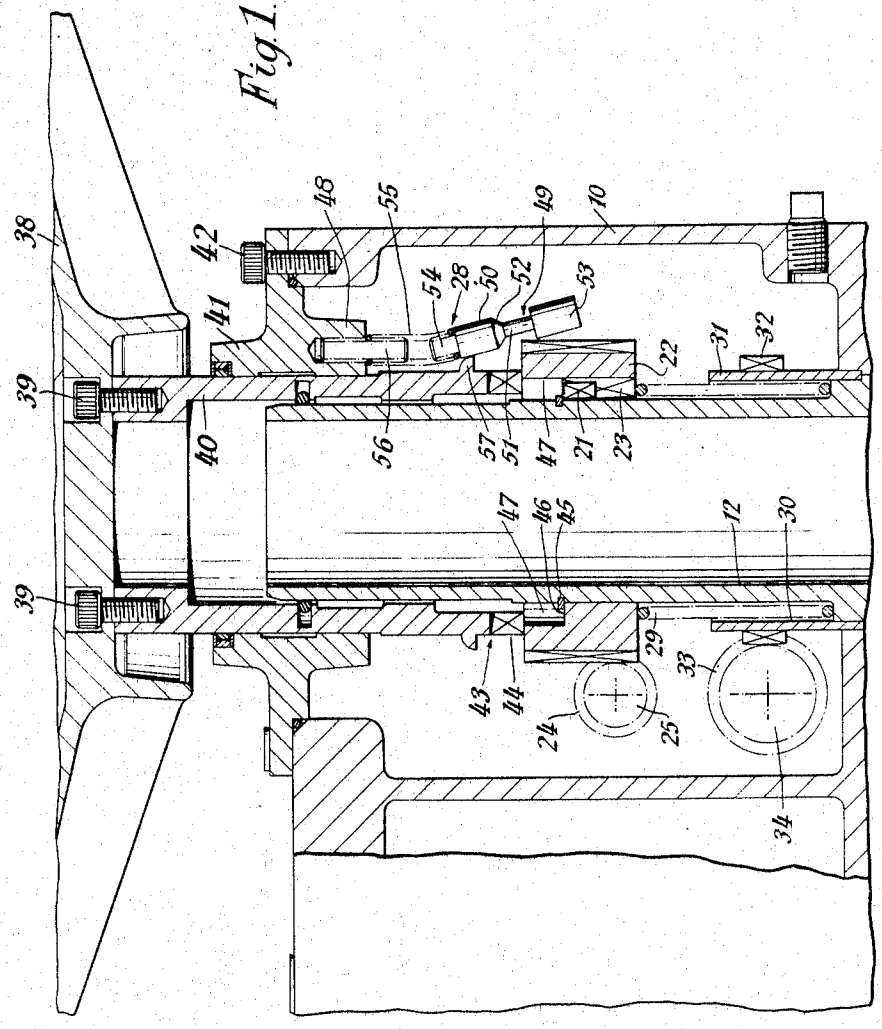
Jan. 17, 1967 P. T. M. NOTT 3,298,249

VALVE ACTUATORS

Filed Jan. 22, 1965 2 Sheets-Sheet 1

Fig. 1.



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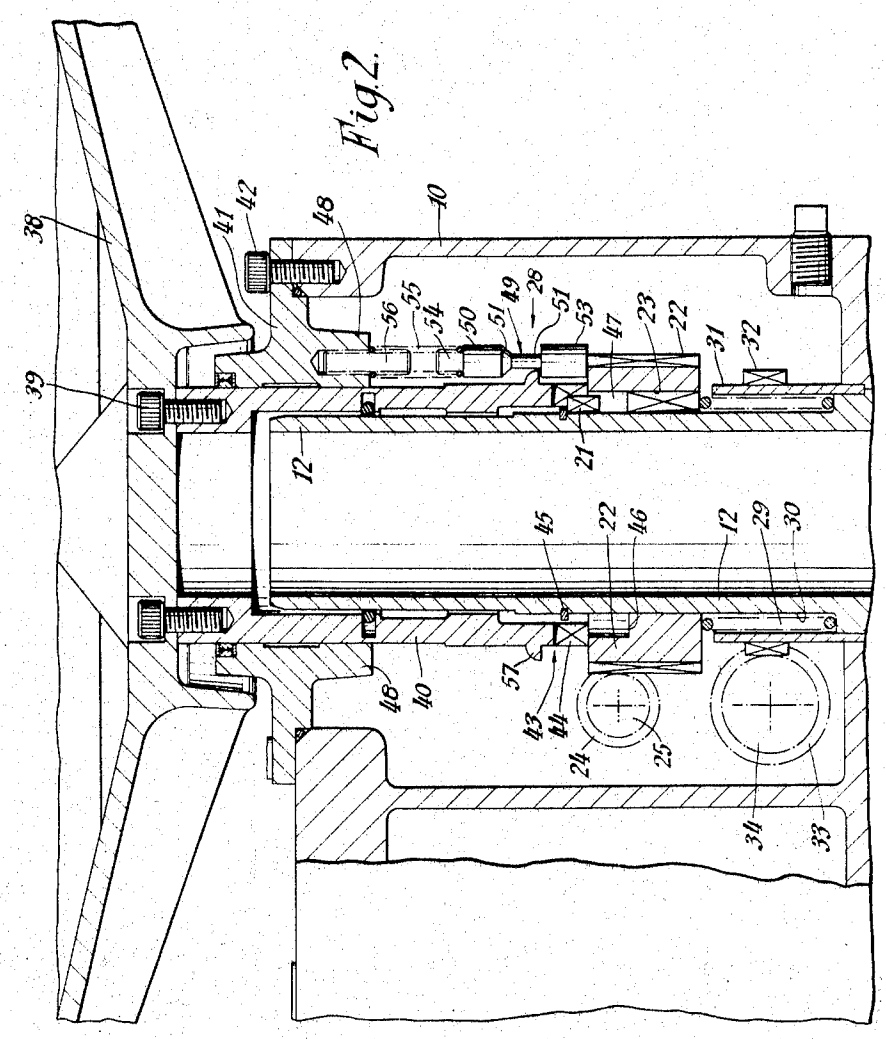
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Fig. 2.



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VALVE ACTUATORS

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8 Claims. (Cl. 74—625)

This invention relates to actuating mechanisms and more particularly to valve actuating mechanisms of the kind incorporating a drive mechanism by which the valve may be selectively operated either manually i.e. by rotation of the customary handwheel, or by power means such as an electric motor.

In known arrangements of such valve actuating mechanisms, for example prior British patent specification No. 842,581, a clutch member is provided which is movable axially by a hand lever in one direction to couple the output shaft or valve spindle to a handwheel for manual operation. The clutch member is automatically moved in opposite direction to reset the actuator for power operation upon energisation of the electric motor which causes the disengagement of retaining means normally holding the clutch member in driving engagement with the handwheel.

An improved and greatly simplified drive mechanism of the kind set out above is described and claimed in U.S. Letters Patent No. 3,198,033. In this later patent specification we have described a drive mechanism in which the manual operation is controlled directly by the handwheel. This improved arrangement is obtained by providing the output shaft or spindle of the valve actuator with a key or like driving member which is normally engaged by the power valve operating means. The manual valve operating means, i.e. the handwheel and its spindle, is movable to engage the driving member and at the same time to disengage the power valve operating means therefrom. The manual valve operating means is held in engagement with the driving member by a retaining device which is released when the power means is operated so as to allow the power means to re-engage the driving member and to disengage the manual valve operating means therefrom.

The object of the present invention is to provide an improved retaining device for permitting the manual valve operating means to be retained in engagement with the driving member on the output shaft or spindle of the actuator. As such the invention provides an improvement in or modification of the actuating mechanism described and claimed in U.S. Letters Patent No. 3,198,033.

In U.S. Letters Patent No. 3,198,033 a valve actuator is described and claimed which has an output shaft or spindle for actuating the valve, the shaft or spindle carrying a key or like driving member which is normally engaged by a power valve operating means, which comprises an electric motor or the like provided with a driving shaft having a worm mounted thereon in driving engagement with a wormwheel which is axially movable on the output shaft for engaging the key or like driving member, for example under the action of a spring or other resilient means. A manual valve operating means, e.g. a handwheel, is also movable to engage said key or driving member and at the same time to disengage the wormwheel of the power valve operating means therefrom. The manual valve operating means is held in engagement with the key or like driving member by a retaining device which is released when the power means is operated so as to allow the wormwheel to re-engage the key or like driving member and to disengage the manual valve operating means therefrom.

According to the present invention a valve actuator as described above is characterised by the fact that the retaining device comprises a resilient member which engages the upper surface of the wormwheel of the power operating means so as to hold the wormwheel out of engagement with the key or like driving member and allow the manual operating means to remain engaged until the power means is energised. Upon energisation of the power means the resilient member is urged tangentially to permit the return of the wormwheel under the action of its spring to its driving position in which the wormwheel engages with the key or like driving member on the output shaft or spindle. As a further feature of the invention the resilient member is formed with a conical ramp or other cam surface thereon which is engageable by an annular lip or flange on the handwheel sleeve or spindle, whereby movement of the handwheel sleeve or spindle to its inoperative position causes the annular lip or flange to cam the resilient member outwardly away from the wormwheel during its subsequent rotation by the power means.

In the preferred embodiment of the invention the resilient retaining member comprises a coiled spring attached at one end to a threaded rod mounted in the cover of the actuator casing and at its other end to a pawl having an enlarged head portion for engaging the upper surface of the axially movable wormwheel. The conical ramp or other cam surface is formed on the pawl at its upper part adjacent its connection to the spring and the cam surface is separated from the enlarged head portion by an intermediate section of reduced diameter for receiving the annular lip or flange on the handwheel sleeve or spindle during manual operation of the actuator.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 is a sectional elevation through the upper part of an actuator in accordance with the invention showing the parts in position for power operation; and

FIGURE 2 is a similar view showing the parts in position for manual operation.

The present invention is particularly applicable to a valve actuator of the type described and claimed in U.S. Letters Patent No. 3,198,033. In the drawings only those parts of the actuator necessary for an understanding of the invention are shown and reference should therefore be made to U.S. Letters Patent No. 3,198,033 for detailed information on the actuator construction.

Referring to the drawings it will be seen that the actuator comprises a main casing **10** which is positioned substantially vertically. The lower part of the casing **10** is provided with a closure plate (not shown) which has an outlet therein for the lower end of the main hollow output shaft **12** which extends vertically in the main casing as shown in the drawings. The output shaft **12** is rotatably mounted in the casing in suitable bearings and at its upper end it is provided with one or more projecting keys or like driving members one of which is shown by the reference **21**. Normally the driving key **21** is maintained in driving engagement with a wormwheel **22** which is slidable axially on the outside of the shaft **12** and which is formed with an axial slot **23** which receives the driving key **21** when the parts are in driving connection. The wormwheel **22** is at all times in driving engagement with a worm **24** which is mounted on the driving shaft **25** of a reversible electric motor (not shown) which is mounted in a horizontally located casing extending from the main casing **10**.

During power operation of the electric motor shaft **25** the worm **24** will be in driving engagement with the lower portion of the wormwheel **22** as shown in FIGURE 1 of the drawings so that the drive from the motor

will be transmitted to the output shaft 12 through the driving key or keys 21 to operate the output spindle of the actuator. In FIGURE 2 of the drawings the wormwheel 22 is shown in its lowermost position in which it is disengaged from the driving key 21. The wormwheel 22 is held in this position by a retaining device shown generally by the reference 28 and which will be hereinafter described. When the retaining device is disengaged from the wormwheel 22 as shown in FIGURE 1 of the drawings the wormwheel is moved upwardly into driving engagement with the key 21 by means of a heavy spring 29 which is mounted in an internal annular slot 30 in a lower sleeve 31 secured to the output shaft 12 for rotation therewith. The sleeve 31 is provided with a worm 32 which drives a wormwheel 33 mounted on a shaft 34 which is thereby rotated during rotation of the output shaft 12 and which is adapted to drive ancillary equipment such as limit control switches.

The manual operation of the actuator is performed by a handwheel 38 which is mounted coaxially about the output shaft 12. The handwheel 38 is fixed by screws 39 to the top of a hollow shaft or sleeve 40 which extends into a closure plate 41 which is secured by bolts 42 at the top of the casing 10. The lower end of the sleeve 40 snugly surrounds the top of the output shaft 12 and is movable rotatably and axially relatively thereto. The lower end of the sleeve 40 is formed with a skirt or flanged portion 43 the lower edge of which is positioned to engage the top surface of the wormwheel 22. The skirt portion 43 is cut away to form a number of annular slots 44 and which are adapted to receive the driving keys 21 on the output shaft 12.

As previously mentioned the wormwheel 22 is normally held in driving engagement with the keys 21 by means of the spring 29 as shown in FIGURE 1 of the drawings. The upper limit of movement of the wormwheel under the action of the spring 29 is determined by the circlip or annular stop member 45 mounted in the output shaft 12 which engages the surface 46 in an annular groove 47 formed in the upper surface of the wormwheel adjacent the output shaft 12. In the power position of the wormwheel 22 as shown in FIGURE 1 the driving keys 21 have been received in the annular groove 47 and have then moved into engagement with the axial slots 23.

To operate the actuator manually the operator merely depresses the handwheel 38 downwardly so that the skirt portion 43 of its sleeve 40 engages the wormwheel 22 to move the wormwheel downwardly against the action of the spring 29 until it is disengaged from the driving keys 21. Further downward movement of the handwheel 38 now drivably engages the slots 44 in the skirt portion 43 of the sleeve 40 with the keys 21 on the output shaft 12. This position is shown in FIGURE 2 of the drawings where it will be seen that the handwheel sleeve is in driving engagement with the keys 21 while the wormwheel 22 is in its lowermost inoperative position. It is to be noted that the worm 24 on the motor shaft 25 is still in driving engagement with the wormwheel 22.

In order to maintain the actuator in its manually operable condition as shown in FIGURE 2 of the drawings there is provided the retaining device as previously mentioned and which is indicated generally in the drawings by the reference numeral 28. The retaining device is mounted in the boss 48 depending from the cover plate 41 around the handwheel sleeve 40. The retaining device 28 comprises a latch device which is mounted on a fixed part of the casing of the actuator and is adapted to engage the upper surface of the axially movable wormwheel 22 when the wormwheel is in its lowermost position as depressed by the downward movement of the handwheel 38, so as to retain the wormwheel in its lowermost position as indicated in FIGURE 2 of the drawings.

The retaining device 28 comprises a pawl 49 having two sections 50 and 51 of different diameter connected by a conical ramp or annular cam section 52. When positioned vertically the pawl 49 has the section 51 of smaller diameter lowermost and this section is provided with an enlarged head portion 53 for engaging the upper surface of the axially movable wormwheel 22. The upper section 50 of larger diameter is provided with a short extension 54 of reduced diameter and which is threaded or otherwise grooved for receiving one end of a coiled spring 55 or a similar resilient device which is thereby attached firmly thereto.

The other end of the coiled spring 55 is similarly firmly attached to the lower end of a short threaded rod 56 which is spaced from the retaining pawl 49 and which has its upper end screwed into the boss 48 depending from the top cover 41 of the actuator.

The arrangement as described provides a pawl 49 which by reason of the intermediate spring section 55 provides a resilient retaining device which under normal operating conditions, at all times urges the pawl to its vertical position as shown in FIGURE 2 of the drawings. When the wormwheel 22 has been depressed by the handwheel sleeve 40 the pawl 52 automatically assumes a vertical position and the subsequent compression of the spring 55 due to the action of the spring 29 on the lower surface of the wormwheel 22, provides a substantially rigid vertical member which under normal conditions will maintain the wormwheel 22 in its lowermost position as shown in FIGURE 2. It will, however, be appreciated that energisation of the electric motor will immediately rotate the wormwheel 22 so that the pawl portion 49 of the retaining device 28 will be moved tangentially as permitted by the resilient connection through the spring 55 with its connection to the actuator structure.

It will be appreciated that as the wormwheel 22 moves upwardly due to energisation of the electric motor the pawl section 49 would normally still rest on the upper surface of the wormwheel 22 and to prevent this the cam surface 52 is provided so as to enable the pawl 49 to be moved outwardly so as to clear the rotating wormwheel 22. This outward movement of the pawl 49 is obtained by forming an annular lip or flange 57 on the handwheel shaft or sleeve 40 so that as the sleeve moves upwardly, under the action of the wormwheel 22 and its spring 29, the annular flange or lip will first engage the conical ramp or cam 52 of the pawl 49 so as to move it outwardly and this position is then maintained by the engagement of the annular lip or flange 57 with the upper portion 50 of the pawl of larger diameter (FIGURE 1).

The present invention provides a greatly simplified form of retaining device which is easily mounted and which is simple in operation. It will be appreciated that the arrangement further provides a positive means of disengaging the handwheel operation of the actuator without the necessity of energising the electric motor. In U.S. Letters Patent No. 3,198,033 it is, of course, necessary to energise the electric motor in order to release the retaining pawl described in that specification. According to the present invention this is not necessary as the operator can pull the handwheel 38 upwardly and as the handwheel shaft or sleeve 40 is moved thereby the annular lip or flange 57 engages the conical ramp or cam section 52 of the pawl 49 so as to force it radially outwardly so that the wormwheel 22 is immediately released to move upwardly under the action of its spring 29 to engage the driving key or keys 21 on the output shaft 12.

It will, of course, be appreciated that more than one retaining device 28 may be provided around the handwheel shaft or sleeve 40 and this will depend generally upon the size of the valve actuator construction.

I claim:

1. A valve actuator comprising a casing, an output shaft for actuating the valve, at least one driving member mounted on said output shaft, power valve operating means engaging said driving member for imparting a driving torque thereto, said power valve operating means comprising a wormwheel carried coaxial with and about said output shaft and axially movable between first and second positions relative to said output shaft, a shaft with a worm mounted thereon adapted to be driven by a motor, said wormwheel having an axial dimension such that said worm engages said wormwheel when said wormwheel is in its first and second positions, first resilient means for biasing said wormwheel toward its first position, a manual valve operating means axially movable between first and second positions relative to said output shaft and having a lower end contacting the upper end of said wormwheel, said lower end including means for engaging said driving member for applying a driving torque thereto, said wormwheel engaging said driving member when in its first position, said manual operating means being out of engagement with said driving means when in its first position, said manual operating means being adapted to move said wormwheel downward out of engagement with said driving member against the biasing action of said first resilient means when it moves from its first to its second position and engage said driving member when in its second position, and a retaining device comprising a second resilient means including a resilient member mounted on the casing of said actuator for engaging the upper surface of said wormwheel when said manual valve operating means is in its second position so as to hold said wormwheel in its second position against the bias of said first resilient means whereby said manual operating means may remain in its second position, said manual valve operating means adapted to be manually moved from its second position to its first position and including means for disengaging said resilient member from the upper surface of said wormwheel so as to allow said wormwheel to return to its first position and into engagement with said driving means when said manual valve operating means is so moved, said resilient member also being adapted to disengage the upper surface of said wormwheel allowing it to return to its first position into engagement with said driving means upon the operation of said wormwheel by said shaft adapted to be driven by a motor.

2. A valve actuator as set forth in claim 1, wherein said driving member comprises a key, and said wormwheel and lower end each define at least one slot for engaging said key.

3. A valve actuator as set forth in claim 2, wherein said key and slots are elongated in the axial direction.

4. A valve actuator as set forth in claim 2, wherein said manual operating means comprises a sleeve concentric with and outside said output shaft having a hand-rotatable member fixed at its upper end.

5. A valve actuator as set forth in claim 4, wherein said resilient member comprises a pawl including a depending head which contacts the top of said wormwheel when the latter is in its second position and a cam surface connected to said head, said sleeve comprising a flange for contacting said cam surface when said manual operating means is moving from its second position toward its first position so that said head is cammed from retaining engagement with said wormwheel, whereby said wormwheel is free to move toward its first position under the influence of said first resilient means and re-engage said driving member.

6. A valve actuator as set forth in claim 5, wherein said second resilient means includes a coil spring with one end threaded to a first rod mounted in the casing and the other end threaded to a second rod connected to the pawl.

7. A valve actuator as set forth in claim 6, wherein said cam surface is conical with its smaller end facing said head, an elongated intermediate section of reduced lateral dimension connected between the top of said head and the smaller end of said conical surface, the outer dimensions of said conical surface and said head overlapping the outer dimension of said flange and the outer dimension of said intermediate section being wholly without the outer dimension of said flange whereby said intermediate section provides a recess in which said flange is positioned when said manual operated means is in its second position.

8. A valve actuator as set forth in claim 7, wherein said first and second rods, said coiled spring, said conical surface, said intermediate section, and said head are axially aligned and axially immovable when said head is in retaining contact with the top of said wormwheel, whereby said coil spring enables said pawl to move from axial alignment in response to forces selectively applied to said pawl by said flange or wormwheel.

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