

Oct. 13, 1931.

R. PENN

1,827,103

DIFFERENTIAL WIDENING MEANS

Filed Jan. 28, 1929

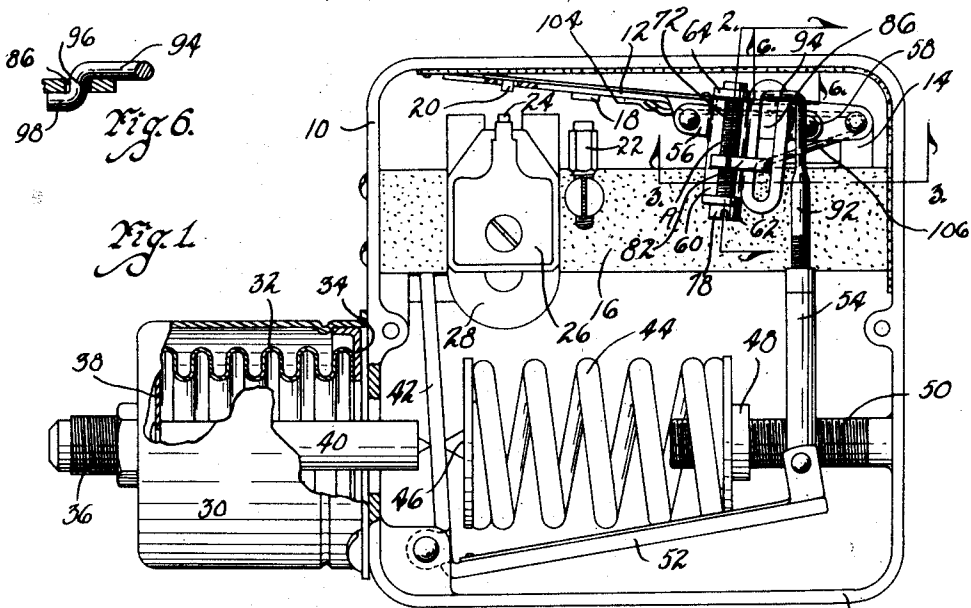


Fig. 1.

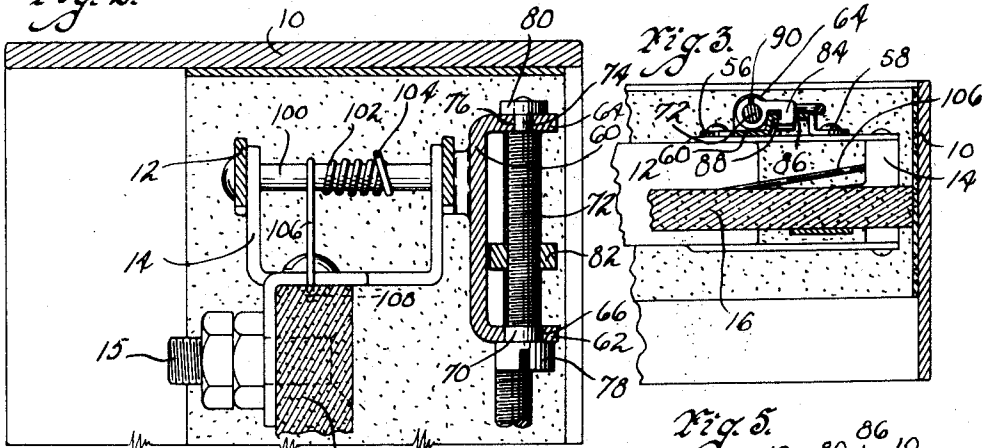


Fig. 2.

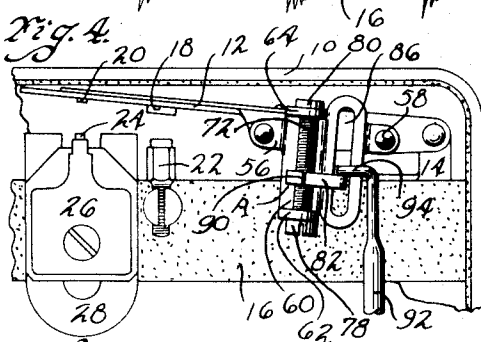


Fig. 3.

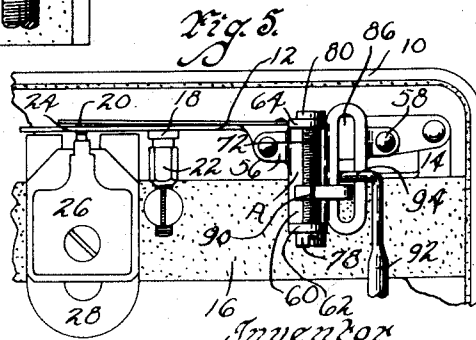


Fig. 4.

Witness
Rector Head.

Inventor
~ Ralph Penn ~
by Bair, Freeman & Sinclair
Attorneys

UNITED STATES PATENT OFFICE

RALPH PENN, OF DES MOINES, IOWA, ASSIGNOR TO PENN ELECTRIC SWITCH CO., OF
DES MOINES, IOWA, A CORPORATION OF IOWA

DIFFERENTIAL WIDENING MEANS

Application filed January 28, 1929. Serial No. 335,653.

The object of this invention is to provide a differential widening means of simple, durable, and comparatively inexpensive construction.

5 A further object of my invention is to provide in connection with a device having a predetermined minimum differential of operation, or an inherent differential of operation, a convenient means for widening such
10 differential of operation, which means is arranged to cause widening in one direction and is adjustably arranged so that the amount of widening can be varied, as desired.

15 More particularly, it is my object to provide in connection with a pressure actuated switch structure having a predetermined or minimum differential of operation, a means for widening such differential, consisting of
20 a lost motion connection between the switch and the actuating means therefor.

Still a further object is to provide in connection with a switch arm having a force acting thereupon, a means for providing a
25 second force acting thereupon in an opposite direction in such a manner that one force will overcome the other when the switch arm is moved to one side of a predetermined position, and vice versa, whereby a lost motion differential widening connection may be applied to the device.

30 With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more
35 fully set forth, pointed out in my claims and illustrated in the accompanying drawings. Although the invention is susceptible of a variety of embodiments, it is unnecessary to
40 fully describe and illustrate more than one in order to give a full understanding of the invention both from its structural and functional standpoints. Accordingly, I have illustrated a preferred and desirable embodiment of the invention in the accompanying
45 drawings in which:

50 Figure 1 is a side elevation of a switch structure to which my differential widening means is applied, parts thereof being broken away and other parts shown in section.

Figure 2 is an enlarged detail sectional view on the line 2—2 of Figure 1.

Figure 3 is an enlarged detail sectional view on the line 3—3 of Figure 1.

Figures 4 and 5 are views of a portion of Figure 1, showing the parts of the device in different positions; and

Figure 6 is an enlarged detail sectional view on the line 6—6 of Figure 1.

On the accompanying drawings, I have used the reference numeral 10 to indicate generally, a switch housing. A switch arm 12 is mounted within the switch housing 10 and pivoted to a bracket 14. The bracket 14 is supported on the bar 16, preferably of insulating material by means of a bolt 15.

The switch arm 12 carries contacts 18 and 20, which are movable with the switch arm. The bar 16 carries contacts 22 and 24 adapted to coact with the contacts 18 and 20 when the switch arm 12 is in the position shown in Figure 5. The contact 24 is mounted on a plate 26 which also serves the purpose of supporting a permanent magnet 28 relative to the bar 16. The magnet 28 is adapted to act upon the switch arm 12 for moving the same when it assumes a predetermined position.

Secured to the switch housing 10 is a bellows housing 30. A bellows 32 is mounted within the housing 30 and sealed relative thereto by means of a washer 34. A fitting 36 is mounted on the bellows housing 30 by means of which pressure from a source of pressure may be introduced into the housing surrounding the bellows 32 for acting thereupon.

The bellows 32 is provided with a head 38 to which is secured an operating pin 40. The pin engages a lever 42 and compression of the bellows 32 is opposed by a spring 44. The spring 44 has an end fitting 46 adapted to engage the opposite side of the lever 42. The spring 44 is adjustable as to tension by means of a washer 48 threaded on a pin 50. The pin 50 is secured to the switch housing 10.

The arm 42 is part of a bell crank lever having a second arm 52. The arm 52 is operatively connected by means of a link 54 with the switch arm 12. The foregoing description is of a switch structure to which my

invention, which I will now describe, may be applied.

My present invention consists of a lost motion connection between the link 54 and the switch arm 12, together with other details of construction which will hereinafter be more fully referred to.

The lost motion connection consists of a fitting A having perforated ears 56 adapted to be secured by means of rivets 58 or the like to the side of the switch arm 12. The fitting A is provided with a bar 60 having upturned ears 62 and 64. The ear 62 is provided with an opening 66 adapted to receive a shoulder portion 70 of a screw 72. The opposite end of the screw 72 is provided with a reduced portion 74 adapted to rotate in an opening 76 formed in the ear 64.

A slotted head 78 is provided on one end of the screw 72 and a collar 80 on the other end thereof. The portion of the screw 72 between the portions 70 and 76 thereof is screw threaded, as clearly illustrated on the drawings.

Coacting with the threaded portion of the screw 72 is an arm 82, whereby rotation of the screw will move the arm longitudinally relative thereto. The arm 82 is provided with an extension 84 adapted to extend through a slot 86 formed in the fitting A. A hook end 88 is formed on the extension 84, whereby rotation of the arm 82 relative to the fitting A is prevented.

Referring to Figure 3, it will be noted that the portion of the fitting A having the slot 86 is raised above the bar 60 of the fitting. The arm 82 is provided with a slot 90, whereby the arm may be squeezed before the screw 72 is inserted therethrough and thus cause frictional engagement between the screw 72 and the arm 82.

Screw threadedly mounted in the link 54 is a rod 92 having a right-angled extension 94. The right-angled extension 94 continues in an extension 96 passing through the slot 86 of the fitting A and then having a hook end 98 to normally prevent removal of the extension 96 from the slot 86. The construction of the rod 92 just described is best illustrated in Figure 6 of the drawings.

A pin 100 is provided for a pivotal connection between the switch arm 12 and the bracket 14. On the pin 100 is a spring 102 having an end 104 adapted to engage the switch arm 12 for constraining it toward switch opening position. The spring 102 is provided with another arm 106 having an end 108 adapted to be embedded in the bar 16.

Practical operation

In the operation of my device, it will be obvious that a varying source of pressure connected with the fitting 36 will cause movement of the bell crank having the arms 42 and 52 for imparting longitudinal movement

to the link 54 and the rod 92, whereby the extension 96 of the rod 92 will move in the slot 86 of the fitting A.

Assuming the parts to be in the position shown in Figure 1, upon sufficient pressure being introduced into the bellows housing 30, the rod 92 will move relative to the fitting A to the position shown in Figure 4 with the extension 96 of the rod 92 engaging the arm 82. Further movement of the rod 92 causes the switch arm 12 to move toward switch closing position and upon the pressure rising to a predetermined point, the switch will be closed, as illustrated in Figure 5.

In order to prevent the switch arm 12 from following the rod 92, due to gravity and/or the attraction of the magnet acting upon the switch arm 12, the spring 102 is provided. When the switch arm 12 is caused to assume a position substantially between open and closed position, the force of the magnet 28 (which of course is increased as the switch arm 12 approaches the magnet) is sufficient to overcome the force of the spring 102 and close the switch. Upon the magnet closing the switch, the arm 82 will leave the extension 96 of the rod 92, as clearly shown in Figure 5 of the drawings, whereby the magnet itself performs the final closing operation.

Upon pressure within the housing 30 being reduced to a predetermined point, the extension 96 of the rod 92 will engage the top of the slot 86 for moving the switch arm to open position. The magnet 28 will resist such movement, so that as the pressure continues to reduce, the spring 44 will exert extra tension on the lever 42. When this extra tension is sufficient to overcome the force of the magnet 28 acting upon the switch arm 12, the switch arm will be moved toward open position and as soon as it starts such movement, it will immediately be in a weaker magnetic field so that the switch opening movement is accelerated and given a snap action. When the switch arm reaches a point between closed and opened position, the force of the spring 102 is sufficient to overcome the weakened force of the magnet 28 acting upon the switch arm 12 for completing the opening movement of the switch.

The spring 44 is provided merely for the purpose of changing the range or setting of the device. It is obvious that a device in which no lost motion connection is provided has a predetermined differential of operation, or in other words, upper and lower limits between which the switch will open and close.

Assuming such differential of operation being two pounds, the spring 44 may be adjusted for opening the switch at ten pounds pressure and closing it at twelve pounds pressure, for example. By increasing the tension of the spring 44, the switch may be made to open at twenty pounds pressure and close at twenty-two pounds pressure, for example.

The differential of operation in each case remains the same.

It is undesirable in some instances, however, to have such a narrow differential of operation. I have therefore provided the slot connection 86 between the switch arm 12 and the rod 92. The differential of operation of the device may be reduced to a minimum by rotating the screw 72 and causing the arm 82 to assume the dotted line position shown in Figure 1. In this position, there is no lost motion.

For increasing the differential of operation to any desired degree, it is merely necessary to rotate the screw 72 for changing the effective length of the slot 86 relative to the rod 92, such as shown in the full line positions of the drawings.

The spring 102 in conjunction with the magnet 28 serves in the capacity of insuring that the switch arm 12 will remain in opened or closed position, depending upon pressure conditions.

It is obvious that my present invention may be applied to any type of switch arm or the like actuated by any movable device. Instead of a switch arm, the arm 12 could be one for operating a valve for instance and instead of pressure means for actuating the arm 12, other devices might be used which have a differential of operation, but my invention could be applied equally as well for the purpose of widening the differential of operation. The term "pressure" as used herein is intended to cover ways and means of actuating the switch arm or the like as for example the arm may be controlled as a result of temperature or by vacuum or by a float device. The term "pressure" has been used as a convenient way of illustrating a source of power or energy for operating the switch device and I do not intend to limit myself to pressure where such term is used.

The switch arm may be so set or arranged that it operates reversely of the method here described.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. The combination with an actuating means, a movable member, means for operatively connecting said means with said member and a force coacting with said movable member to influence the action thereof in varying degrees according to the position of the movable member, said movable member normally operating at a predetermined minimum differential, of means for widening such differential of operation comprising a lost

motion connection included in said means for connecting the actuating means with the movable member and means acting upon said movable member to hold it in a position where said force does not act thereupon.

2. The combination with a movable arm, a magnet adjacent thereto and actuating means for moving said arm toward and away from said magnet whereby said arm has a minimum differential of operation, of means for widening such differential of operation comprising a slotted member and a connecting member having a portion to freely travel in the slot of said slotted member, said members serving to operatively connect the movable arm and the actuating means therefor together and means to prevent said magnet from normally moving said movable arm.

3. The combination with a movable arm, a magnet adjacent thereto and actuating means for moving said arm toward and away from said magnet whereby said arm has a predetermined minimum differential of operation, of means for widening such differential of operation comprising a slotted member and a connecting member having a portion to freely travel in the slot of said slotted member, said members serving to operatively connect the movable arm and the actuating means together and spring means acting on said movable arm for causing the same to remain substantially spaced from said magnet against the influence thereof except when caused by said actuating means to assume a position relatively closer to the magnet.

4. In a device of the class described, a freely movable element, means for actuating the same, a magnet for exerting a first force on said element of a varying degree depending on the position thereof relative to the magnet, and a second force oppositely acting upon said element, whereby when the element is on one side of a predetermined position said second force is able to overcome the first force of said magnet and vice versa.

5. In a device of the class described, a freely movable element, means for actuating the same, a device for exerting a force on said element of a varying degree depending on the position thereof, a second force oppositely acting upon said element, whereby when the element is on one side of a predetermined position said second force is able to overcome the first force and vice versa, and mechanism for operatively connecting said actuating means with said movable element, said mechanism including a lost motion connection.

6. In a device of the class described, a movable element, means for actuating the same, a device for exerting a force on said element of a varying degree depending on the position thereof, a second force acting upon said element, whereby when the element is on one side of a predetermined position said second force is able to overcome the first force and

vice versa, and mechanism for operatively connecting said actuating means with said movable element, said mechanism comprising a pair of members, one of which is freely movable relative to the other and limited in such free movement.

7. In a device of the class described, an arm, a magnet adjacent said arm, resilient means to cause said arm to remain substantially spaced from said magnet except when caused to assume a position relatively closer to the magnet whereupon the magnet overcomes the force of the resilient means and draws the arm toward itself, actuating means for said arm to cause it to assume such position relatively closer to the magnet and an adjustable lost motion connection means interposed between said actuating means and said arm.

8. In a device of the class described, a pair of movable members and means for operatively connecting them together comprising a slotted element carried by one of the members, a traveler in said slot, a threaded rod journaled on said slotted element and confined against longitudinal sliding movement relative thereto, said traveler being threaded on said rod and a pin carried by the other member and movable in the slot of the slotted element from one end of such slot to said traveler.

9. In a device of the class described, a pair of movable members, means for operatively connecting them together comprising a slotted element carried by one of the members, a traveler in said slot, a threaded rod journaled on said slotted element and confined against longitudinal sliding movement relative thereto, said traveler being threaded on said rod, a pin carried by the other member and movable in the slot of the slotted element from one end of such slot to said traveler, a magnet acting upon one of the movable members to move it in one direction and a spring opposing said magnet.

10. In a device of the class described, a pair of movable members and means for operatively connecting them together comprising a slotted element carried by one of the members, a traveler in said slot, a threaded rod journaled on said slotted element and confined against longitudinal sliding movement relative thereto, said traveler being threaded on said rod and a pin carried by the other member and movable in the slot of the slotted element from one end of such slot to said traveler, and a magnet acting upon one of the movable members to move it in one direction.

11. In a device of the class described, a pair of movable members and link means for operatively connecting them together, a slotted element carried by one of the members, a traveler in said slot, a threaded rod journaled on said slotted element and confined against longitudinal sliding movement relative thereto, said traveler being threaded on said rod,

one end of said link being slidable in the slot of the slotted element from one end of such slot to said traveler.

Des Moines, Iowa, December 4, 1928.

RALPH PENN.

70

75

80

85

90

95

100

105

110

115

120

125

130