

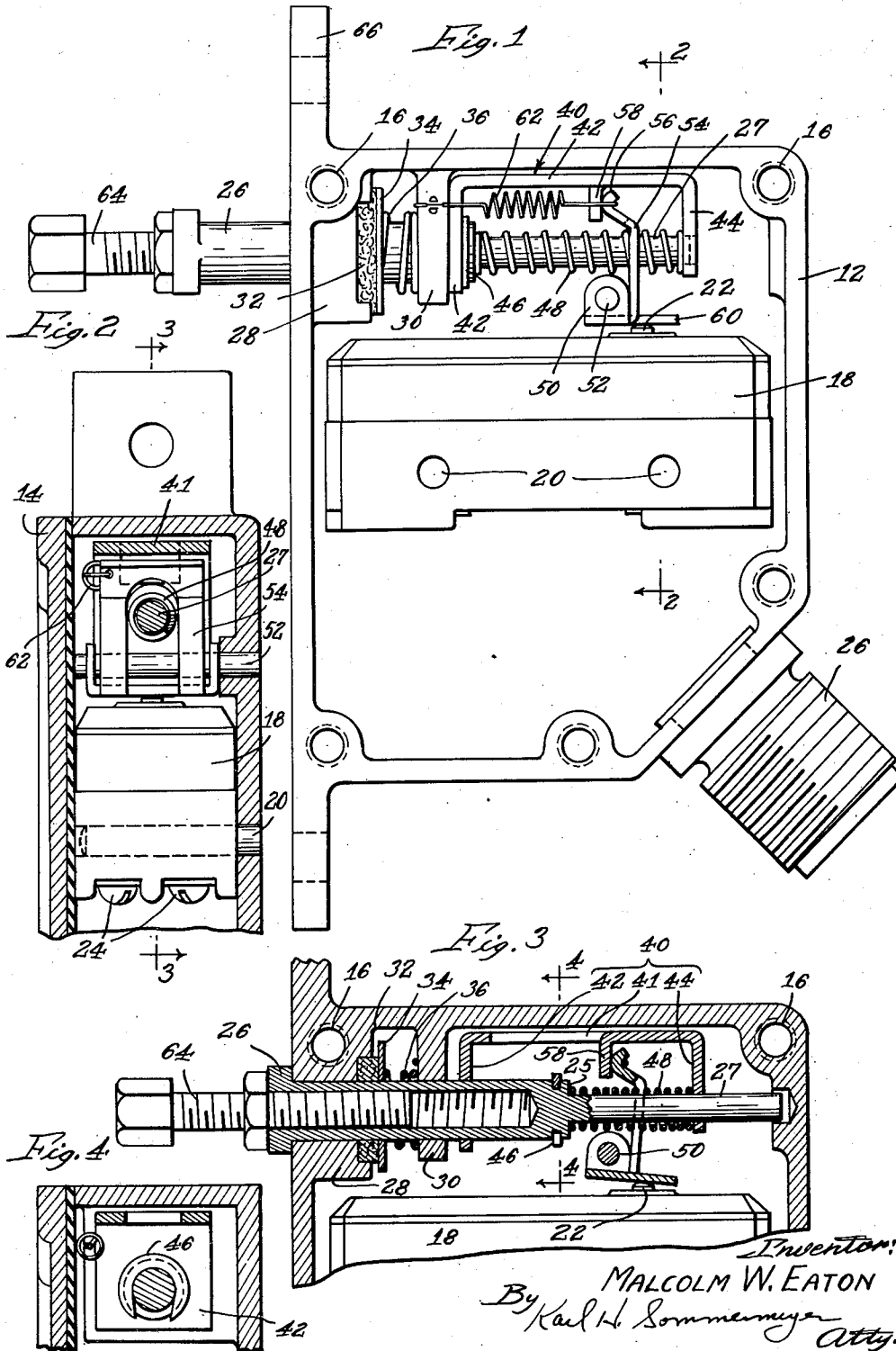
July 7, 1942.

M. W. EATON

2,289,108

ELECTRIC SWITCH CONSTRUCTION

Filed Nov. 15, 1940



Inventor:
MALCOLM W. EATON
By Karl H. Sommermeyer
Att'y.

UNITED STATES PATENT OFFICE

2,289,108

ELECTRIC SWITCH CONSTRUCTION

Malcolm W. Eaton, Freeport, Ill., assignor to
Micro Switch Corporation, Freeport, Ill., a cor-
poration of Illinois

Application November 15, 1940, Serial No. 365,780

5 Claims. (Cl. 74—470)

The present invention is related to electric switches.

Objects of this invention include the provision of a rugged, compact, low cost electric switch construction, suitable for use as a limit switch or the like, the provision of such a switch that operates in response to a small motion of its actuating member while permitting a relatively large overtravel of the actuating member beyond the switch operating point thereof, the provision of such a switch requiring a small operating effort and having inherent accuracy and reliability of operation, the provision of an improved switch actuating mechanism, and the provision of an improved electric switch construction. Other objects of the invention will become apparent from the following description of a specific embodiment thereof which serves by way of example to illustrate the manner in which the invention may be carried out, without thereby limiting the invention to the specific details of the example. In the drawing:

Fig. 1 is an elevational view showing the interior of the switch of my invention;

Fig. 2 is a partial sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a partial sectional view taken along the line 3—3 of Fig. 2, showing the mechanism of Fig. 1 in a different operated position, and,

Fig. 4 is a partial sectional view taken along the line 4—4 of Fig. 3.

In the drawing, a shallow die cast metal housing 12 is closed by a gasketed cover 14 (Figs. 2 and 4) held by screws in the tapped holes 16. Within the housing, a unitary elongated rectangular switch 18, fits accurately onto a pair of supporting pins 20 (Figs. 1 and 2), lies horizontally as seen in Fig. 1 across the housing, and fills the central portion thereof so as to divide the space within the housing into two substantially separated spaces above and below the unitary switch 18.

This switch 18 may be of the type described and claimed in Patent 1,960,020 to P. K. McGall. Switch 18 has a small operating pin 22 that projects vertically from its top and is adapted to be depressed for operating the electric contacts within the switch 18. It also has terminals 24 on its bottom face (Fig. 2). Accordingly the actuating pin 22 and the terminals 24 are located in the spaces respectively above and below the unitary switch 18. An aperture in the side of the housing is fitted with a conduit bushing 26 and opens into the lower or terminal space. This lower space in the housing permits conduct-

ing wires to be brought in easily for attachment to the terminals 24 of the switch. The unitary switch 18 itself may be lifted off its supporting pins 20 while the circuit wires are being fitted to it and then slipped back into place.

The space in the housing above the unitary switch 18 contains a mechanism for actuating the switch. This mechanism includes a reciprocal plunger 28 extending through the wall of the housing and supported thereby. The plunger 28 has its supporting bearings partly in an enlargement or boss 28 in the wall of the housing and partly in an internal bracket 30 spaced slightly from the boss 28. A felt washer 32 held by a metal washer 34 and a spring 36, bearing against the bracket 30 provides a seal against oil and moisture. The right end 27 of the plunger, that extends inside the housing, has a smaller diameter than the part that fits the supporting bearings. A rider 40 consists of a metal strip 41 having two downturned ends 42 and 44 perforated to fit the large and small diameters respectively of the plunger 26, so as to be reciprocable thereon (Figs. 1 and 3). A C-shaped key 46 clamped in a circumferential groove near the inner end of the large diameter portion of the plunger 26 serves as a stop for preventing the rider 40 from sliding forward (to the right as seen in Figs. 1 and 3) off the end of the plunger. A spring 48 encircling the small diameter portion 27 of the plunger bears at one end against the shoulder between the large and small diameters of the plunger, and at its forward end against the forward end 44 of the rider 40. Accordingly, the spring 48 urges the rider 40 forward on the plunger until it stops against the key 46.

A bell crank 50 is pivoted on a pin 52 immediately below the plunger 26 and spring 48, and has a perforated arm 54 extending upward and carrying a curved abutment face 56 substantially vertically above the axis of the pin 52. The small diameter portion 27 of the plunger, and the spring 48, extend through the perforation of the arm 54 so that the abutment face 56 lies above the plunger and immediately below the longitudinal strip portion 41 of the rider 40. This construction gives the bell crank an effective lever arm that is longer than the slight spacing of the bell crank pivot 52 below the plunger 26. A tab 58 punched and bent down out of the longitudinal strip portion 41 of the rider 40 engages the abutment face 56 of the bell crank arm 54, for driving the bell crank

toward the right, as seen in the drawing, with the forward motion of the plunger 26.

A forward extending arm 60 of the bell crank lies above the operating pin 22 of the unitary switch 18 for depressing it and operating the switch in response to the forward driving motion of the actuating plunger 26. A coil spring 62 connected between the bracket 30 and the upper end of the bell crank arm 54, serves to retract the bell crank and with it the rider 40 and plunger 26 to their normal position as shown in Fig. 1.

When the actuating plunger 26 is moved forward (toward the right) as shown in Fig. 3, the resulting forward motion of the rider 40 drives the bell crank 50 against the operating pin 22 of the switch 18 for operating it, and the resilience of the spring 48 permits the plunger 26 to continue its forward motion beyond the point at which the switch 18 operates. The considerable "overtravel" motion of the plunger 26 can be noted in Fig. 3 where the plunger 26, moved to its extreme forward position has carried the key 48 away from the end 42 of the rider 40.

The large diameter portion of the plunger 26 is hollow, and threaded to receive a headed extension screw 64 which may be adjusted to vary the effective length of the plunger. The housing may be mounted either by a pair of integral mounting lugs 66, or by screws threaded into the holes 16.

The lower surface of the arm 60 of the bell crank 50 is parallel to the axis of the bell crank pivot 52, which in turn is parallel to the two supporting pins 20 of the unitary switch 18. Accordingly, movement of the switch 18 on its two pins will not, by itself, bring the actuating pin 22 into engagement with a higher or lower spot of the bell crank arm 60. That is, movement of unitary switch 18 on its pins 22 cannot effect operation of switch 18 by the plunger 26 and bell crank 50.

Throughout the specification and claims, directional terms such as above, below, horizontal, vertical, forward, etc. are used for convenience and for indicating relative directions and are not used in a restrictive sense.

It will be apparent to those skilled in the art that the present invention is capable of numerous modifications and variations, and that the particular embodiment herein shown and described serves simply as an example. Accordingly the invention is to be limited only in accordance with the scope of the appended claims.

I claim:

1. In combination in a construction of the class described, a reciprocable actuating plunger, a rider carried by said plunger and slideable lengthwise thereon, a spring holding said rider forward on said plunger, a stop on said plunger for limiting the forward motion of the rider thereon, a bell crank supported separately from said plunger and rider, and abutting said rider to be driven by the forward motion of said rider, and a spring for urging said bell crank against said rider.

2. In combination in a construction of the class described, a reciprocable actuating plunger, a rider carried by said plunger and slideable lengthwise thereon, a spring holding said rider forward on said plunger, a stop on said plunger for limiting the forward motion of the rider thereon, and a bell crank supported separately from said plunger and rider, said bell crank hav-

ing an arm abutting said rider so as to be driven by the forward motion thereof, and having another arm for transmitting the driving force of said rider in a direction at an angle to the forward motion of said plunger.

3. In combination in a compact actuator construction of the class described, a reciprocable actuating plunger, a rider carried by said plunger and slideable lengthwise thereon, a spring urging said rider forward on said plunger, a stop on said plunger for limiting the forward motion of said rider thereon, a bell crank having a pivot axis close to the plunger at one side thereof, the bell crank having an arm extending across said plunger, and having an abutment face on said arm for engagement by said rider at a position across said plunger from the bell crank pivot, whereby the effective lever arm length is longer than the spacing between the plunger and the pivot axis.

4. In combination in a compact actuator construction of the class described, a reciprocable actuating plunger, a rider carried by said plunger and slideable lengthwise thereon, said rider constituting a strip lying above said plunger and having down-turned, perforated ends slideably fitting said plunger, a spring encircling said plunger between the down-turned ends of said rider and bearing against the forward end of said rider to urge it forward on said plunger, a stop for abutting the rearward down-turned end of said rider for limiting the forward motion of said rider on said plunger, a bell crank having its pivot axis below said plunger, and having an arm extending to a point above said plunger to provide an abutment surface above said plunger, said rider having an abutment extending down from said strip so as to lie between said strip and said plunger for engaging said abutment surface of said arm so that the forward motion of said plunger and rider drives said bell crank.

5. In combination in a compact actuator construction of the class described, a bearing for a reciprocable plunger, a plunger in said bearing, said plunger having an unsupported end extending forward beyond said bearing, a rider carried by said extended end of said plunger and slideable thereon, said rider constituting a strip lying above said plunger and having down-turned perforated ends slideably fitting said plunger, said plunger having a large diameter to fit said bearing and a smaller diameter portion constituting most of said extended end thereof, one end of said rider fitting the large diameter and the other fitting the small diameter of said plunger, a spring bearing at one end against the shoulder between said large and small diameters of said plunger and at the other end against the forward end of said rider, a stop near said shoulder for abutting the rearward end of said rider for limiting the forward motion of said rider on said plunger, a bell crank pivoted on a shaft lying below said plunger and perpendicular thereto, said bell crank having an arm extending upward alongside said plunger and having an abutment face on said arm in a position above said plunger and between said plunger and strip, said rider having an abutment extending downward from said strip and engaging said abutment surface of said arm for driving said bell crank forward with said plunger and rider, and a spring for rotating said bell crank against said abutment of said rider.

MALCOLM W. EATON.