Feb. 1, 1966 O. ASCHWANDEN 3,233,057

CAM OPERABLE ADJUSTABLE SNAP-ACTION ELECTRICAL SWITCH

Filed July 30, 1963

FIG. 1.

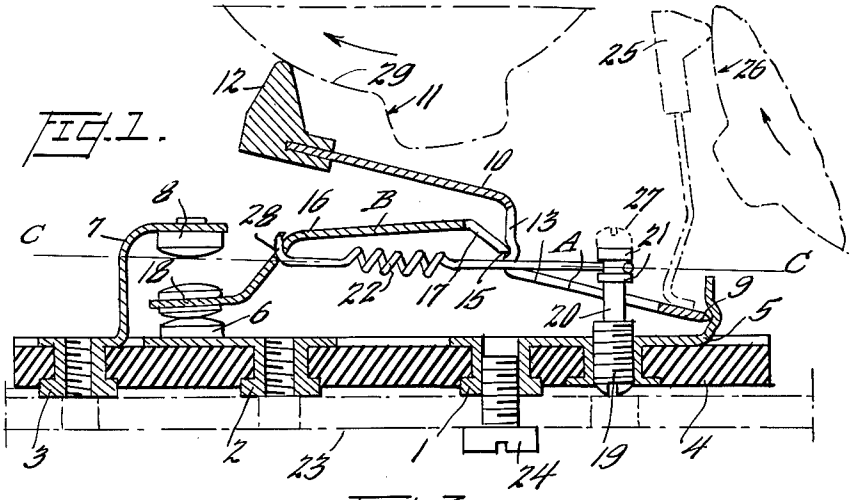


FIG. 3.

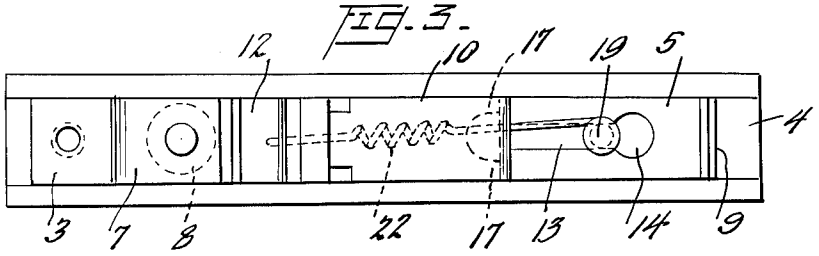
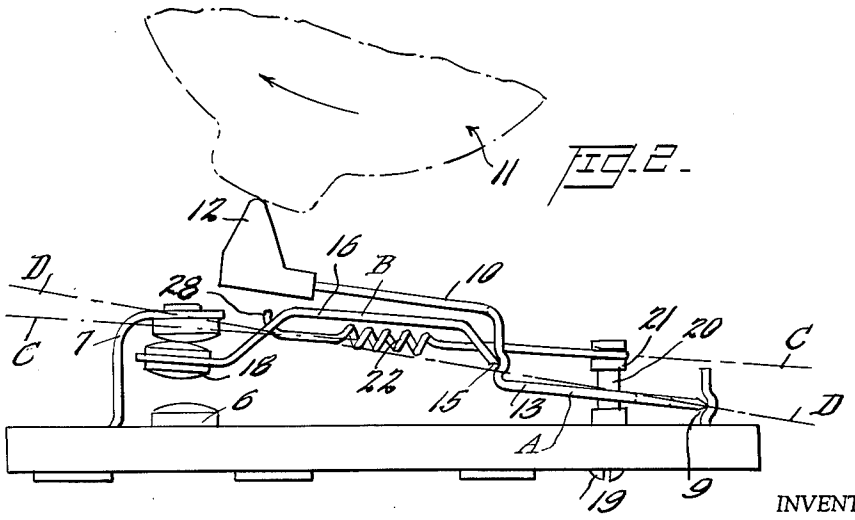


FIG. 2.



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United States Patent Office 3,233,057
Patented Feb. 1, 1966

3,233,057

CAM OPERABLE ADJUSTABLE SNAP-ACTION ELECTRICAL SWITCH

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Filed July 30, 1963, Ser. No. 298,678
Claims priority, application Austria, Aug. 17, 1962, A 6,659/62
1 Claim. (Cl. 200—67)

This invention relates to an electric switch having two contact elements arranged on a switch frame, a contact arm reciprocatable between the contact elements, a spring engaging the contact arm in a first pivot point, under the influence of which the contact arm will lie on one or the other contact element, and an operating lever for initiating the switching movement. The operating lever is rockably supported on the switch frame by means of a second pivot point, whereby the contact arm and the spring are each associated respectively through a third and a fourth pivot point with the operating arm and the switch frame or vice versa.

Through automation, a great need has arisen for controls and switchgears to be as compact as possible, for which entire rows of switches are required generally in juxtaposed relation. The most exacting demands as to accuracy of switching on and off are thereby made in accordance with the refined technique of automation and the range of the switching programs. This again demands high precision of the control block and its individual parts.

While it is now possible to have switches, and especially small switches, built in series with minimum tolerances, in assembling them to switchblocks, there result disadvantages in using switches of the conventional type. If, for instance, the switches are actuated through a series of cam disks arranged on a common shaft, because of the small erecting tolerances the switches will be at unequal distances from the cam disks. Therefore, on account of these unequal distances, the operating levers on the cam disks are rocked to a greater or lesser extent, which means that the switches, as actuated by the cam disks, actuate at different moments. The switches as used heretofore have fixed set operating levers, so that the deviations in the moments for actuating the switches can only be eliminated to a certain extent by restricting the tolerances, which necessitates complicated adjustment and renders erection expensive and slower. It is already known to have these fixed operating levers provided with regulating means. The drawback of this is that the regulating means are located on a movable part of the switch. It is also known to have each switch of a switchblock individually and movably supported within a fixed frame, but the possibility of regulation is then expensive. Consequently, accurate tuning of all switches united to one switchblock for actuation at the same moment is impossible with simple means.

The primary object of the invention is to create a switch in which, independently on such erecting tolerances, the switching moment has to be determined accurately. Moreover, this switch shall be constructed in such a way that it is above all suitable for arranging these switches side-by-side in rows to form switchblocks.

The switch is characterized in that, in addition to the change in position of the pivot points capable of being effected by the operating lever, at least one of the four pivot points is adjustable by means of a regulating screw for altering the switching moment of the switch in dependence on the movement of the operating lever.

Further features of the invention will appear from the following description and claim taken in conjunction with

the accompanying drawing wherein there is shown, purely by way of example, one preferred form of embodiment incorporating the invention.

In said annexed drawing:

FIG. 1 is a longitudinal section of an unactuated switch;

FIG. 2 is a side view of the switch according to FIG. 1 showing another position; and,

FIG. 3 is a top plan view of the switch.

The switch comprises three electric terminals **1**, **2**, **3**, these reference numerals designating at the same time the sequence of the electric connections of the switch. The terminals **1**, **2**, **3** are formed as nuts and are mounted on the underside of a switch base plate of insulating material, representing the switch frame **4**. Terminal **1** is integral with a metal plate **5** which is on the upper side of base **4**. Terminal **2** forms one piece together with a lower contact element **6**, and terminal **3** also forms one piece together with a bow **7** carrying the upper contact element **8**, which are riveted to the switch base plate **4**. Plate **5** is turned up at one end and has a prismatic notch **9** therein which serves as a stationary pivot point for a rockable operating lever **10**. This latter consists of a metal-strip of the same width as the bow **7**. The free extremity of the operating lever **10** is formed for actuation through a cam disk **11** or a slide or the like. For this purpose, the free end of said lever is formed by a special attachable part **10** of a sliding material. When using a metal cam disk or a slide, said material may consist of an insulating substance. Alternatively, instead of part **12**, a roller may be provided. Lever **10** has a longitudinal slot **13** therein which extends into a circular aperture **14**. Lever **10** has a prismatic notch **15** which serves as a pivot point for the forked end **17** of a contact arm **16**. The contact arm **16** carries a contact **18**.

In the switch base plate **4**, besides the electric terminal, there is arranged a regulating screw **19** having a pin **20** which, in the direction of rocking of lever **10**, projects through the slot **13**. At the top, said pin has an adjoining collar **21** which in diameter is larger than the width of slot **13** so as to provide a stop for lever **10** which is rockable about the notch **9** between the switch base plate **4** and collar **21**. At the same time, the upper free end of the screw **19** serves as stationary pivot point for a tension-spring **22** with the other end engaging the pivot point **28** of the contact arm **16**. Spring **22** presses contact arm **16** into the notch **15**, and contact arm **16** together with lever **10** into notch **9**. The aperture **14** has a diameter somewhat larger than the collar **21**. The switch with its terminals **1**, **2**, **3** is mounted on a base **23**, the surface having a printed circuit (not shown) on whose conducting contacts the terminals **1**, **2**, **3** lie. The switch is mounted on the base **23** by means of screws **24** (one only shown).

The operation of the switch is as follows: With the switch unactuated according to FIG. 1, the operating lever **10** rests on part **29** of the cam disk **11**. Thereby notch **15** lies above the direction of action of draw-spring **22**. Contact **18** thus rests on contact element **6**. With the switch operated according to FIG. 2, the notch **15** lies below the direction of action of the spring **22**, and contact **18** rests on contact element **8**.

By turning the screw **19** by means of a screwdriver, the pivot point of spring **22** at screw **19** is altered to the other pivot points **28**, **15** and **9**. Therefore the characteristics of the switch are changed. If the operating lever **10** of the switch passes over the part **29** of the cam disk **11**, because of erecting tolerances, lies somewhat lower (FIG. 1) than another switch of the same switchblock, by adjusting the regulating screw **19** of one switch (or of both switches) it can be achieved that both switches, operated by such cam disks **11**, actuate at the same moment, i.e.

the contacts **18** tilt into another position simultaneously.

But it is also possible that a switch shall actuate after another switch only with a certain delay. Such delay may likewise be determined accurately by setting the screw **19** correspondingly.

By altering the switching moment of the switch, the time, from the commencement of the movement of lever **10** to the tilting of contact **18** into another position, will be changed.

The other pivot point **28**, **15**, **9** may also be adjustable. Most simply, readjustment can be carried out at the stationary pivot points, hence at notch **9** or at screw **19**.

As indicated on FIGS. 1 and 2, the reference characters A and B represent toggle joint members and the line C indicates an action line with the toggle members in the position shown in FIG. 1 and the action line D in FIG. 2 shows the toggle members in the second position, as to the contact members **6** and **8**, together with the movable contact member **18**, which is mounted on one of the toggle joint members B. Thus, as to the toggle joint junction, the action line C in FIG. 1 shows the switch in the position in which the contacts **18** and **6** are in contact with each other and FIG. 2 shows the action line D for the toggle members with the contacts **18** and **8** in contact with each other.

The operating lever **10** may have several arms, such as the arm **25** shown in dash-dotted lines (FIG. 1) which is to be actuated by a cam disk **26**. These two cam disks **11** and **26** then act on the switch in series-connection.

Screw **19** may have points of engagement at both ends for screwing it into the switch base plate **4**. For this purpose, collar **21** may have a screw-head **27** as shown in dash-dotted line, FIG. 1.

Advantageously, the switch in accordance with the invention can be used for printed circuits, in as much as the electric terminals **1**, **2**, **3** formed as nuts lying in one plane are disposed on the switch base plate **4**, so that the switch with the nuts lies on a base provided with a printed circuit and may thus be mounted. The electric terminals **1**, **2**, **3** then serve at the same time for fixing. Thus, in switches known heretofore, the necessary special fixing bores may be dispensed with, whereby the overall length of the switch is shortened.

If a fixing bore at each end of the switch base plate **4** is maintained, all switches can be fixed on one common profiled bar or the like. The common base **23** may then be done away with, and the undersides of the switch form a terminal board. Thus, the electric conductors are connected direct to the terminals **1**, **2** and **3**.

Furthermore, a single defective switch can be replaced without the other switches being thereby influenced in any way, which also minimizes maintenance work on the switch or control block.

When installing or removing a switch, the operating

The switch according to the invention has a very low lever **10** rests on collar **21** so that the rocking path of height and width. By reason of the special structural design of the switch, the overall width of a switch is substantially governed by the width of the metal-strip adopted for the operating lever **10**. Hence these switches may be built very narrow and can be used very well in cam-controlled switchblocks, such switchblocks becoming very compact even with a plurality of juxtaposed switches. Also the height of the switch is very low because of the simple structural design of contact arm **16** and operating lever **10**.

By having contact arm **16** pivoted to the rockable operating lever **10**, the electric contact elements **6**, **8** are self-cleaning, since contact **18** of contact arm **16** slides first on the respective contact of the stationary contact element **6** or **8**, before it rises. Therewith any welding at the contacts are avoided.

Three switches assembled on a switchblock may, for instance, serve as a three-phase switch. All three operating levers **10** are then, for instance actuated by a single pressure plate. In order that the three switches shall work simultaneously, each switch is adjusted by means of its screw **19**.

Instead of cam disks **11** any known operating members may be provided.

The terminals **1**, **2**, **3** may also be formed as contact lugs. These are then lodged in the switch base plate **4** and are then inserted and fixed in the base **23** which, for instance, has a printed circuit.

What I claim is:

Electric switch comprising a frame, two spaced contact elements arranged on the frame, a contact arm mounted to reciprocate between said elements, a tension coil spring connected at one end to said arm and the other end to the frame at a pivot point thereon so that under the influence of the spring said arm will abut on one or the other of said contact elements, an operating lever for initiating the switching movement and rockably supported on the switch frame at a notch therein and having a pivot point intermediate its ends, said arm being mounted at the pivot point on the operating lever, a regulating screw on the frame which is the pivot point of the tension coil spring on the frame and is adjustable toward and away from the frame with at least one part of the operating lever and the contact arm forming the parts of a toggle joint, and the pivot point of the operating lever on the frame lying outside of an action line of the spring and upon actuating the switch the pivot point of the operating lever and the contact arm lying between an action line of the spring and a line of the extended toggle joint.

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