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ACTUATOR DESIGN

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FIG. 1

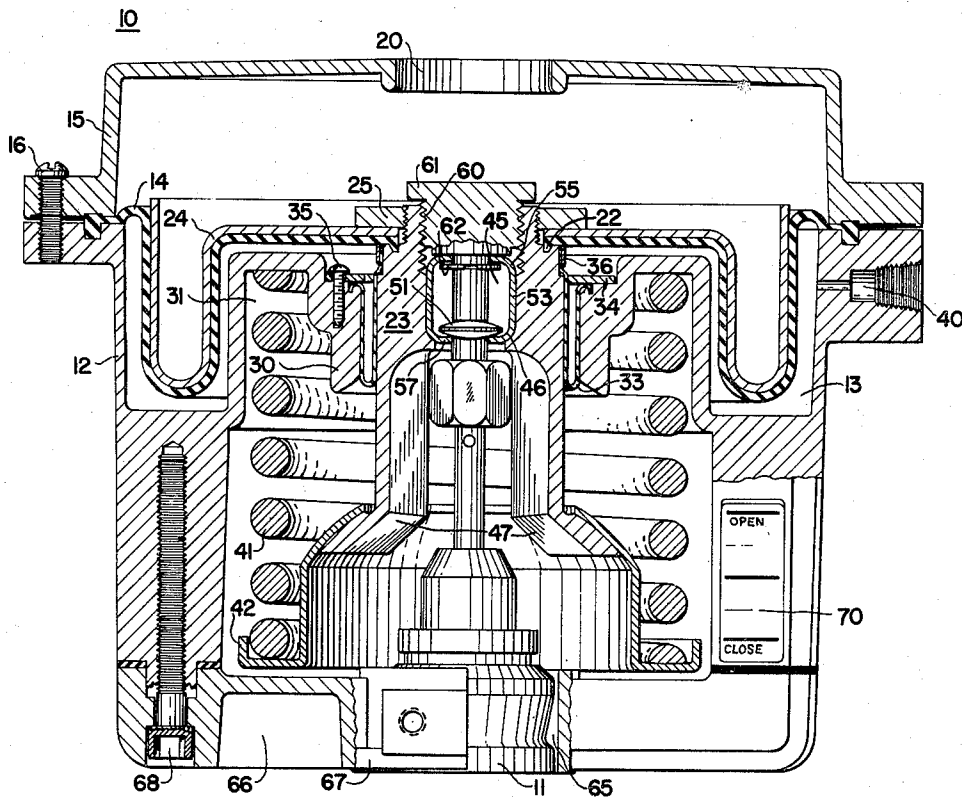


FIG. 2

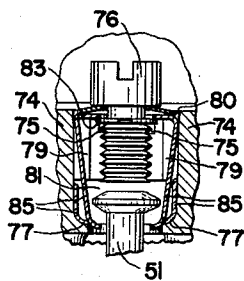


FIG. 3

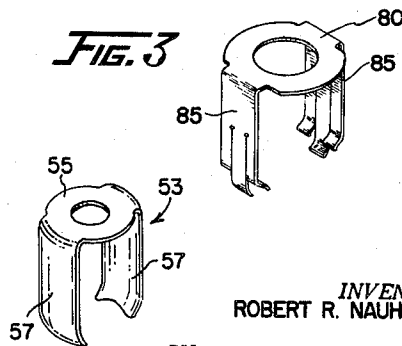


FIG. 1a

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ACTUATOR DESIGN

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My invention relates to an improved actuator design and more particularly to improvements in an actuator which facilitates simple attachment and detachment of the actuator to a device normally connected to the actuator to be operated thereby without requiring disassembly of the actuator for removal of the same.

In the past, actuators for operating devices were normally designed as separate and distinct units from the device and the interconnecting linkages between the actuator and the device made for large cumbersome combinations but permitted the disassembly of the actuator from the device without requiring disassembly of either of the units. In the attempt to reduce the overall size of the combination of an actuator and a device normally used together, the connection between the two is normally made within one or the other of the units and while this arrangement facilitated the overall reduction in size of the combination of the units, it required that to remove the actuator for repair or maintenance that one or the other of the devices had to be disassembled to facilitate detachment of the units. The present invention is directed to an arrangement of an improved actuator which is normally mounted with a device to be operated thereby such that the overall size of the and length of the combination of elements is substantially reduced and in which the connection between the two are made within one of these devices to reduce the dimensional requirements. This improved actuator design permits the disassembly of the device from the actuator without requiring that the actuator be disassembled or the device be disassembled.

It is therefore an object of this invention to provide an improved actuator design which may be readily attached or detached from the device to be operated thereby.

A further object of this invention is to provide an improved pneumatic actuator which may be readily attached or detached to the device which it is to operate.

A further object of the invention is to provide an improved connection apparatus for an actuator.

These and other objects of this invention will be apparent from a reading of the attached description together with the drawing, wherein:

Figure 1 shows a sectional view of my improved actuator together with a stem of a device to be operated thereby, the remaining details of the device being omitted for simplicity,

Figure 1A shows a perspective view of the connecting mechanism used in Figure 1,

Figure 2 shows a second embodiment of my improved actuator in partial section with details to a connection mechanism for the actuator, and

Figure 3 shows a perspective view of the connection mechanism used in Figure 2.

In the drawings, Figure 1 shows our improved actuator design in the form of a pneumatic actuator indicated generally at 10 and having attached thereto the stem 11 of a device which the actuator is to operate with

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the remaining details of the device being omitted. The device could be a valve in which the stem attached to the actuator would carry the valve operating plug (not shown). The improved pneumatic actuator 10 includes a base 12 having a recessed portion 13 at one extremity over which is positioned a diaphragm 14, the diaphragm being held in position over the recess by a cover member 15 which is generally cup shaped in form and is attached to the base through screw means indicated at 16. As shown in the drawing, a cover member 15 has an aperture 20 therein which is centrally located over the diaphragm for purposes which will be later noted.

Diaphragm 14 has a central opening with a beaded flange 22 surrounding or defining the same, the flange 22 being positioned over a cylindrically shaped support member 23. Positioned on top of the diaphragm is a forming cup member 24 which overlies the diaphragm to shape the same and provide for guiding the diaphragm as the rolling action takes place therein due to actuator movement. The diaphragm and the supporting cup 24 are held in place by a clamping nut 25 which is threaded onto the upper portion of the support 23 forming a seal for the diaphragm at this point. Base 12 also includes a cup-shaped flange or inner flange member or section 30 which defines an annular recess 31 on the under surface thereof and serves to mount an inner diaphragm 33 which is secured at its outer extremity to the flange portion 30 by a clamping plate 34 and screw means 35. The inner extremity of the inner diaphragm 33 is connected to the supporting member 23 by means of a small clamping ring 36 which is positioned with the inner rim of the inner diaphragm under the surface of the diaphragm 14 to be clamped to the supporting member 23 by means of the supporting plate 34 and screw or nut 25. The diaphragms 14 and 33 define a chamber in the recessed area 13 of the base to provide a variable chamber or working chamber for the actuator. Tapped through the base 12 is an aperture 40 providing a conduit for an air supply to this chamber to transmit the working pressure to the chamber to act on the diaphragm 14. It will be noted that the inner diaphragm 33 is similarly shaped with that of the outer or larger diaphragm 14 and is positioned between the surface of the flange, and the support 23 to provide the rolling action as the working pressure within the chamber 13 expands and moves the diaphragms upward while the inner diaphragm 33 acts as a seal to complete the chamber. Positioned in the recessed portion 31 of the inner flange 30 of the base is a return spring member 41 which is a coil spring and rests at one extremity against the flange in the recess 31 and is carried at its other extremity by an annular spring supporting member 42 which is mounted on the support member 23. Thus the return spring imparts a bias through the support members 42 and 23 to the diaphragm urging the same downward as seen in the drawing.

Support member 23 also has a recess indicated generally at 45 at the upper extremity thereof which extends through the support member and has sloped or tapered sides surfaces 46 at one extremity. Positioned in this recess portion and extending between flange like extensions 47 of the support member 23 which support the cup-shaped spring member 42 is the valve stem 11 or stem of the device to be operated. This stem carries a knob 51 which is located within the recess of 45 adjacent to sloping sides 46 thereof. Also positioned in the recess 45 is a connection member 53 which is shown in section in Figure 1, and in detail in Figure 1A. Member 53 is generally cylindrical in form having a plurality of flange extensions 57 at one extremity thereof. The extremities 57 of the connection member are positioned adjacent to knob 51 on the stem. These extensions are

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flexible and upon movement of the connection member 53 downward within the recess 45 they will be forced to bend toward and around; knob 51, as shown in Figure 1, gripping or holding the same, due to the sloping sides 46 of the recess. The opposite extremity of the connection member has a flange-like extension 55 which encircles a screw means 61 and is held in position by a snap washer 62, the screw means 61 having a threaded periphery which is adapted to be threaded into the recess moving the connection member 53 down. Thus the stem 11 is secured to the support member 23 through the knob 51 and the deformed extensions of the connection member 53 providing an operative connection between the diaphragm and the device to be operated.

Disassembly of the device is easily facilitated simply by partially withdrawing the screw means 61 retracting the flange-like extensions 57 from around the head of the knob or hub 51 releasing the stem so that it may be separated from the actuator. With this arrangement, there is no need for disassembling the diaphragm or the parts of the actuator to separate the device from the actuator. Flange-like extensions of the lower portion of the base 12, indicated at 65, mount a cover plate 66 having a centrally located aperture 67 therein. The bottom of plate or lower cover is secured to the extensions 65 of base 12 by screws 68 and this portion of the actuator is designed to mount adjacent to or be positioned on the device which is to be operated, such as the body of the valve, without further mechanical connection. The flange-like extensions 65 of the base expose the spring 41 and the support plate 42 such that its position relative to the base may be readily apparent, giving an indication of when the valve is open or closed. Suitable indicia 70 may be included on the extension 65 of base 12 to indicate the degree of opening or closing of the valve member or the degree of operation of the actuator.

With the introduction of air to the chamber 13 through the passage 40 the diaphragm 14 will move upward relative to the base 12 causing a rolling action of the diaphragm between the forming member 24 and the surface of the cover 15 with a similar action being produced in the diaphragm 33 between the surface of the support member 23 and the flange portion 30 of the base. Movement of the diaphragm will carry the support member 23 up against the force of spring 41 lifting the stem 11 of the device which is to be operated by the actuator. Attachment of the stem may be readily made merely by inserting the knob 51 of the stem 11 into the recess 45 and moving the screw 61 into the recess at the upper extremity of the supporting member 23 to deform the connection member 53 causing the flange-like extension 57 at the extremity thereof to bend around the knob securing the stem to the support member 23 and hence the diaphragm 14 while the extension 55 is held to the screw 61. Disconnection may be made merely by removal of the screw releasing the clamping force on member 53 which results in a withdrawal of the flange-like extensions 57 away from the knob. The modification or embodiment shown in Figures 2 and 3 is substantially the same as that of Figure 1 except for the connection member and hence the remaining details of the actuator are omitted in Figures 2 and 3 since this will be the same as in Figure 1. A portion of a support member 74 (corresponding to support member 23 in Figure 1) is shown in Figure 2 which has instead of the general recess 45 a centrally located tapped aperture 75 into which a screw means 76 is adapted to be threaded. Extending from sides of tapped aperture and forming part of said aperture are plurality of slots 79 shown here as two slots, the sides of which are slightly sloped toward the upper extremity of the support member 74 and which are sharply curved at 77 at which point a larger recessed area 81 in support member 74 is located and into which knob 51 of the device extends. A connection

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member 80 shown in perspective in Figure 3 is attached to screw means 76 by means of back washer 83 and includes a pair of split flange-like extensions 85 having portions of different lengths which are flexible. The extensions 85 each have three parts, with the longer part located between short side parts and all with transversely extending fingers at their extremities. Each flange-like extension fits into a slot and as the screw means is threaded in aperture 75 the flange-like extensions are moved down into the slots such that the side parts of the extensions follow the sloping sides of the slots and the longer center part as it engages the curved surface 77 of the slots is deflected inwardly toward knob 51. The transversely extending fingers are positioned below the lower surface of the knob 51 to secure the same within the support member 74. Detachment of the device is accomplished in the same manner as in the preferred embodiment, that is, by a partial withdrawal of the screw means 76. Thus a simple method of connecting the detachment or attachment of the actuator to the device to be operated thereby is facilitated with this improved actuator design.

I claim as my invention:

1. In combination, an actuator having a movable member and a stationary means supporting said movable member for movement relative thereto, a device to be operated by said actuator including a movable operating member, means included in one of said members having an aperture and screw means at one extremity thereof, means including a knob on the other of said members, said members being normally positioned such that said knob is located within said aperture of said other member, and connection means including flexible flange-like extensions at one extremity thereof extending into said aperture, said screw means operating to move said connection means in said aperture causing said extensions to deflect toward and around said knob connecting said members in operative relationship.
2. In combination, an actuator having a movable member and a stationary means supporting said movable member for movement relative thereto, a device to be operated by said actuator including a movable operating member, the movable member of said actuator having an aperture and screw means in one extremity thereof, means including a knob on the operating member of said device, said members being normally positioned such that said knob is located within the aperture of said actuator member, and connection means including flexible flange extensions at the extremity thereof positioned in said aperture, said screw means operating to position said connection means in said aperture causing said extensions to deflect toward and around said knob connecting said members in operative relationship.
3. In combination, an actuator having a movable member and a stationary means supporting said movable member for movement relative thereto, a device to be operated by said actuator including a movable operating member, the movable member of said actuator having an aperture therethrough and movable means in one extremity thereof, means including a knob on the operating member of said device, said members being normally positioned such that said knob is located within the aperture of said actuator member, and connection means having flange like extensions at the extremities thereof extending said aperture, said movable means being operative to position said connection means causing said extensions to deflect toward and around said knob connecting said members in operative relationship.
4. In combination, an actuator having a movable member and a stationary means supporting said movable member for movement relative thereto, a device to be operated by said actuator including a movable operating member, the movable member of said actuator having an aperture therethrough and screw means in one extremity thereof, means including a knob on the operating

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member of said device, said members being normally positioned such that said knob is located within the aperture of said actuator member, and a cylindrically shaped member having flange-like extensions at the extremities thereof positioned in said aperture, said screw means operating to move said extensions of said cylindrical shaped member toward and around said knob connecting said members in operative relationship.

5. In combination, a diaphragm type actuator having a diaphragm type chamber and support means enclosing the same, a device to be operated by said diaphragm type actuator and including a movable member, means included in the diaphragm of said actuator having an aperture therethrough and screw means at one extremity thereof, hub means positioned on the moveable member of said device and normally positioned in the aperture of said diaphragm, and connection means including flexible extension means extending into said aperture adjacent said hub, the screw means in said diaphragm operating to move said extension means toward said hub means with the extremity of said extension means being positioned around said hub means connecting said diaphragm and said operating member in operative relationship.

6. In combination, an actuator having a movable member and a stationary means supporting said movable member for movement relative thereto, a device to be operated by said actuator including a movable operating member, a recess included in one of said members, hub means included on the other of said members and nor-

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mally positioned in said recess, connection means having flange-like extensions positioned in said recess adjacent said hub means, and movable means positioned in said recess and mounting said connection means being operative to move said flange-like extensions of said connection means around said hub means to clamp said hub means to said member having said recess.

7. In combination, a diaphragm type actuator having a movable diaphragm and a casing means surrounding the same, a device to be operated by said diaphragm type actuator including a movable stem, means including a recess attached to said diaphragm, hub means positioned on said stem and normally located in said recess, connection means having flange-like extensions positioned in said recess adjacent said hub means, and screw means threaded into said means including said recess of the diaphragm and operative to position said extensions to displace the same around said hub means and clamp said hub means to said diaphragm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,468,849	Trainor	May 3, 1949
2,496,215	Jones	Jan. 31, 1950
2,524,446	Johnson	Oct. 3, 1950
2,590,175	Hajdu	Mar. 25, 1952
2,595,211	Le Clair	Apr. 29, 1952
2,608,211	Tlorburn et al.	Aug. 26, 1952