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MOTOR OPERATED VALVE

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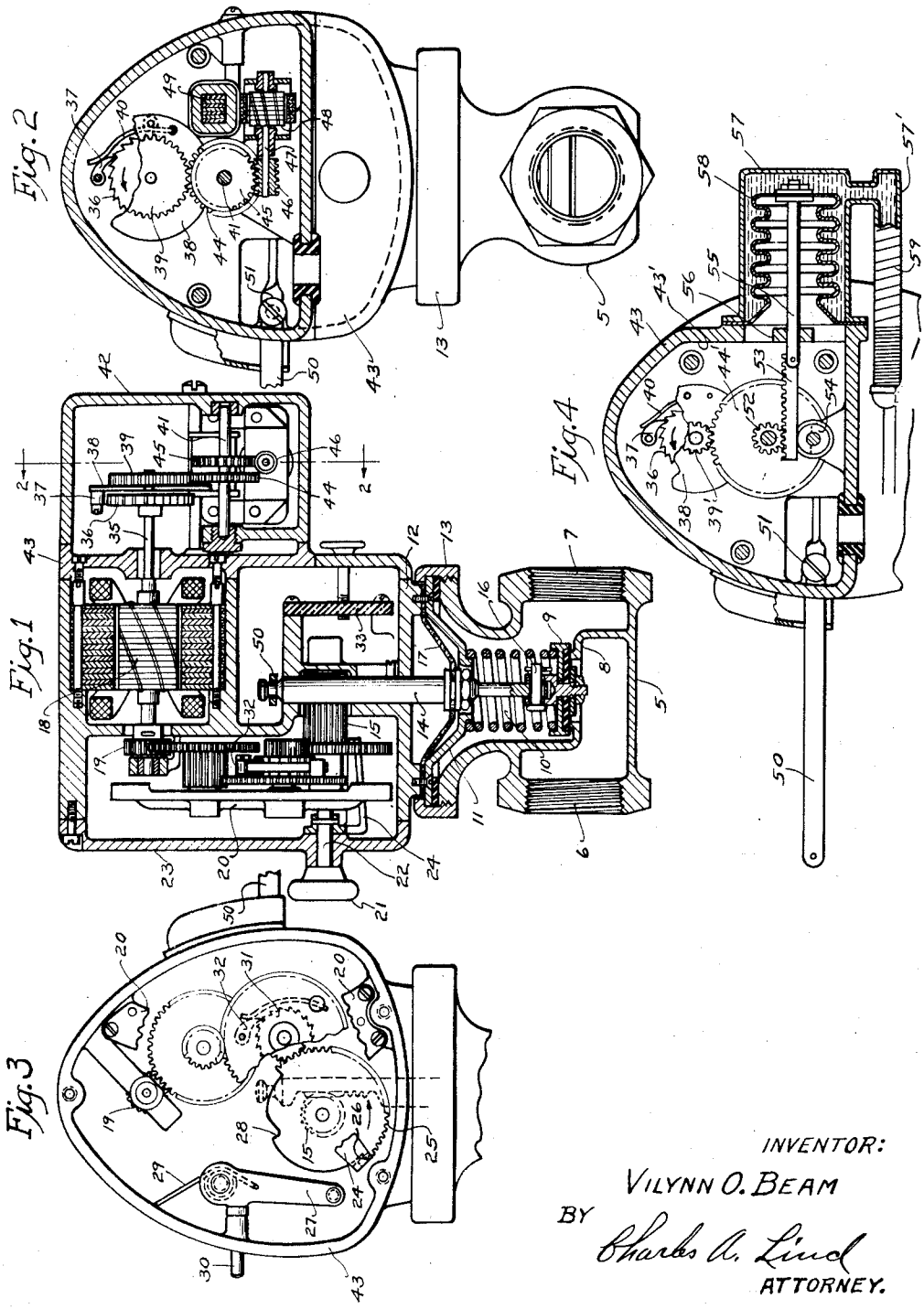


Fig. 2

Fig. 4

Fig. 1

Fig. 3

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MOTOR OPERATED VALVE

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This invention relates to improvements in motor operated valves and has for its object to provide a simple and practical means for retarding the valve-opening operation of the motor to the end that the valve may be opened relatively slowly irrespective of the power applied to the motor.

In accordance with the present invention, there is provided in addition to the valve-opening motor a second motor which is coupled to the valve-opening motor by a self-locking gear mechanism in such a manner that unless the second motor is actuated the valve-opening motor will be ineffective to open the valve. Means are also provided for permitting free rotation of the valve-opening motor in a valve-closing direction when power to the valve-opening motor is cut off.

For a more complete understanding of the invention reference is made to the detailed description taken in connection with the accompanying drawing wherein the preferred form of the invention is shown.

Referring to the drawing,

Fig. 1 is a vertical section through a well known type of motor operated valve and showing the present invention applied thereto;

Fig. 2 is a vertical cross section on line 2—2 of Fig. 1 and showing certain details of the present invention;

Fig. 3 is a fragmentary side elevation looking at the left hand side of Fig. 1 with the cover plate removed, parts being broken away to more fully show the construction, and

Fig. 4 is a fragmentary view similar to Fig. 2 but illustrating another type of means for retarding the valve-opening operation of the valve-operating motor.

In the drawing, 5 designates a valve casing having inlet 6, outlet 7 and apertured partition 8. The valve is indicated at 9 and is normally held to its seat by a spring 10 the upper end of which bears against a spanner 11 secured to the base 12 of a main housing 43 wherein the valve operating mechanism is contained, this housing being secured to the valve casing by a clamping collar 13. The valve stem comprises a rack 14 in operative engagement with a final drive pinion 15, the lower end of the stem being connected to the valve by a hinge 16, it being noted that the valve stem passes through the spanner 11. A flexible diaphragm 17 provides a seal between the valve stem and valve casing.

The rotor of the valve-operating motor is indicated at 18, there being affixed to the rotor shaft a pinion 19 which drives a gear train of which the rack pinion 15 is a part, the support for the gear train being indicated at 20. In order that the valve 9 may be manually opened in the event of current failure, there is provided a hand knob 21 having a shaft 22 supported by a side wall 23 of the housing 43, this shaft having affixed thereto an angled arm 24 the outer end of which extends across the periphery of a segmental gear 25 which forms part of the gear train between pinions 15 and 19. By so turning the knob 21 that the arm will engage the shoulder 26 on the gear 25, the valve may be opened. In order to hold the valve in open position there is provided a latch 27 adapted to engage with a notch 28 in the segmental gear 25. This latch comprises an arm normally held in retracted position by a spring 29, the arm being brought into operative position by a push rod 30 supported in a wall of the housing 43 as is clearly shown in Fig. 3.

In order that the valve may be opened by the manual operating means as said, there is provided in the gear train an over-running clutch comprising a ratchet 31 and pawl 32. The gear 25 may, therefore, be rotated in one direction as indicated by the arrow thereon without imparting rotation to the gears between the motor pinion 19 and the pawl and ratchet as will be readily understood. The notch 28 is so located that when the valve motor is energized, the gear 25 will be further rotated in the valve-opening direction and consequently the latch arm 27 will automatically move to normal non-operative position as shown in Fig. 3 and thereby pass the control of the valve over to the motor.

The electrical connections for supplying current to the motor are not shown but element 33 indicates the block whereto the various binding posts are secured. The valve operating mechanism thus far described forms no part of the present invention except as it may be in combination with the controlling mechanism for the motor now to be described.

As shown in Fig. 1 the shaft of the rotor 18 of the valve-operating motor is extended as indicated at 35. Affixed to the shaft extension 35 is a ratchet 36, the pawl therefor being indicated at 37. The pawl is mounted on a disk or plate 38 which is secured to the side of a gear 39 which is mounted for rotation on the shaft extension 35. A spring 40 carried by the plate 38 serves to hold the pawl in engagement with its ratchet. 41 indicates a shaft suitably supported at its ends in bearings formed in a casing 42 secured to the main housing 43. Not-rotatably secured on the shaft 41 is a gear 44 which meshes with the gear 39. Similarly secured on the shaft is a worm wheel 45 which meshes with a worm 46 affixed to the shaft 47 of a rotor 48 of a small motor the stator or field of which is indicated at 49. This motor may be termed a governing motor. The electrical connections for supplying current to the governing motor are not shown but the arrangement will be such that when current is supplied to the main or valve-operating motor, current will also be supplied to the governing motor either from the same or a different source of supply.

The direction of rotation of the rotor 18 of the valve operating motor in opening the valve is indicated by the arrow on the ratchet 36 in Fig. 2. The rotor of the valve-operating motor can rotate to open the valve only as the rotor 48 of the governing motor is rotated and hence the valve 9 can be opened as slowly as may be desired by proper control of the governing motor. This motor is a simple constant speed motor of any preferred construction.

The pawl and ratchet between the two motors is for the purpose of allowing the valve spring 10, through the intermediate gear train, to reverse the direction of rotation of the rotor 18 when current to the valve-operating motor is cut off, it being understood that said spring normally tends to close the valve.

In certain types of gas burners there is provided a damper designed to be opened when the gas supply valve is opened. To permit the damper to be opened by the valve operating mechanism there is provided a lever 50 pivoted as at 51 and suitably connected to the top of the valve stem rack as by a fork connection as shown in Fig. 1, it being understood that the outer end of the lever is appropriately connected to the damper.

As will be readily appreciated from the foregoing description, the invention is in the nature of an attachment for a type of electric valve now on the market. To apply the invention it is only necessary to extend the motor shaft to provide the extension 35 for the reception of the elements to be mounted thereon. The casing 42 forms the support for the governing motor and is readily secured to the main housing 43.

It will, of course, be readily appreciated that the arrangement of gearing between the governing motor and the valve-opening motor or prime mover may be considerably varied without departing from the spirit of the invention. Thus, the worm gear 45 might well be mounted on the motor shaft extension 35, provision being made for an over-running clutch of appropriate form. However, by providing the gear train as shown, the governing motor may be a relatively small and simple affair with consequent saving in cost of manufacture.

While the prime mover for opening the valve is preferably an electric motor, nevertheless such mover may in certain instances be a spring motor and the expression prime mover as used in the appended claims is, therefore, intended to cover not only a rotary electric motor but also such other motors as would rotate at high speed if unrestrained.

Instead of rotary electric motor for controlling the operation of the valve-operating motor there may be provided a motor of the reciprocating type as shown in Fig. 4. In this view, parts similar to those in the other view are designated by the same reference characters. In place of the gear 39 there is provided a pinion 39′. Meshing with pinion 39′ is a gear 44′. Affixed on the same shaft as gear 44′ is a pinion 52. In mesh with pinion 52 is a rack 53 supported by a roller 54. Connected to the rack 53 is a rod 55 which is slidably mounted in a bearing 56 formed in the side wall 43′ of the casing 43. Secured to the side wall 43′ is a receptacle 57. Positioned within the receptacle 57 is a cup-type bellows 58 the rim thereof being flanged and secured to the flange of the receptacle 57 in a fluid tight manner. The outer end of the rod 55 is connected to the closed end of the bellows 58 for movement therewith. The space between the bellows 58 and receptacle is filled with a heat-expansible fluid such as alcohol. When the fluid expands the bellows will contract. The receptacle is provided with a leg 57′ about which is wrapped an electric heating element 59. When current is supplied to the valve-operating motor, current will also be supplied to the heating element whereupon the fluid surrounding the bel-

lows will gradually compress the latter and thus permit the rack 53 to release the valve operating motor for rotation as will now be readily understood. The bellows is a metal bellows and is stiff enough to prevent the valve-operating motor from contracting it. It will of course be understood that by regulating the heating effect on the fluid about the bellows, the rate of opening of the valve can be controlled as desired. Fluid operated motors of this type are commonly known as vapor motors. It will of course be understood that when current is cut off to the valve-operating motor, current will also be cut off to the heating element 59 whereupon the spring 10 will immediately close the valve.

What I claim is:

1. The combination with a valve and a prime mover for opening the valve, of a second prime mover and self-locking gear mechanism coupling the two prime movers in such a manner that unless the second prime mover is actuated the valve-opening prime mover will be incapable of opening the valve, and means embodied as part of said mechanism permitting said valve to close when power is cut off from the valve-opening prime mover.

2. The combination with a valve and a prime mover for opening the valve, of a second prime mover, and means comprising an over-running clutch and screw drive mechanism coupling said prime movers whereby the valve-opening prime mover is free to move toward valve closing direction but is not free to move in a valve-opening direction unless the second prime mover is actuated.

3. The combination with a valve and a prime mover tending to rotate at high speed when actuated for operating the valve, of a second prime mover capable of restraining the speed of the first prime mover and a screw drive connection between the second prime mover and the first prime mover, said second prime mover comprising a fluid operated motor.

4. The combination with a valve and a prime mover for opening the valve, of a second prime mover capable of restricting the action of the first prime mover, and a rack and pinion connection between said prime movers serving to prevent operation of the valve-opening prime mover unless the second prime mover is actuated.

5. The combination with a valve and a rotary motor for opening said valve, of a second motor capable of restraining the operation of the first motor, said second motor being adapted to produce reciprocating rectilinear motion, and a rack and gear connection between said motor serving to prevent operation of the rotary motor unless the second motor is actuated.

6. The combination with an electric motor tending to rotate at high speed when actuated, of means for restraining the speed of the electric motor comprising a second motor, and a self-locking mechanism coupling the two motors whereby the electric motor is free to rotate in one direction but is not free to rotate in the other direction unless the second motor is actuated.

7. The combination with a valve and a prime mover operable to open said valve and tending to operate at high speed, of a second prime mover, an element adapted to be driven at a relatively low speed by the second prime mover, and means connected with said element for limiting the forward speed of the first mentioned prime mover but not limiting the reverse movement thereof.

In testimony whereof I affix my signature.

VILYNN O. BEAM.