Oct. 16, 1951 H. C. BLODGETT 2,571,818

LIMIT SWITCH

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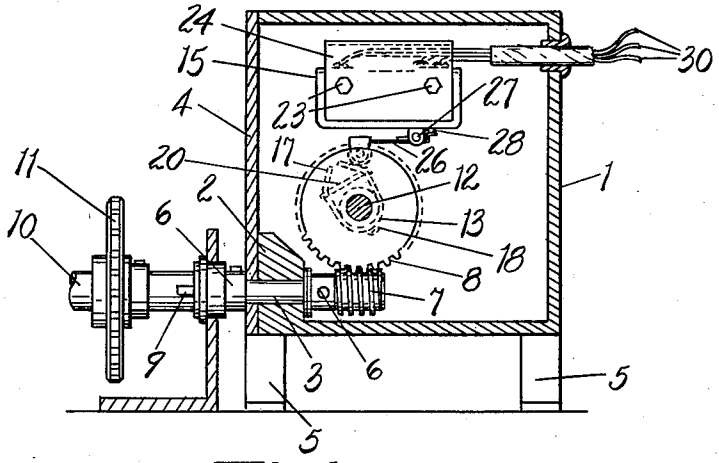



Fig. 1.

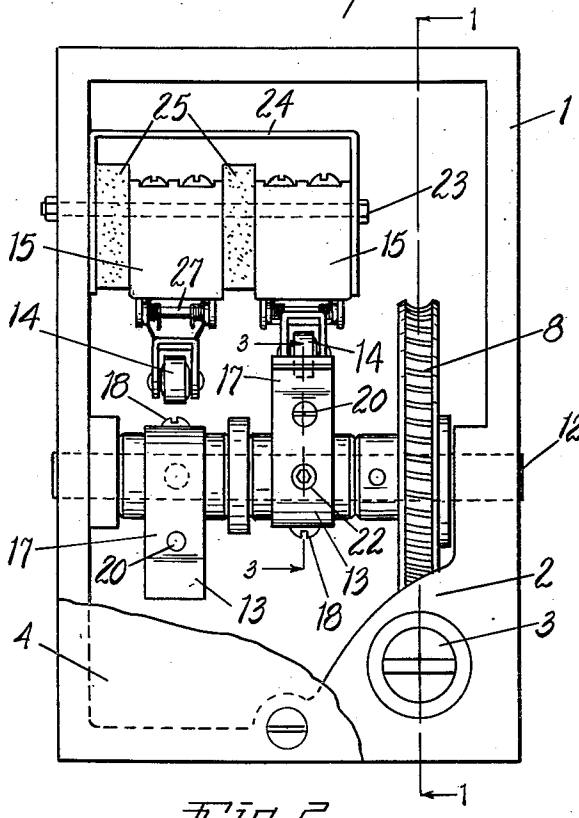



Fig. 2.

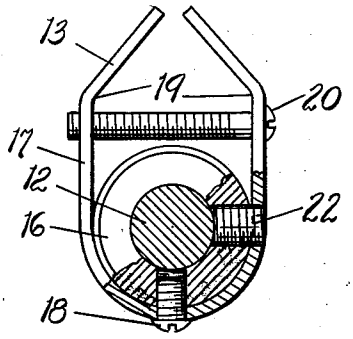



Fig. 3.

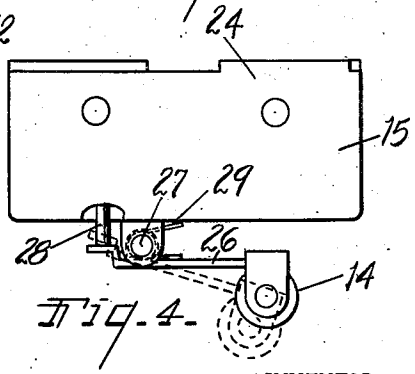



Fig. 4.

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## LIMIT SWITCH

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6 Claims. (Cl. 200—166)

1

This invention relates to improvements in limit switches.

The principal objects of this invention are:

First, to provide a novel form of limit switch for limiting the movement of any mechanical device which requires stopping at a certain point.

Second, to provide a limit switch which is extremely simple, low in cost and efficient in operation.

Third, to provide a limit switch of simple construction which is capable of very fine adjustment.

Other objects and advantages of my invention will be apparent from a consideration of the following description and claims. The drawings, of which there is one sheet, illustrate a preferred form of my limit switch.

Fig. 1 is a vertical cross sectional view of my limit switch in operative position and having a driving connection from a device, the operation of which is to be limited.

Fig. 2 is an end elevational view of my limit switch with the cover partially broken away to illustrate the working mechanism of the switch.

Fig. 3 is a fragmentary vertical cross sectional view along the line 3—3 in Fig. 2.

Fig. 4 is an enlarged side elevational view of the electrical switch mechanism used in my limit switch.

My limit switch can be used advantageously for controlling the operation of various mechanical devices such as automatic doors, machines and the like, which devices are designed to operate in one or opposite directions and to be stopped at particular points in their cycle of operation. My limit switch can be connected to interrupt the supply of electrical energy to the device being controlled or can be connected to suitable clutch or brake mechanism for immediately effecting the stopping of the device. The particular manner in which my limit switch is connected to the device to be controlled forms no part of the present invention and so is not illustrated.

My limit switch consists of a suitable casing 1 having a thickened boss 2 formed in one corner thereof to provide a journal bearing for a drive shaft 3. A suitable cover 4 is provided for closing the casing, and mounting brackets 5 are provided as desired for mounting my switch on a suitable support.

The driving shaft 3 is provided with collars 6 pinned to the shaft on opposite sides of the boss 2 to restrain the shaft against axial movement and the inner end of the driving shaft is

2

provided with a worm 7 drivingly engageable with the gear 8. The outer end of the driving shaft is provided with a tongue 9 or other suitable means for making a driving connection with a power shaft 10.

The power shaft 10 may be connected in any of several well known manners to run in timed relationship with the device to be controlled by the limit switch and in the example illustrated the shaft 10 is provided with a sprocket 11 adapted to be driven by a chain, not illustrated, from the operating mechanism of an overhead door. It will be appreciated that the driving connection to the shaft 10 can be geared in any desirable ratio to the device to be controlled.

The gear 8 within the casing 1 is non-rotatably secured to a cross shaft 12 journalled in the walls of the casing and extending at right angles to the driving shaft 3 so that rotation of the driving shaft and worm 7 will impart rotary motion to the cross shaft 12. The cross shaft rotatably carries a pair of switch actuating members generally indicated at 13 and arranged to engage and operate the rollers 14 of a pair of electrical switches 15. The actuating members 13 and switches 15 are of identical construction so only one of each will be described.

The actuating member is most clearly illustrated in Fig. 3 and consists of a bushing 16 having sliding engagement with the cross shaft 12. Partially embracing the bushing 16 is a generally U-shaped actuating arm 17 which is formed of springable material and which is secured to the bushing by the screw 18. The legs of the actuating arm are bent toward each other at as 19 and are apertured to receive the adjusting screw 20 which has a threaded engagement with one leg of the actuating arm at 21. A set screw 22 is provided for clamping the bushing and actuating arm to the cross shaft in any adjusted position thereof.

The switches 15 are of the micro-switch type and are secured to one wall of the casing 1 by the bolts 23 and a U-shaped bracket 24. The term "micro-switch" is intended to describe any precision built switch which requires only a small and accurately controlled movement of its contacts to operate the switch. Spacer blocks 25 of insulating material are provided for accurately locating each switch over its associated acuating arm 13.

Each switch 15 is provided with a lever 26 pivotally supported at 27 on the switch and carrying the roller 14 at its free end. The opposite end of the lever 26 is engaged with and arranged

to actuate the plunger 28 or operating member of the switch. A biasing spring 29 is wrapped around the pivot and in the example illustrated is arranged to bias the lever 26 to depress the plunger 28 and close the electrical circuit in the switch 15.

From the foregoing description it will be apparent that the actuating arms 13 and their bushings 16 can be roughly adjusted on the cross shaft 12 to engage and depress their associated switch rollers 14 at any desired point in the cycle of rotation of the driving shaft 3. For example, these points may be selected to determine the opening and closing limits of an overhead door. The normally closed micro-switches 15 can be connected through the conductors 30 to solenoid operated switches for energizing the driving motor of the door so that when one of the switches 15 is actuated by depressing its roller 14 the motor and door will be stopped.

After the actuating arms 13 have been roughly adjusted on the cross shaft 12, an extremely fine micrometer adjustment of each switch may be obtained by adjusting the screws 20 to vary the spacing of the converging ends 19 of the U-shaped arms 17. Obviously if the arms 19 are converged engagement between the arms and the rollers 14 will be delayed relative to the rotational cycle of the cross shaft and if the arms are permitted to expand by backing off the screws 20 the engagement between the arms and the rollers will be advanced.

I have thus described a limit switch which is capable of very fine adjustment and which may be constructed from a few simple parts and without requiring accurate control of the tolerances of the parts. The switch is thus economically manufactured and can be assembled in various arrangements depending upon the circuit or circuits to be controlled to meet practically any operating condition. Obviously more or less actuating arms and switches could be provided as desired to control any number of electrical circuits.

I have thus described a highly practical commercial embodiment of my switch so that others may reproduce the same without further description.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination with a limit switch having an electrical switching element and a shaft driven in timed relationship to a port to be controlled by the switch, a bushing adjustably secured to said shaft, a U-shaped springable actuating arm partially embracing said bushing and secured thereto, the legs of said arm being bent into converging relationship and defining apertures for receiving an adjusting screw, and an adjusting screw positioned in said apertures and having threaded engagement with one of said legs to adjust the spacing between the converging ends of said legs, said switch having an operating member positioned opposite said actuating arm to be actuated thereby, and means biasing said member to unactuated position.

2. In combination with a limit switch having an electrical switching element and a shaft for operating said element at predetermined angular positions of said shaft, a U-shaped springable



actuating arm partially embracing said shaft, the legs of said U-shaped arm projecting laterally from said shaft and defining apertures for receiving an adjusting screw, and an adjusting screw positioned in said apertures and having threaded engagement with one of said legs to adjust the spacing between the ends of the legs of said arm, said switch having an operating member positioned opposite said actuating arm to be actuated by the end of one of the legs thereof.

3. An actuating arm for a limit switch having a rotatable shaft element and an electrical micro-switch to be actuated therefrom, said actuating arm comprising a bushing arranged to embrace said shaft element, a set screw for clamping said bushing to said shaft element, a generally U-shaped strap of springable material embracing said bushing and secured thereto, the ends of said strap being bent into converging relationship, and a screw extending between the legs of said U-shaped strap and having threaded engagement with one of said legs to effect adjustment of the spacing between said legs.

4. An actuating arm for a limit switch having a rotatable shaft element and an electrical micro-switch to be actuated therefrom, said actuating arm comprising a bushing arranged to embrace said shaft element, a set screw for clamping said bushing to said shaft element, a generally U-shaped strap of springable material embracing said bushing, and a screw extending between the legs of said U-shaped strap and having threaded engagement with one of said legs to effect adjustment of the spacing between said legs.

5. An actuating arm for a limit switch having a rotatable element and an electrical switch to be actuated therefrom, said actuating arm comprising a bushing arranged to embrace said element, means for clamping said bushing to said element, a generally U-shaped strap of springable character embracing said bushing, and screw means extending between the legs of said U-shaped strap to effect adjustment of the spacing between said legs.

6. An actuating arm for a limit switch having a rotatable element and an electrical switch to be actuated therefrom, said actuating arm comprising, a generally U-shaped strap of springable character embracing said element with the arms of the strap projecting laterally from the axis of rotation of the element, and screw means extending between the legs of said U-shaped strap to effect adjustment of the spacing between said legs.

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