March 13, 1962 LOUIS BENJETSKY NOW BY JUDICIAL CHANGE OF NAME LOUIS BENSON 3,025,372

RECIPROCATING TYPE ACTUATING MEANS

Filed Aug. 7, 1958

Fig. 1

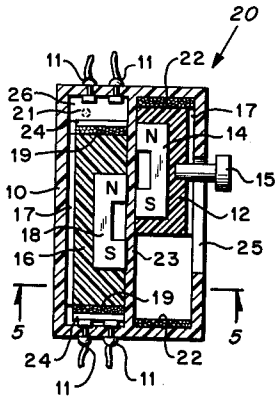


Fig. 2

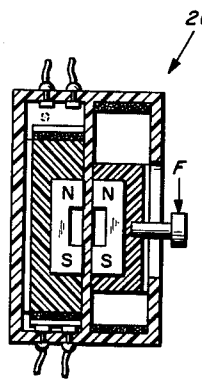


Fig. 3

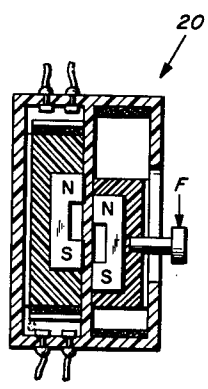


Fig. 4

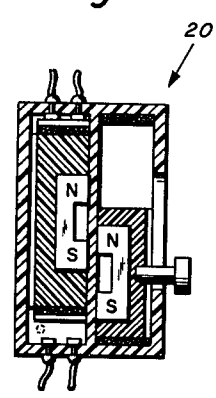
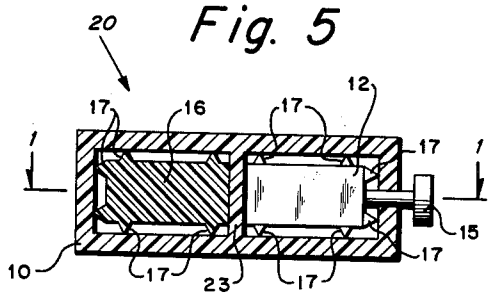


Fig. 5



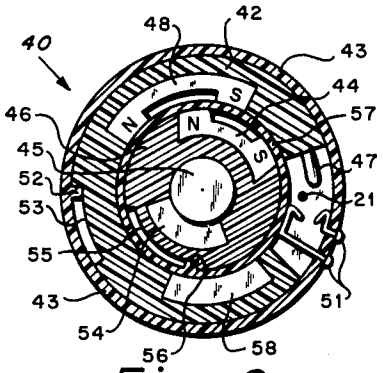
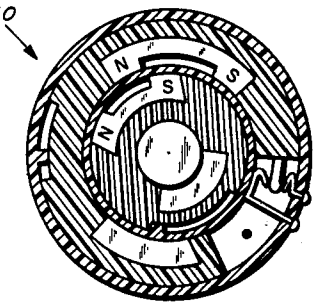


Fig. 6

Fig. 7



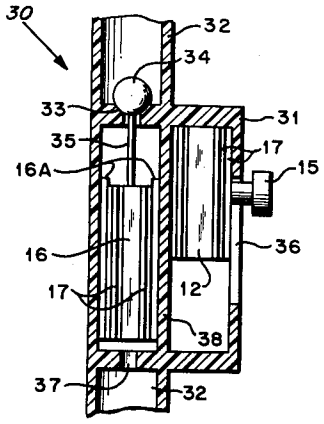


Fig. 8

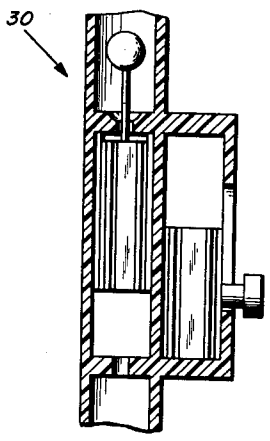


Fig. 9

United States Patent Office 3,025,372 Patented Mar. 13, 1962

3,025,372

RECIPROCATING TYPE ACTUATING MEANS

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Filed Aug. 7, 1958, Ser. No. 753,831
5 Claims. (Cl. 200—87)

The present invention relates to a reciprocating device, and more particularly to a magnetic reciprocating device in which translational movement of one driver member in a given direction effects opposing directional movement of a cooperating slave member without the use of interconnecting linkage between the two members.

The ensuing specification will discuss at length the incorporation of such a device into, first, electric switches and, secondly, a flow restricting valve, though the uses as described do not purport to be exhaustive.

An object of the instant invention is to provide a reciprocating device completely devoid of any mechanical connecting linkage between the principal cooperating members.

A second object is to provide moisture-proof, waterproof explosion-proof, positive acting electrical switching means capable of sustained operation with prolonged longevity.

A further object is to provide a positive acting flow restricting valve with no physical connection between actuator and actuated members.

Subsequent objects and advantages will become apparent in more detail in the explanation of the annexed drawing and specification in which:

FIGS. 1, 2, 3 and 4, respectively, show sequential operation of an embodiment of the instant invention as incorporated into a linear-actuated electrical switch; whereas FIG. 1 is taken on line 1—1 of FIG. 5.

FIG. 5 is a sectional view taken on line 5—5 of FIG. 1.

FIGS. 6 and 7, respectively, show sequential operation of an embodiment of the instant invention as incorporated into a rotary actuated electrical switch.

FIGS. 8 and 9, respectively, show sequential operation of an embodiment of the instant invention as incorporated into a flow restricting valve.

Referring now to the drawing, wherein like reference numerals designate like or corresponding parts through the several views, there is shown in FIGS. 1 through 5 an embodiment of the basic inventive device as incorporated into a linear actuated electrical switch.

The basic inventive reciprocating device, as shown in FIGS. 1 through 5, consists of a housing **10** divided into two compartments by partition **23**. Contained within each compartment are permanent magnets **14** and **18**, arranged with like complementary pole faces top and bottom, intermedially molded or fitted into slidable members **12** and **16**, respectively.

Slidable member **12** is shorter in length than slidable member **16**. Handle **15**, movable in elongated slot **25**, is fixedly engaged with or may be made integral with slidable member **12**.

Operation of the basic inventive device is described as follows:

Referring to FIG. 1 in particular, permanent magnets **14** and **18** are disposed about partition **23** with the south pole S of magnet **14** attracting the north pole N of magnet **18**.

Concurrently, repelling magnetic action is taking place between the respective north poles N as well as the respective south poles S of magnets **14** and **18**. Thus, slidable members **12** and **16**, being engaged with magnets **14** and **18**, respectively, and restricted within the confines of container **10** are subjected to forces in opposing direction. These forces are still in effect even though no

movement occurs due to the restraining confines of container **10**.

Referring now to FIG. 2, a downward outside force F is applied to handle **15**, which in turn depresses slidable member **12** so that the poles of magnet **14** are aligned (N—N and S—S) and opposing those of magnet **18**.

As shown in FIG. 3, the downward outside force F acting on handle **15** has depressed slidable member **12** still further so that the poles of magnet **14** are now disaligned with the corresponding poles of magnet **18**. Once the critical positioning shown in FIG. 2 has been passed, slidable members **12** and **16** begin to move in opposing directions by virtue of a combined repelling and attractive force as described above, until movement in each respective direction is halted by the restraining confines of container **10**. This latter position is shown in FIG. 4.

Assuming now that the component positions shown in FIG. 4 are in effect, and that the ultimate positions shown in FIG. 1 are desired, mere reversal of direction of force F upon handle **15** through a comparable distance as explained above will accomplish this result.

As previously mentioned, the basic inventive concept lies within the scope of the above described operational action. Now, the description will deal with inclusion of this concept within more particularized embodiments.

Referring again to FIGS. 1 through 5 wherein a linear actuated electrical switch, generally designated by reference numeral **20**, is depicted, the operation of the components previously described remains unchanged. Upper and lower electrical contact assemblies **11** in container **10** may be incorporated as desired into suitable circuitry (not shown) which would utilize the switching operation performed by the instant invention. Of course, it may be understood that the number and arrangement of contact assemblies shown does not purport to be limiting or inclusive, since these factors are determined by the nature of the desired electrical result.

The slidable member **12**, hereinafter referred to for descriptive purposes as driving member **12** may be cushioned at either of its ultimate positions as shown within the right hand chamber of container **10** with a resilient material **22** such as foam rubber. This may be bonded to either the container **10**, as shown, or the extremities of driving member **12**.

The slidable member **16**, as shown within the left hand chamber of container **10**, hereinafter referred to for descriptive purposes as driven member **16**, may also be cushioned at its extremities with a resilient material **19** such as foam rubber.

The resilient materials **19** and **22** are optional expedients to be utilized if relatively noiseless operation is desired.

A metallic contact bridging plate **24** is secured to the resilient material **19** at either or both extremities of driven member **16** depending upon the number of contacts desired. Of course, if resilient material **19** is not utilized, the plate **24** may be secured directly to driven member **16**. The contact bridging plate **24** may also take the form of a resilient member itself, in the form of a metallic spring, though not shown as such.

The driving member **12** and the driven member **16** are provided with rails **17** for reducing friction within each chamber and for eliminating air pockets within the chamber.

The chamber shown on the left, containing the driven member **16**, may be pressurized with a gas **26**, such as air, for example, and hermetically sealed to entrap the desired pressure. This would facilitate the reduction of electrical arcing within the chamber, and would permit successfully sustained operation at all altitudes, including underwater, as well as rendering the switch explosion-proof. If desired, this chamber may be completely evacu-

ated of gas for operation at which arcing is to be stimulated.

Operation of electrical switch 20 utilizes the means previously described in the basic inventive concept, in which force F displaces driving member 12 by a certain proportionate amount, thereby causing driven member 16 to be activated in a direction opposite to that of force F. Termination of movement by driven member 16 results in a bridging of contact assemblies 11 by plate 24 to effectively close that portion of the electrical circuit.

Whereas the electrical switch shown in FIGS. 1 through 5 has dealt exclusively with linear actuation, the showing in FIGS. 6 and 7 provide for a configuration which utilizes rotary motion for actuation of the switching mechanism.

The rotary switch generally designated by the numeral 40, as will be explained later, may be designed for dynamic stability, thus providing advantageous utility for aircraft installations, where subjection to vibration, G-forces and varying altitudes will occur.

In essence, the operation of the inventive reciprocating device is of the same nature as shown in FIGS. 1 through 5. The principal deviation, however, dwells mainly in the circular configuration, which presents additional structural demands.

Container 43 is divided into two chambers by partition 57. The inner chamber houses driving magnet 44 which is fixedly disposed within rotatably sliding member 46. Knob 45 is attached to sliding member 46 to facilitate rotation of sliding member 46 in either a clockwise or counterclockwise direction.

The outer chamber houses driven magnet 48 which is fixedly disposed within rotatably sliding member 42. Metallic pin 47 is fixedly attached to one extremity of sliding member 42. Metallic spring contacts 51 are also disposed within the outer chamber to receive metallic pin 47 to thus complete the electrical continuity between contacts 51. Gas 21, within the hermetically sealed outer chamber, may be pressurized or completely evacuated depending upon the intended use of the device.

Dynamic balancing, as previously mentioned, is accomplished by the insertion of fixedly incorporated balancing weights 54 and 58 arranged opposite magnets 44 and 48 within slidable members 46 and 42, respectively.

Stop member 56, disposed within elongated slot 55, limits the arcuate travel of sliding member 46. Likewise, stop member 52, disposed within elongated slot 53, limits the arcuate travel of sliding member 42. Rails 17, similar to those shown in FIGS. 1 through 5, may be incorporated with slidable members 42 and 46, although they are not indicated in FIGS. 6 and 7.

Referring now to FIG. 6, it is noted that electrical continuity between contacts 51 is non-existent. It is also pointed out that due to the combined attractive and repulsive forces created by the relative positions of magnets 44 and 48, slidable members 46 and 42 tend to abut stops 52 and 56 in opposing arcuate directions.

As knob 45 is rotated counterclockwise, slidable member 42 is held motionless by stop 52 until the respective poles of magnet 44 reach a point immediately past alignment with the like poles of magnet 48. At this point, slidable member 42 begins and continues to arcuately rotate in a clockwise direction until stop 52 is again encountered. Slidable member 46 continues to rotate in a counterclockwise direction until stop 56 is encountered.

By this time, pin 47 has bridged the gap between spring contact members 51 and electrical continuity is effected between said contact members. FIG. 7 shows the relationship of components before slidable member 42 is seated against stop 52.

Another possible configuration into which the inventive reciprocating mechanism is employed is the flow restricting valve 30 depicted in FIGS. 8 and 9.

Here, much of the configuration of the switch 20 is utilized. The arrangement of magnets incorporated into slidable members 12 and 16 in valve 30 is identical to that shown in switch 20. Partition 38 separates and forms chambers within container 31 for reciprocal movement of sliding members 12 and 16. Tube-like extensions 32 are provided about the longitudinal ends of the chamber housing sliding member 16. Opening 37 and valve seat and opening 33 offer compatible passage of either liquid or gas between extension 32 and the left hand chamber. Rod 35, attached to one extremity of slidable member 16 extends through seat and opening 33, and has connected to its other extremity ball 34. Rails 17 on slidable members 12 and 16 are provided as in switch 20.

In operation, as shown in FIG. 8, ball 34 effects a seal upon valve seat 33 by virtue of the magnetic forces described previously, thus preventing transmittal of liquid or gas between extension 32 and the left hand chamber at this junction. As a downward force is exerted upon handle 15 which, in turn, depresses slidable member 12, slidable member 16 is actuated in the opposite direction. This action unseats ball 34 from seat 33, thus permitting the passage of air or gas therethrough. Slidable member 16 continues its movement until stops 16A abut container 31.

It should be understood, of course, that the foregoing disclosure relates only to a preferred embodiment of the instant invention and that numerous modifications and alterations of the apparatus disclosed may be made without departing from the spirit and the scope as set forth.

The magnetic aand electrical contact members are, of course, composed of materials best suited for performance of the desired result. Containers 10, 31 and 43 and slidable encasing members 16, 12, 42 and 46 may be composed of materials such as plastic, aluminum or the like.

The slidable members, as shown, are disposed in juxtaposition about either an arcuate or longitudinal axis. This axis may appear as a wall or partition, as shown in the preferred embodiment, or simply the point of contact between the slidable members if no separation is desired.

Though the inventive reciprocating type actuating means, as shown, is utilized in the operation of, and integrated with, electrical switches and flow control valves, it should be understood that these uses are not to be construed as exhaustive. For example, the inventive device may be utilized to actuate a foreign device which is disposed within the effective scope of said inventive device.

What is claimed is:

1. A device of the character described; container means, a slave magnet unit carried by said container means for limited travel of a discrete distance along a plane, a driver magnet unit carried by said container means for limited travel in excess of said discrete distance along said plane while maintaining a substantially constant lateral spaced-apart relationship to said slave magnet unit, said slave magnet unit being a structurally free body within said container means and within the effective magnetic scope of said driver magnet unit, magnetic means on said slave magnet unit and said driver magnet unit for urging oppositely directional movement of said slave magnet unit and said driver magnet unit, partition means disposed between said slave magnet unit and said driver magnet unit to form a plurality of discrete chambers, said slave magnet unit and said driver magnet unit each being slidably guided along said partition means, said partition means being curved, stop means within said container means for limiting the distance of travel of said slave magnet unit and said driver magnet unit, counter-weight means for balancing said slave magnet unit and said driver magnet unit within said container means.

2. In the device of claim 1, electrical contact means within and protruding through said container means for connection to an outside electrical source, means on at

least one of said magnet units for opening and closing said contact means.

3. In the device of claim 2, spacer means for separating portions of said slave magnet unit and said driver magnet unit means from the inner confines of said container means.

4. In the device of claim 3, at least one of said chambers being hermetically sealed, gas entrapped within said sealed chamber being maintained at a discrete level of pressure by said seal.

5. In the device of claim 4, gas pressure within said hermetically sealed chamber to be maintained at vacuum level by said seal.

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