Feb. 10, 1931. M. E. HENNING 1,791,896

ADJUSTMENT SCALE FOR SWITCHES

Filed Nov. 19, 1929

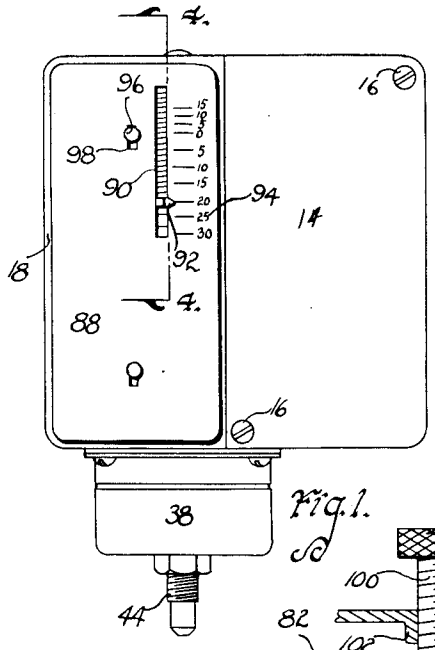


Fig. 1.

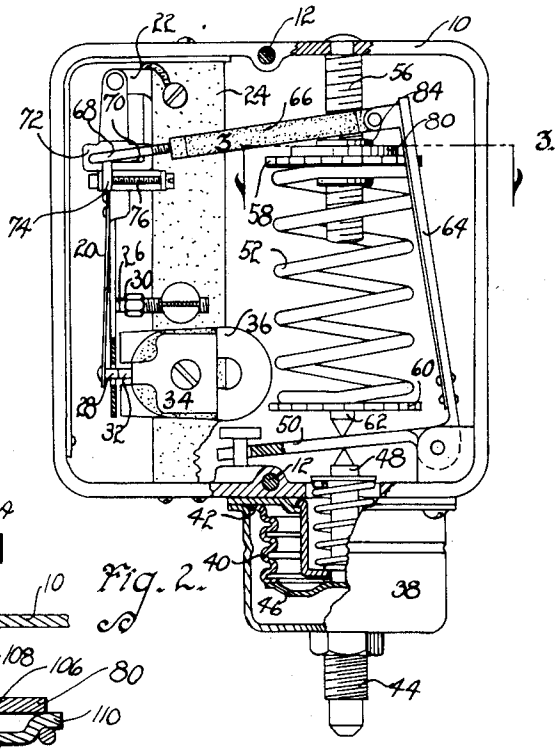


Fig. 2.

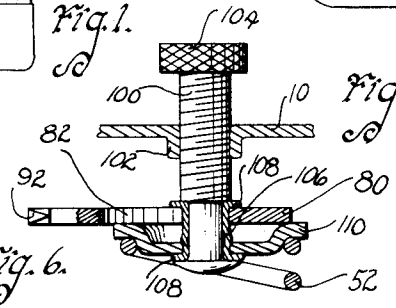


Fig. 6.

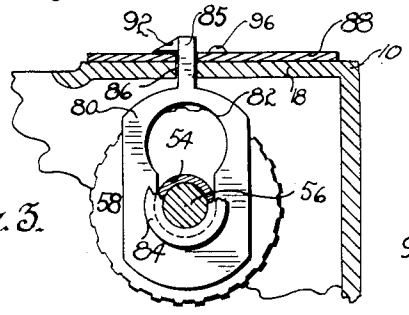


Fig. 3.

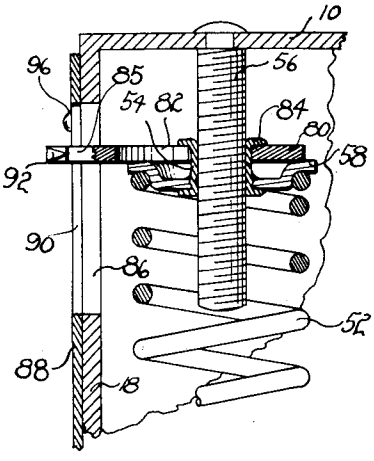


Fig. 4.

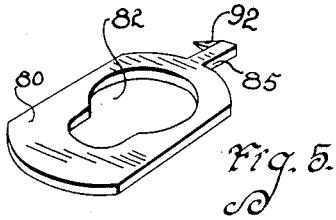


Fig. 5.

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UNITED STATES PATENT OFFICE

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ADJUSTMENT SCALE FOR SWITCHES

Application filed November 19, 1929. Serial No. 408,283.

The object of this invention is to provide in connection with a pressure actuated switch structure a visual indicating means or scale to denote the amount of adjustment required in order to cause the switch mechanism to operate at a given degree of pressure.

A further object of the invention is to provide improved means for connecting an indicating member to a pressure spring having an adjustable connection with a threaded member carried by the switch housing.

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 fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of a switch structure to which my improved adjustment scale is applied.

Figure 2 is an opposite side elevation with a face plate removed, parts being broken away and other parts being shown in section.

Figure 3 is a detail sectional view on the line 3—3 of Figure 2 illustrating the manner of mounting the indicating member relative to the adjustable parts.

Figure 4 is a detail section of the same parts on the line 4—4 of Figure 1.

Figure 5 is a perspective view of the indicating member detached.

Figure 6 is a detail section showing a modified form of means for adjusting the tension of the spring.

In the accompanying drawings I have illustrated a switch housing having an integral wall or rim member 10 of substantially rectangular formation. The housing is adapted to be closed at one side by a face plate (not shown) held in place relative to the wall member 10 by means of screws 12. The opposite face of the housing is closed in part by a face plate 14 held in place by screws 16 and in part by a wall member 18 formed integrally with the wall or rim member 10.

Within the switch housing is mounted a switch arm 20 which is pivoted to a bracket 22. The bracket 22 is supported on a bar 24, which preferably is of insulating material.

The switch arm 20 carries contacts 26 and 28 which are movable with the switch arm. The bar 24 carries contacts 30 and 32 adapted to coact with the contacts 26 and 28 when the switch arm 20 is in closed position shown in Figure 2. The contact 32 is mounted on a plate 34 which also serves the purpose of supporting a permanent magnet 36 relative to the bar 24. The magnet 36 is adapted to act upon the switch arm 20 for moving the same when it reaches a predetermined position.

Secured to the housing wall 10 is a bellows housing 38 containing a bellows 40 which is sealed relative to the bellows housing by means of a peripheral flange 42. A threaded nipple 44 is mounted on the bellows housing 38, by means of which pressure from a suitable source may be introduced into the bellows housing around the bellows 40 for acting thereupon.

The bellows 40 is provided with a head 46 to which is secured an operating pin 48. The pin engages a lever 50 and compression of the bellows 40 is opposed by a spring 52 within the switch housing.

The spring 52 is adjustable as to tension and, in the form shown in Figures 2 and 4, a collar 54 is threaded on a stud 56 carried by the housing wall 10. An adjusting washer 58 is rigidly fixed to the collar 54 and forms a support for one end of the spring 52. A similar adjusting washer 60 acts as a support for the other end of the spring 52 and the last named washer is provided with a center pin 62 engaging the lever 50 in opposition to the pin 48. The adjusting washers 58 and 60 preferably are formed with milled or fluted peripheries to facilitate the operation of adjustment by manually engaging them for causing their rotation.

The lever arm 50 is part of a bell crank lever having a second arm 64 which is operatively connected by means of a link 66 with the switch arm 20. The foregoing description is that of a common switch structure to which my invention may be applied.

This switch structure may also include a

lost motion connection between the lever arm 64 and the switch arm 20, including a rod 68 threadedly mounted on the link 66 and having a portion extending through a slot 70 in a fitting 72. The rod 68 engages between one end of the slot 70 and an arm 74 having a threaded connection with an adjusting screw 76 swiveled in the fitting 72 at one side of the slot.

The screw 76 is provided for the purpose of adjusting the position of the arm 74 and thereby regulating the amount of play of the rod 68 in the slot 70. The purpose of this adjustment is for regulating the amount of the differential between the opening and closing of the switch arm 20 and it forms no part of my present invention.

In the operation of the switch mechanism as described, it will be obvious that a varying source of pressure connected with the nipple 44 will cause movement of the bell crank having the arms 50 and 64 for imparting longitudinal movement to the link 66 whereby said rod will move in the slot 70 of the fitting 72.

Assuming the switch arm 20 to be in open position, when sufficient pressure is introduced to the bellows housing 38, the rod 68 will move relative to the fitting 72 so that it engages the arm 74. Further movement of the rod 68 causes the switch arm 20 to move toward closing position and when the pressure rises to a predetermined point, the switch will be closed as illustrated in Figure 2.

When the switch arm 20 reaches a position substantially midway between open and closed position, the force of the magnet 36, which of course increases as the switch arm approaches the magnet, is sufficient to exert a pull upon the switch arm and close the switch. When the magnet acts to close the switch, the arm 74 will move away from that part of the rod 68 extending within the slot 70, as indicated in Figure 2, and the magnet itself performs the final closing operation.

When pressure within the bellows housing 38 is reduced to a predetermined point, the end of the rod 68 will engage the end of the slot 70 for moving the switch arm to open position. The magnet 36 will resist such movement, so that as the pressure continues to reduce, the spring 52 will exert extra tension on the lever arm 50. When this extra tension is sufficient to overcome the force of the magnet 36 upon the switch arm 20, the switch arm will be moved toward open position. 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.

The spring 52 is provided primarily for the purpose of changing the range or setting of the device. In other words it determines the degree of pressure at which the switch will be operated to open position. It is obvious that the switch mechanism will have a given or predetermined differential of operation between the upper and lower limits of opening and closing, such differential being determined by the lost motion connection including the slot 70 and screw 76.

It is also obvious that the range or point of pressure at which the switch will operate in one direction is determined by the strength of the spring 52 and that this point may be varied by adjusting the tension of said spring. This adjustment is effected by turning the collar 54 and this may be accomplished manually by rotating the washer 58 or indeed by manual rotation of the washer 60, each of said washers preferably being rigidly connected to the spring 52.

Assuming that the differential of operation is two pounds, the spring 52 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 52, the switch may be opened at twenty pounds pressure and closed at twenty-two pounds pressure, for example. The differential of operation in each case remains the same, unless an adjustment is made by turning the screw 76.

My present improvement relates to a visual means for guiding the operator in adjusting the tension of the screw 52 whereby the required adjustment may be made for causing the switch to operate at a given range or degree of pressure.

A guide plate 80 is provided and it has a swivel connection with the collar 54. The swivel connection may be accomplished by forming the guide plate 80 with a key hole slot 82 which loosely engages the collar 54 between the washer 58 and a flange 84 formed on one end of the collar. Because of the key hole formation of the slot 82 the operation of assembling the plate upon collar is facilitated in that the wider end of the slot may be caused to pass over the flange 84 and then the plate is slid lengthwise so that the narrow end of the slot engages collar 54 whereby removal of the plate by movement longitudinally of the axis of the collar is prevented.

The guide plate 80 is formed at one end with a narrow arm 85 which extends through a longitudinal slot 86 formed in the housing wall 18.

A scale plate 88 is mounted on the outer face of the wall member 18 and is formed with a slot 90 registering with the slot 86. The arm 85 of the guide plate extends also through the slot 90 and is formed at its end with an indicating finger 92 which overlies one margin of the slot 90.

The scale plate 88 is formed with suitable graduations 94 extending along one margin of the slot 90 to exact with the indicating

finger 92 in determining the amount of the desired adjustment. The graduation 94 includes suitable indicia and these may extend in both directions from the zero point as the switch may at times be used for operating under vacuum as well as under pressure.

By noting the position of the indicating finger 92 relative to the graduations 94 the operator may be guided in making the desired adjustment of the spring 52, inasmuch as the guide plate 80 will necessarily move in a direction axially of the threaded stud 56 as the collar 54 is rotated on said stud. This of course causes the indicating finger 92 to travel along the slot 90 and the marginal graduations 94.

The scale plate 88 may have a slight range of adjustment on the housing wall 18 by means of screws 96 extending through slots 98, so that the scale plate may be initially located in the required position for causing the graduations 94 to conform to the tension actually exerted by the spring 52.

It is obvious that my present invention may be applied to any type of switch mechanism in which an adjustable spring is employed for causing an operation of the switch arm in one direction, the spring being adjustable by means of a rotary member. It is also obvious that any type of switch arm and operating means therefore may be employed in the switch mechanism.

In the form shown in Figure 6 the adjusting means for spring 52 consists of a screw member 100 which takes the place of the stud 56 in the other construction. The screw 100 has a threaded engagement with a tapped seat 102 formed in the wall 10 of the housing. The screw 100 extends outside of the housing and is formed with a milled head 104 by means of which it may be rotated manually for adjusting the tension of the spring 52.

The inner end portion of the screw 100 has a swivel connection with a collar 106 which corresponds with the threaded collar 54 of the form heretofore described. The collar 106 is formed with end flanges 108 and it supports a washer 110 engaging one end of the spring 52. The collar 106 also carries an indicating plate 80 in a manner similar to that described in connection with the other construction.

In the modified form according to Figure 6, the adjusting plate A travels in a direction axially of the spring 52 when the screw 100 is rotated for adjusting the tension of the spring. The indicating finger 92 of the indicating plate acts in a manner previously described to denote the pressure exerted by the spring.

It should be noted that the term "pressure" as used herein is intended to cover means for actuating the switch arm or the like in one direction in opposition to the spring 52 and that this means is so actuated that the switch arm may be employed, as for example, in connection with devices controlled by differences of temperature or pressure or operation of a float device. I have, therefore, employed the term pressure merely as a convenient way of illustrating a source of power or energy for operating the switch device in one direction and I do not intend to limit myself to the ordinary meaning of the term where it is so used.

It is also obvious that the switch arm may be so set or arranged that it operates reversely of the method here illustrated and 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. In a switch mechanism having a housing, a switch arm, a lever, a pressure actuating means acting on said lever, connections between said lever and the switch arm for actuating the latter in one direction with variation of pressure in said pressure actuating means, and a spring acting on said lever in opposition to said pressure actuating means, rotary means for adjusting the tension of said spring; an adjustment indicator comprising an indicating plate having a swivel connection with the rotary adjusting means, a part on said plate extending outside of the housing, and a graduated scale carried by the housing to coact with said part for indicating the degree of adjustment of said spring.

2. In a switch mechanism, a coil spring, a threaded member arranged axially of said spring for adjusting the tension of the latter, a collar on said threaded member, said collar engaging the spring for forming a support for one end thereof, and being movable in a direction axially of the spring as the tension thereof is adjusted, an indicating plate having a swivel connection with said collar, an indicating finger on said plate, and a graduated scale arranged to coact with said indicating finger to determine the degree of adjustment of said spring.

3. In a switch mechanism, a coil spring, a washer at each end forming supports for said spring, a stud fixed axially of said spring, an adjusting collar having a threaded engagement with said stud and rigidly connected with one of said washers, an indicating plate mounted parallel with the last named washer and having an opening to receive said collar, means for holding said indicating plate in fixed relation to said collar and the adjacent washer to cause travel of said plate longitudinally of the stud as said

collar is rotated, without corresponding turning of the plate, and means coacting with said plate for indicating the amount of adjustment of said spring by rotation of said collar.

4. In a switch mechanism, a housing, a coil spring in said housing, a washer at each end forming supports for said spring, a stud fixed axially of said spring, an adjusting collar having a threaded engagement with said stud and rigidly connected with one of said washers, an indicating plate mounted parallel with the last named washer and having an opening to receive said adjusting collar, means for holding said indicating plate in fixed relation to said collar and the adjacent washer to cause travel of said plate longitudinally of the stud as said collar is rotated, said housing being formed with a slot, an arm on said indicating plate projecting through said slot and formed at its end with a pointer, and a graduated scale arranged along one margin of said slot to coact with said pointer in determining the adjustment of said spring.

Des Moines, Iowa, September 18, 1929.

MALCOLM E. HENNING.