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G. H. HANSEN

2,307,265

SWITCH MECHANISM

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Fig. 1.

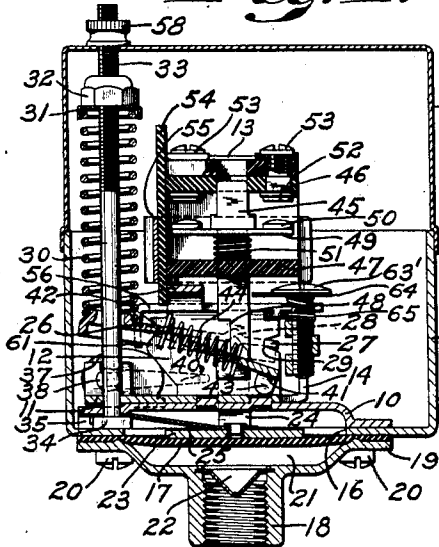


Fig. 2.

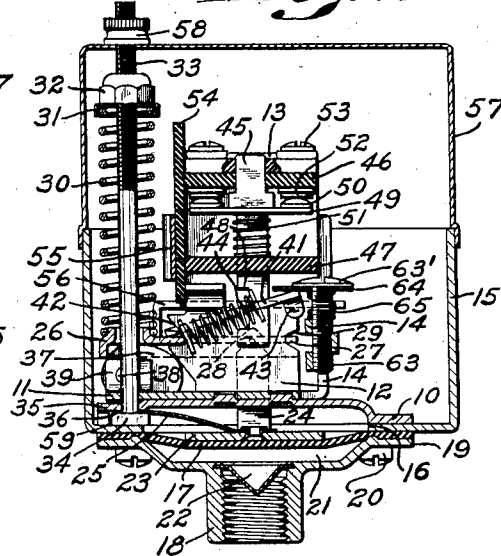


Fig. 3.

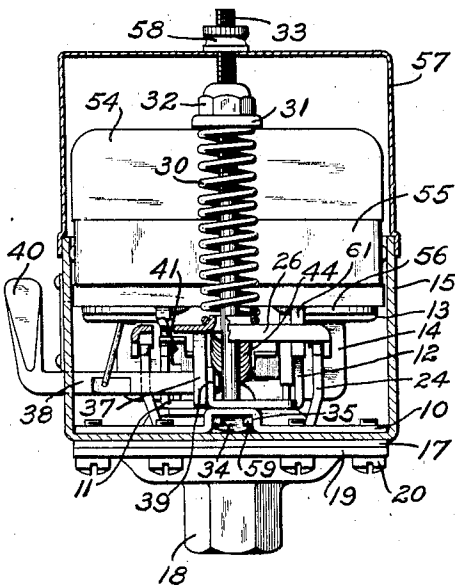


Fig. 4.

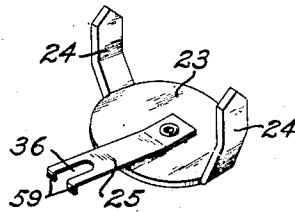
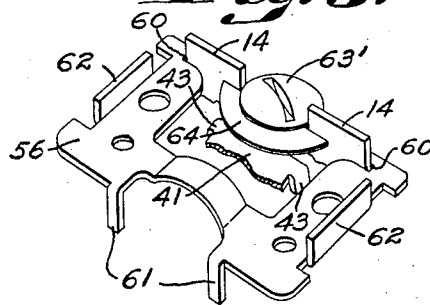


Fig. 5.



Gilbert H. Hansen INVENTOR.
BY Lieber & Lieber ATTORNEYS.

UNITED STATES PATENT OFFICE

2,307,265

SWITCH MECHANISM

Gilbert H. Hansen, Batavia, Ill., assignor to Leto M. Furnas and William C. Furnas, partners, doing business as Furnas Electric Company, Batavia, Ill.

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16 Claims. (Cl. 200—83)

The present invention relates in general to improvements in electric switch mechanisms, and relates more particularly to improvements in the construction and operation of fluid pressure actuated switch assemblages of the type shown and described in Furnas and Hansen Patent No. 2,193,127, granted March 12, 1940.

An object of the invention is to provide an improved fluid pressure operable electric switch mechanism, which is both simple in construction, efficient in operation.

In the pressure actuated electric switch assembly of the patent above identified, the fluid under pressure which operates the toggle for moving the switch contacts with a snap action, coacts with one of the toggle levers through a disk engaging the top of the diaphragm and having opposite integral side projections provided with knife edges engageable with V-shaped sockets in the opposite side portions of the toggle lever, and the side projections of the disk are normally maintained in snug coaction with the toggle lever sockets by means of a helical spiral spring located within the fluid pressure chamber and coacting with the lower face of the diaphragm. While this spring operates in a satisfactory manner when properly installed and the switch assembly is disposed in normal vertical position, it is relatively costly, rather difficult to install and to retain in proper position, and may permit the intervening disk to become displaced with respect to the diaphragm and lever sockets when the switch is disposed horizontally, thereby making the use of such springs quite objectionable under certain conditions of operation.

It is therefore a more specific object of the present invention to provide improved instrumentalities for maintaining the motion transmitting element or saddle disk of such a pressure actuated switch in proper position with respect to the toggle mechanism which actuates the switch contacts, at all times.

Another specific object of the invention is to provide an improved switch mechanism in which the motion transfer element between the diaphragm and the toggle or switch contacts, is resiliently and effectively maintained in operative position at all times.

A further specific object of this invention is to provide a simple and durable pressure switch assembly wherein a relatively loose saddle member or motion transfer disk is interposed between the pressure actuated diaphragm and the contact actuating toggle, and is constantly retained in snug and proper coaction with the toggle lever

sockets, by means disposed outside of the fluid chamber.

Still another specific object of the present invention is to provide an improved electric switch structure which can be readily assembled and dismantled, and which may also be manufactured and sold at moderate cost.

An additional specific object of the invention is to provide an improved motion transmitting connection between a fluid actuated diaphragm and a motion transfer lever, which will retain the parts in operative relationship regardless of the disposition of the mechanism.

These and other objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the features constituting the present improvement, and of the construction and operation of a pressure switch built in accordance with the invention, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the several views.

Fig. 1 is a vertical section through one of the improved fluid pressure actuated switches, showing the same released for automatic pressure actuation and with the contacts opened by fluid pressure;

Fig. 2 is a similar section through the same switch mechanism, showing the contacts closed;

Fig. 3 is a rear side elevation of the same switch assemblage, showing the contact actuating toggles locked in contact open position by the manually actuated cam;

Fig. 4 is a perspective view of the motion transmitting saddle element which is interposed between the diaphragm and toggle mechanism, and of the leaf spring for holding this element in the lever sockets; and

Fig. 5 is a perspective view of the improved assembly plate for holding the toggle and frame in assembled condition.

While the invention has been shown and described as being especially applicable to a fluid pressure actuated electric switch assembly such as disclosed in prior Patent No. 2,193,127, it is not the desire or intent to thereby unnecessarily restrict the scope or utility of the improvement.

With reference to the drawing, the improved fluid pressure actuated electric switch mechanism shown therein, comprises in general, a main frame having a lower base 10 rigidly attached to an upper frame member 11 provided with integral lower side walls 12 and upper side flanges

13, and with an integral front wall 14 spanning the space between and extending upwardly above the side walls 12; a lower cup-shaped casing 15 with the bottom of which the frame base 10 coacts, and which is provided with a large central opening 16; a circular flexible diaphragm 17 coacting with the lower face of the casing 15 and normally closing the opening 16; a fluid pressure fitting 18 having a flange 19 which is clamped against the diaphragm 17 and to the casing 15 and base 10 by means of screws 20 so as to form a fluid chamber 21; an inverted conical member 22 having a restricted central fluid inlet opening, and being interposed between the chamber 21 and the fluid supply; a motion transmitting saddle element or disk 23 coacting with the central top portion of the diaphragm 17 and having integral opposite side projections 24 extending upwardly through the opening 16 and through a hole in the base 10 adjacent to the side walls 12; a leaf spring 25 secured to the central upper portion of the disk 23 and extending toward the rear of the switch assemblage; a main U-shaped toggle member or lever 26 having opposite side arms 27 provided with V-notches 28 which are normally engaged by knife edges at the upper ends of the disk projections 24, the lever 26 being swingable in fulcrum notches 29 formed in the front portions of the frame side walls 12; a primary adjustment spring 30 coacting with the rear swinging portion of the lever 26 and reacting against a cup-washer 31 which coacts with a nut 32 having screw thread coaction with a fixed bolt 33 the lower head 34 of which is fitted in a recess 35 in the base 10 and is adapted to coact with the bifurcated outer end 36 of the leaf spring 25, while its upper threaded end extends upwardly some distance above the nut 32; a cam 37 secured to a shaft 38 journaled in a socket 39 formed in the frame member 11 and having an external manipulating handle 40; an auxiliary U-shaped toggle lever 41 having side arms coacting with rear fulcrum notches 42 in the side walls 12 so as to swing therebetween, and also having lower lugs 43 cooperable with the bottom of the frame member 11 to limit the downward swing; a toggle actuating tension spring 44 connecting the central portions of the toggle levers 26, 41 to swing the same from one position to the other with a snap action; a set of movable switch contact carrier bars 45 slidable in upper and lower fixed insulation plates 46, 47 respectively, and each having a rear lower notch 48 with which the toggle lever 41 is cooperable; a transverse plate 49 loosely suspended from the medial portion of each carrier bar 45 and providing a support for a pair of movable contacts 50; a compression spring 51 embracing each bar 45 between the adjacent plates 47, 49; fixed contacts 52 secured to the upper plate 46 and each having a terminal attaching screw 53 associated therewith; a flash guard 54 secured to the rear edges of the frame flanges 13 by a clip 55; an assembly plate 56 coacting with the frame member 11 beneath the lower insulation plate 47; and a removable cup-shaped cover 57 coacting with the casing 15 and being detachably secured thereto by a clamping nut 58 coacting with the upper end of the threaded bolt 33.

Practically all of the important parts of the improved switch mechanism may be formed of sheet material with the aid of punches and dies, or of standard stock, and the casing 15 may be provided with suitable openings for the electrical

connections associated with the terminal screws 53. While the general assemblage and operation of the improved switch are quite similar to those of the switch shown in prior Patent No. 2,193,127, the improved mechanism involves simplified instrumentalities for assembling and for maintaining the motion transmitting element or disk 23 in place; simpler and more effective means comprising the assembly plate 56 for retaining the toggle in place and the frame in assembled condition; and improved means for effecting rapid and accurate adjustment of the toggle throw in order to insure most efficient and sensitive operation.

Referring to Figs. 1, 2, 3 and 4, it is to be noted that one end of the flexible leaf spring 25 is riveted or otherwise rigidly attached to the center of the disk 23, while the opposite bifurcated end thereof is firmly clamped between the bolt head 34 and the recessed portion 35 of the frame base 10 within which the bolt head is snugly confined. In order to prevent the spring 25 from sliding away from the bolt 33 and thereby shifting the fulcrum projections 24 of the disk 23, the bifurcated spring end 36 is preferably provided with integral flanges or projections 59 which snugly engage the bolt head 34 when the structure is assembled. The main spring 30 which embraces the bolt 33 and coacts with the lever 26 and nut 32, serves to normally hold the leaf spring 25 clamped in position, but the disk 23 and spring 25 may be readily released and removed from the switch assembly by merely compressing the spring 30 sufficiently to permit the projections 59 to be withdrawn forwardly over the top of the bolt head 34. The leaf spring 25 should be stiff enough to normally maintain the side projections 24 of the disk 23 in proper position and in snug coaction with the sockets 28 of the toggle lever 26 at all times, and the use of such an external spring obviates obstructions within the fluid chamber 21 and permits free flexing of the diaphragm 17 under all conditions of operation.

Referring to Figs. 1, 2, 3 and 5, the improved assembly plate 56 for retaining the toggle and frame properly assembled, is formed of stiff sheet metal and has the opposite sides of its front portion provided with notches 60 firmly engaging the opposite sides of the front frame wall 14, while its rear portion is provided with integral depending lugs 61 which normally extend downwardly over the notches 42 in the rear portions of the frame walls 12 to prevent the toggle lever 41 from becoming displaced. The assembly plate 56 is moreover provided with integral upper opposite side lugs 62 which coact with the bottom of the lower insulation plate 47, and the plate 56 is thus held firmly against the ledges of the frame member 11 formed between the side walls 12 and flanges 13. It will thus be noted that the assembly plate 56 not only retains the toggle lever 41 in proper position, but also strengthens the upper frame member 11 by firmly retaining the front wall 14 thereof in upright position.

Again referring to Figs. 1, 2, 3 and 5, while the main spring 30 provides means for varying the pressure at which the switch will act, it is also desirable to provide means for varying the pressure range of action, and for this purpose an adjustable screw 63 which coacts with the front frame wall 14 is provided. While the swinging forward end of the auxiliary toggle lever 41 has heretofore been caused to coact directly with the enlarged head 63' of the screw 62, it has been

found desirable to increase the area of coaction, and a stop plate 64 of increased area has therefore been applied directly beneath the screw head 63'. This stop plate 64 is forced upwardly against the screw head 63' by a spring 65 embracing the screw 62 and coacting with the wall 14, and the screw 63 is snugly secured to the wall 14 and is frictionally retained in various positions of adjustment, see Fig. 5.

During normal operation of the improved switch mechanism, when the cam actuating handle 40 is in upright position, the switch will be open and the cam 37 will be effective to hold the contacts 50, 52 open, by virtue of its coaction with the toggle lever 26. During such positioning of the switch the leaf spring 30 will function to retain the projections 24 of the disk 23 in engagement with the notches or sockets 28 of the main toggle lever 26, and the disk 23 cannot become displaced from central position even if the switch assemblage is disposed on its side. When the cam 37 is positioned as in Figs. 1 and 2, the adjusting nut 32 may be manipulated to predetermine the pressure at which the switch will operate, and after the spring has been thus adjusted, reduction in pressure within the chamber 21 will cause the toggle levers to throw over center in one direction, whereas increase in such fluid pressure will cause the toggle levers to throw over center in the opposite direction. Such actuation of the toggle levers is caused by the toggle spring 44 connecting the levers 26, 41. The increase in pressure within the chamber 21 beyond a predetermined amount, will cause the switch to be open, whereas a decrease in said pressure below a certain amount will cause the switch to close. The actuation of the contacts is effected with a snap action in an obvious manner, and it will be apparent that the action of the switch when the cam 37 is inactive, is entirely automatic and the range of action can be quickly adjusted by manipulation of the adjusting screw 63.

From the foregoing detailed description it will be apparent that the present invention provides three major improvements over the prior switch assembly of the patent herein identified. The improved disk 23 and leaf spring 25 insures proper maintenance of the motion transmitting element interposed between the diaphragm 17 and lever 26, in desired position, while permitting convenient insertion and removal of the motion transmitting element. This improved structure moreover prevents clogging and obstruction of the pressure chamber 21 with unnecessary and undesirable parts, and the leaf spring 25 can be manufactured and applied at minimum expense. The improved assembly plate 56 obviously reinforces the entire frame structure and also maintains the toggles in proper operating position at all times; and the improved stop plate 64 which is associated with the adjusting screw 63, also materially enhances the efficiency of operation of the switch. The entire switch assemblage can be readily constructed and assembled or dismantled, at minimum cost and with minimum effort, and has proven highly successful in actual commercial use.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed:

1. In combination, a frame having relatively

movable contacts associated therewith, a lever operable to relatively move said contacts, a fluid pressure actuated diaphragm, a motion transmitting element interposed between said lever and said diaphragm, said element having flat surface contact with said diaphragm and knife-edge coaction with said lever, and a leaf spring for constantly urging said element against said lever, said leaf spring having one end secured to said element and its opposite end secured to said frame.

2. In combination, a frame having relatively movable contacts associated therewith, a lever operable to relatively move said contacts, a fluid pressure actuated diaphragm, a motion transmitting element interposed between said lever and said diaphragm, said element having flat surface contact with said diaphragm and knife-edge coaction with said lever, and a leaf spring for constantly urging said element against said lever, said leaf spring having one end rigidly attached to said element and its opposite end detachably secured to said frame.

3. In combination, a frame having relatively movable contacts associated therewith, a lever for relatively moving said contacts and being swingably suspended from said frame, a fluid pressure actuated diaphragm secured to said frame, a one piece motion transmitting element interposed directly between said lever and said diaphragm, said element having a disk in surface engagement with said diaphragm and an integral projection in pivotal coaction with said lever, and a leaf spring connecting said disk and said frame to constantly urge said disk projection into engagement with said lever.

4. In combination, a frame having relatively movable contacts associated therewith, a lever for relatively moving said contacts and being swingably suspended from said frame, a fluid pressure actuated diaphragm secured to said frame, a one piece motion transmitting element interposed directly between said lever and said diaphragm, said element having a disk in surface engagement with said diaphragm and an integral projection in pivotal coaction with said lever, and a leaf spring having one end rigidly attached to said disk and its opposite end detachably secured to said frame, said spring being biased to constantly urge said disk projection against said lever.

5. In combination, a frame, a lever swingably suspended from said frame, a diaphragm associated with said frame laterally of said lever, a rigid motion transmitting element interposed directly between said diaphragm and said lever, said element having a disk engaging said diaphragm and an integral projection in pivotal coaction with said lever, and a leaf spring connecting said disk with said frame.

6. In combination, a frame, a lever swingably suspended from said frame, a diaphragm associated with said frame laterally of said lever, a rigid motion transmitting element interposed directly between said diaphragm and said lever, said element having a disk engaging said diaphragm and an integral projection in pivotal coaction with said lever, and a leaf spring connecting said disk with said frame, said leaf spring being formed to constantly urge said disk toward said lever and having one end detachably connected to the adjacent structure.

7. In combination, a frame, a lever swingably suspended from said frame, a diaphragm spaced laterally from said lever, a motion transmitting

element interposed between said diaphragm and said lever, a leaf spring connecting said element with said frame, and a coil spring for simultaneously urging said lever in one direction and for clamping said leaf spring in position.

8. In combination, a frame, a lever swingably suspended from said frame, a diaphragm spaced laterally from said lever, a motion transmitting element interposed between said diaphragm and said lever, a leaf spring connecting said element with said frame, a bolt coacting with said frame through an end of said leaf spring, and a coil spring coacting with said lever and reacting against said bolt to exert a clamping effect upon said leaf spring end.

9. In combination, a frame, a toggle lever having one end pivotally suspended from said frame, a fluid pressure flexed diaphragm spaced laterally from the medial portion of said lever, a rigid motion transmitting element interposed directly between said diaphragm and said medial lever portion, a leaf spring connecting said element and said frame, a bolt coacting with said frame through one end of said leaf spring, a coil spring embracing said bolt and coacting with the opposite end of said lever, and adjustable means carried by said bolt and against which said coil spring reacts.

10. In combination, a frame, a toggle lever having one end pivotally suspended from said frame, a fluid pressure flexed diaphragm spaced laterally from the medial portion of said lever, a rigid motion transmitting element interposed directly between said diaphragm and said medial lever portion, a leaf spring having one end rigidly attached to said element and having an opposite bifurcated end coacting with said frame, a bolt having a head coacting with said frame through said bifurcated spring end and extending through said lever, a coil spring embracing said bolt and coacting with the opposite swinging end of said lever, and a nut adjustable along said bolt and against which said coil spring reacts to clamp said leaf spring in place.

11. In combination, a frame having opposite side walls formed integral with a base portion and also having an integral front wall extending upwardly from said base portion and spanning the space between said side walls, a lever swingably suspended in notches at the rear edges of said side walls, and a separate assembly plate secured to said frame and having front portions interlocking with the upper end of said front wall and rear portions providing closures for said notches.

12. In combination, a one-piece frame member having a base and integral upstanding side walls and a front wall spanning the space between said side walls, each of said side walls having an off-set portion at its upper end and also having a

pivot notch in the rear edge thereof, a lever having pivot portions disposed within said notches, and a separate assembly plate resting upon said off-set portions and having integral front portions interlockable with said front wall and other integral portions providing closures for said notches.

13. In combination, a one-piece frame member having a base and integral upstanding side walls and a front wall spanning the space between said side walls, each of said side walls having an off-set portion at its upper end and also having a pivot notch in the rear edge thereof, a lever having pivot portions disposed within said notches, and a single separate assembly plate coacting with said off-set portions and having front notches coacting with the upper free end of said front wall and integral rear lugs spanning said pivot notches.

14. In combination, a one-piece sheet-metal frame member having a base and integral upstanding side walls and a front wall spanning the space between said side walls, each of said side walls having an off-set portion at its upper end and also having a pivot notch in the rear edge thereof, a lever having pivot portions disposed within said notches, and a single separate assembly plate coacting with said off-set portions and having front notches interlocking with the upper free end of said front wall and integral rear depending lugs spanning said pivot notches.

15. In combination, a frame having relatively movable contacts associated therewith, a lever for relatively moving said contacts and being swingably suspended from said frame, a fluid pressure actuated diaphragm secured to said frame, a one piece motion transmitting element interposed directly between said lever and said diaphragm, said element having a disk in surface engagement with said diaphragm and an integral projection in pivotal coaction with said lever, and elongated resilient means having one end rigidly attached to said disk and its opposite end detachably secured to said frame, said resilient means being biased to constantly urge said disk projection against said lever.

16. In combination, a frame having relatively movable contacts associated therewith, a lever operable to relatively move said contacts, a fluid pressure actuated diaphragm, a motion transmitting element interposed between said lever and said diaphragm, said element having flat surface contact with said diaphragm and knife-edge coaction with said lever, and spring means for constantly urging said element against said lever, said spring means having one portion secured to said element and another portion secured to said frame.

GILBERT H. HANSEN.