previously designed governors of the same general type, and in which the Venturi sleeve is mounted removably in the outlet of the valve-casing so that a sleeve of different design or character may be substituted therefor whenever conditions warrant such a substitution.

Other objects of the invention and the various advantages and characteristics of the present governor construction will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the claim at the conclusion hereof.

In the drawing which accompanies and forms a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Fig. 1 is a vertical, longitudinal section of a zero governor embodying the invention; and

Fig. 2 is a transverse section on the line 2—2 of Fig. 1 showing in detail the specific construction and arrangement of the Venturi sleeve which constitutes the compensating means whereby a constant zero pressure is maintained at the outlet of the casing.

The governor which forms the subject matter of the invention is designed for use in connection with equipment for proportionally mixing gas and air for combustion in a furnace or other gas burning appliance, and operates to reduce the line pressure of gas in a gas supply pipe *p* to zero or atmospheric pressure. It comprises as one of the essential parts thereof a hollow, cast metal valve-casing 3. This valve-casing comprises a horizontally extending inlet 4 at one end thereof and a horizontally extending outlet 5 at its other end, and embodies a partition 6 between the inlet

and outlet. The partition is formed integrally with the valve-casing, extends horizontally and is provided with a circular opening 7 for establishing communication between the inlet 4 and the outlet 5. The inlet 4 is connected to the gas supply pipe *p* by an internal screw thread 8 which is formed in the inlet end of the valve-casing and engages an external screw thread on the pipe. The gas in the supply pipe *p* flows from the inlet to the outlet 5 via the circular opening 7 in the partition 6. The outlet 5 includes an elongated bore 9. The latter is of uniform diameter throughout its entire length and is formed in an extension 3^a which is formed integrally with and projects horizontally from the valve-casing. An internal screw thread 10 is formed in the outer end of the bore 9 and forms a connection whereby the outlet 5 of the valve-casing may be connected to the suction chamber of a proportional gas and air mixer of the Venturi suction T type, or to the proportioning valve of a proportional gas and air mixer of the pressure blower type. When suction is applied to the inlet, gas is drawn from the supply pipe *p* through the outlet 5.

In order to maintain at zero or atmospheric pressure the gas passing out of the valve-casing via the outlet 5, a valve 11 is provided. This valve is located in the outlet 5 beneath the partition 6, is mounted on a vertically extending stem 12 and cooperates with a cylindrical seat 13 in the circular opening 7 to control the flow of gas from the inlet to the outlet. The lower end of the stem 12 is mounted in an annular bushing 14. The latter is disposed in a cylindrical socket 15 in the upper end of a plug 16. The plug 16 extends through the bottom wall of the valve-casing 3 and is secured in place by a screw thread connection 17. When the valve stem 12 is raised, the valve 11 is shifted towards the cylindrical seat 13 and diminishes the flow of gas from the inlet to the outlet. When the valve stem 12 is lowered, the valve is shifted away from the seat 13 and permits of a greater flow of gas into the outlet. By shifting the valve, the pressure of the gas in the outlet may be maintained at zero or atmospheric pressure.

The valve is shifted for pressure governing purposes by means of a diaphragm 18. This diaphragm is disposed in and supported by a two-piece, cast metal housing 19. The latter is mounted above the valve-casing and comprises an upper section 20 and a lower section 21. The lower section is substantially circular in conformation, forms a space 22 beneath the diaphragm and embodies a central opening 23 which communicates with an opening 24 in the top wall of the valve-casing 3 and receives the upper end of the valve stem 12. The upper section 20 forms a space 25 above the diaphragm and has the marginal part thereof clamped to the marginal part of the lower section by means of an annular series of bolts 26. The diaphragm 18 is clamped between the housing sections by the bolts 26 and is connected to the upper end of the valve stem 12 by means of an upper metallic disk 27 and a lower metallic disk 28. The lower disk 28 fits against the bottom face of the diaphragm and is supported on a cup 29 which fits around the upper end of the valve stem. The upper disk 27 fits against the top face of the diaphragm and is secured in place by a nut 30 on the extreme upper end of the stem 12. The nut 30 clamps the lower disk against the cup 29 and clamps the two disks together with the central portion of the dia-

phragm therebetween. The passage of gas from the inlet 4 of the valve-casing into the space 22 beneath the diaphragm 18 is prevented by means of a diaphragm 31. The latter serves to close the opening 24 and has the marginal part thereof clamped between the lower housing section 21 and the top wall of the valve-casing. The central portion of the diaphragm 31 extends around the upper end of the valve stem 12 and is clamped between the bottom of the cup 29 and a washer 32 which rests upon annular shoulder 12^a on the valve stem.

The space 25 above the diaphragm 18 is open to atmosphere through the medium of a tubular plug 33. The latter extends through the top wall of a cap 34 which is detachably secured to the central portion of the upper housing section 20. The weight of the diaphragm assembly, the valve stem 12 and the valve 11 is counterbalanced by means of a suspension spring 35 of the coil type. The latter is housed in a tube 36 and is connected to and extends upwardly from the top wall of the cap 34. The upper end of the spring 35 is supported by means of an adjustment screw 37 which is supported on a washer 38 at the upper end of the tube 36 and is housed in a cap 39. The lower end of the spring extends into the space 25 above the diaphragm 18 and is connected to the threaded upper end of the valve stem 12. By manipulating the screw 37, the tension of the spring 35 may be adjusted so that the spring serves accurately to counterbalance the weight of the diaphragm assembly, the valve stem and the valve.

An equalizing passage 40 leads from the space 22 beneath the diaphragm 18 to the bore 9. This passage comprises a vertical part 41, a horizontal part 42 and a vertical part 43. The vertical part 41 extends through the central portion of the lower housing section 21 into the top wall of the valve-casing 3. The horizontal part 42 extends longitudinally with respect to the valve-casing and is arranged so that the inner end thereof intersects the lower end of the vertical part 41 of the equalizing passage. The vertical part 43 is formed in the extension 3^a of the valve-casing and is arranged so that its upper end intersects the outer end of the horizontal part 42 and its lower end intersects the bore 9. A Venturi sleeve 44 is pressed or otherwise secured removably in the bore 9. This sleeve extends from the inner end of the bore to the internal screw thread 10 and is provided with a throat 45. The latter is in the nature of a restriction. It is located in the central portion of the sleeve and is joined to the sleeve ends by outwardly flared portions 46 and 47. An annular groove 48 is formed in the outer periphery of the Venturi sleeve. This groove registers with the lower end of the part 43 of the equalizing passage 40 and is disposed adjacent to and around the throat 45. A plurality of comparatively small ports 49 extend through the throat and intersect the annular groove 48. These ports establish communication between the interior of the Venturi sleeve and the equalizing passage 40 and serve to transmit any pressure in the outlet of the valve-casing to the space 22 beneath the diaphragm 18. In the event that the pressure of the gas flowing through the outlet becomes greater than zero or atmospheric pressure, the diaphragm 18 which is subject to pressure fluctuations in the outlet by way of the equalizing passage 40, is forced upwardly by the pressure exerted against the under face thereof and operates through the medium of the valve stem 12 to shift the valve 11 towards the seat

13 so as to diminish the flow of gas through the opening 7 and thus reduce the gas in the outlet to zero or atmospheric pressure. By virtue of the fact that the suspension spring 35 accurately counterbalances the weight of the diaphragm assembly, the valve stem and the valve, the diaphragm 18 operates to maintain zero or atmospheric pressure of the gas at the outlet 5 of the valve-casing. Due to unavoidable pressure losses and restrictions to flow, there is generally a tendency for the governor to show an increasing minus pressure, that is, a slight vacuum, at the outlet as the flow through the valve-casing increases. By utilizing the Venturi sleeve in the outlet, the gas flowing through the outlet is always at zero or atmospheric pressure regardless of the rate of flow. This is due to the fact that during an increase in the rate of flow of the gas through the casing, a slight suction is created at the throat 45 of the Venturi sleeve in accordance with well-known laws of physics. This slight suction is transmitted to the space 22 with the result that the diaphragm 18 moves the valve 11 downwardly so as to increase the size of the valve opening and bring the gas within the outlet 5 to zero pressure. As the flow of gas through the outlet increases, the throat suction of the Venturi sleeve which is a function of the rate of flow through the sleeve increases. This increased suction effects, through the medium of the diaphragm, a greater opening of the valve 11, and hence precludes the creation of an increasing minus pressure of the gas in the outlet. By utilizing a Venturi sleeve in the outlet and arranging the equalizing passage so that the inlet end thereof extends through the throat of the venturi, simple means is provided for counteracting or compensating for the increasing minus pressure which is generally created at the outlet as the flow of gas increases. As a result of the action of the Venturi sleeve, the gas at the outlet of the governor is always at zero or atmospheric pressure, regardless of the rate of flow of the gas through the valve-casing.

Assuming that the gas in the supply pipe *p* is under a slight pressure and suction is applied to the outlet 5 for the purpose of drawing the gas through the valve-casing, the operation of the governor is as follows:

Upon entry into the inlet 4 of the valve-casing, the gas flows through the opening 7 into the outlet 5 and is reduced to zero or atmospheric pressure as it passes between the valve and the valve seat. In the event that the pressure of the gas in the outlet increases beyond zero or atmospheric pressure, the pressure is transmitted by way of the equalizing passage 40 to the under side of the diaphragm 18 and causes the diaphragm to raise the valve and thus diminish the flow of gas from the outlet to the inlet and bring the pressure of the gas within the outlet to zero. When the flow of gas through the casing increases to such an extent that there is a tendency for a minus pressure to be created at the outlet, a slight suction is developed at the throat of the Venturi sleeve. This suction, as previously pointed out, is transmitted to the space 22 beneath the diaphragm 18 and results in the valve opening being slightly increased and an increased flow of gas into the outlet. This increased flow of gas into the outlet compensates for the minus pressure which would normally be created in the outlet upon an increase of flow of gas through the casing. As the flow of gas through the casing

increases, the suction at the throat of the Venturi sleeve increases. This increased suction is transmitted to the diaphragm 18 with the result that the valve is further opened so as to allow the passage of sufficient gas into the outlet to prevent the creation or development of a minus pressure within the outlet.

The herein described governor is exceedingly efficient in operation by virtue of the fact that it serves to maintain the pressure of the gas at the outlet at zero or atmospheric pressure regardless of the rate of flow of the gas through the valve-casing. Inasmuch as the Venturi sleeve is mounted removably in the outlet end of the valve-casing, a new or different sleeve may be applied to the casing when desired or conditions require such application.

Whereas the governor has been described as being adapted primarily for use in connection with equipment for proportionally mixing gas and air for combustion in a furnace or other gas burning appliance, it is to be understood that the governor may be used wherever it is necessary to reduce to zero or atmospheric pressure the line pressure of gas in a pipe system. It is also to be understood that the invention is not to be restricted to the details set forth, since these may be modified within the scope of the appended claim, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

In a governor of the character described, the combination of an elongated, horizontally extending valve-casing provided at one end thereof with an inlet for receiving gas from a source of supply and at its other end with a substantially cylindrical outlet for connection to a suction device, a valve arranged to control the flow of gas from the inlet to the outlet and embodying a vertical stem extending upwardly through the valve casing, a horizontally extending diaphragm above the valve casing connected to the upper end of the valve stem and adapted in response to fluctuation thereof to shift the valve, a separately formed housing for the diaphragm associated with and located above the valve-casing and comprising an upper section forming a space on top of the diaphragm open to atmosphere and a lower section mounted directly on the top of the valve casing and forming a closed space under the diaphragm, a vertically extending suspension spring above the diaphragm having the upper end thereof anchored and its lower end applied to the upper end of the valve stem and operative to counterbalance the weight of the diaphragm, valve stem and valve, and a separately formed cylindrical Venturi sleeve fitting and removably secured in the outlet of the valve-casing and embodying a throat for producing a restricted flow of the gas as it flows through the outlet, said sleeve having a circumferential groove in the outer periphery thereof and a plurality of transverse ports extending through the throat and intersecting the groove, the valve-casing and the lower section of the diaphragm housing having serially connected ducts therein forming an equalizing passage between the groove and the closed space under the diaphragm whereby pressure in the outlet is transmitted to said closed space.

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