Dec. 12, 1950 F. C. FUKE 2,533,571

ROCKER-ARM SNAP SWITCH

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Fig. 1.

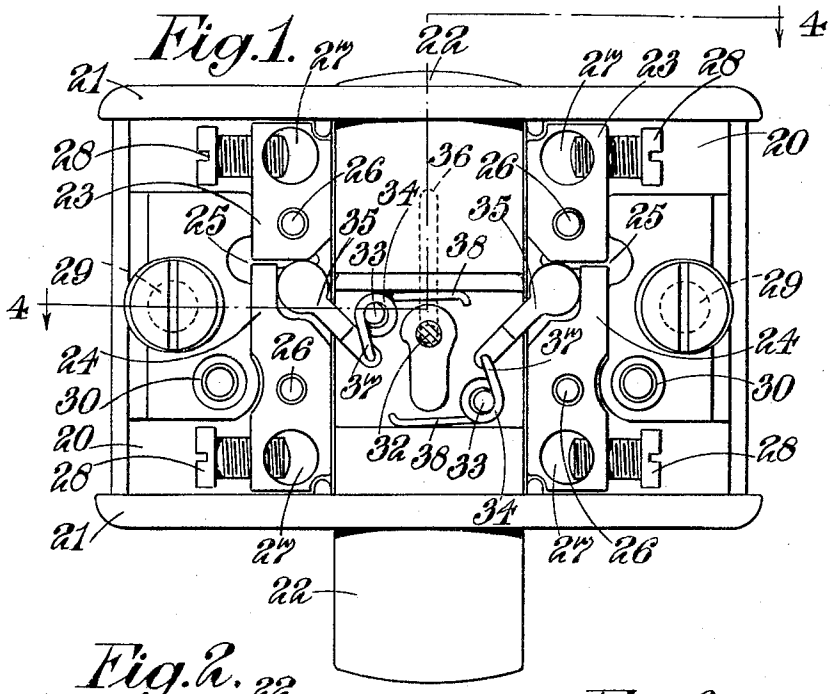

Fig. 2.

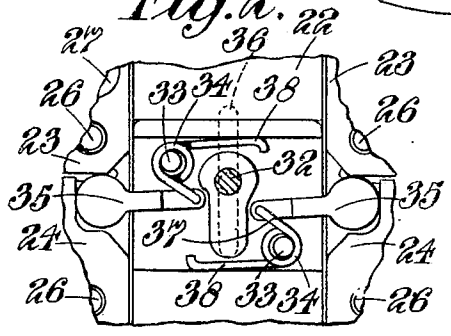

Fig. 3.

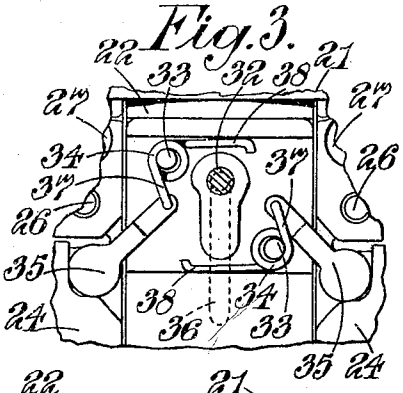

Fig. 4.

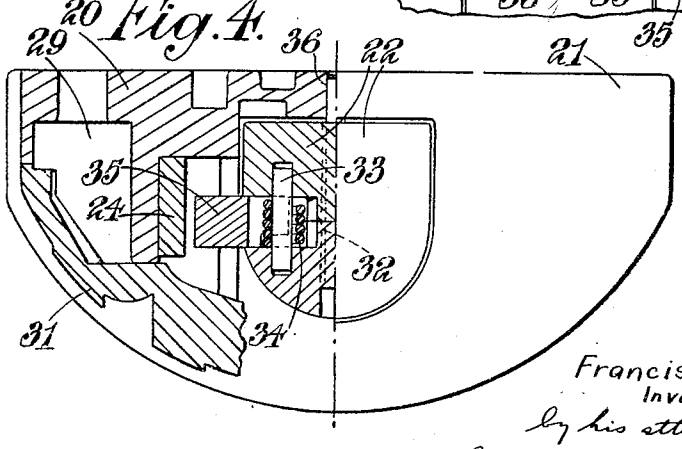

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Fig. 5.

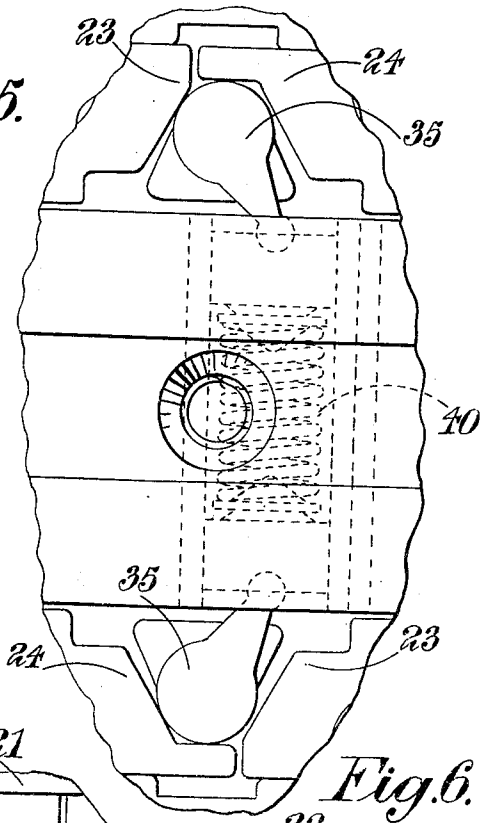

Fig. 6.

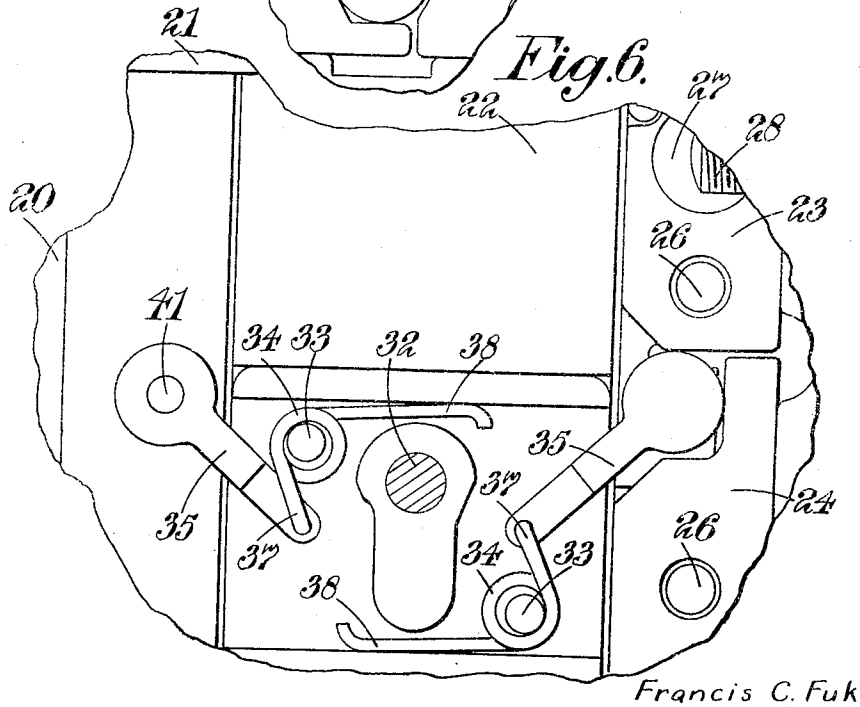

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Fig. 7.

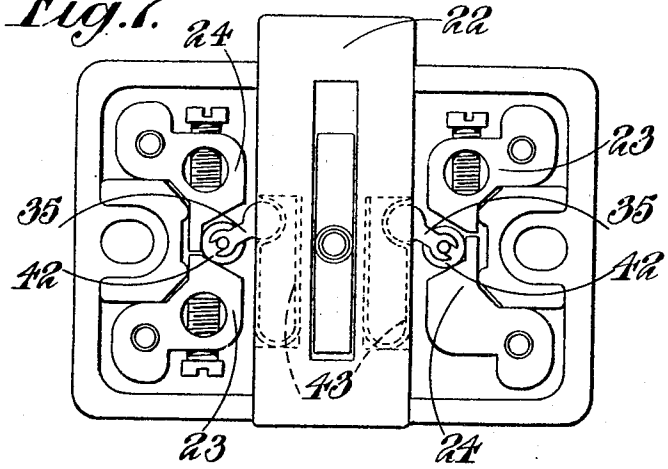
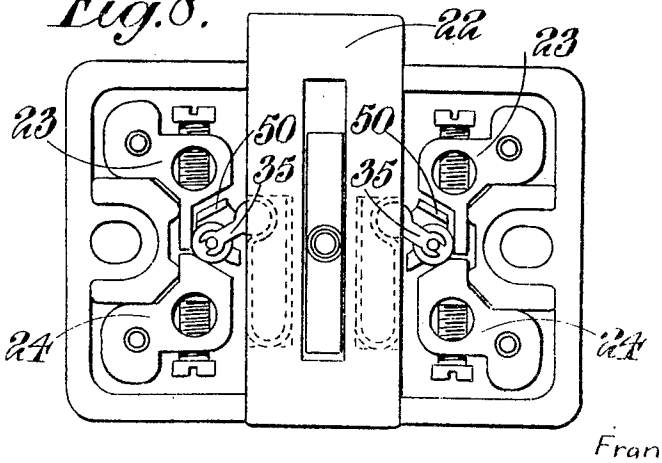


Fig. 8.



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2,533,571

ROCKER-ARM SNAP SWITCH

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Application December 1, 1945, Serial No. 632,155
In Great Britain May 30, 1944

1 Claim. (Cl. 200—67)

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This invention relates to electric switches and is particularly (but not exclusively) concerned with switches of the micro-break type for the control of alternating current.

In an electric switch of the tumbler type it has already been proposed (see British specification No. 552,181) to determine the length of break per pole by a gap, which is constant, between two fixed rigid contacts, switching being effected by a third and movable contact which in moving makes rubbing and abutting contact with the face of one or both of the fixed contacts under the influence of a snap-action operating mechanism.

The present invention is concerned with an electric switch comprising in combination with two fixed contacts with a gap between them, a switch operating member movable to and fro between two limiting positions, and a movable contact element in the from of a rocking arm, one end of which (hereinafter referred to as the outer end) has a floating bearing in a trough-like housing or journal provided in part by one of the fixed contacts and in part by the other fixed contact, and the other end of which (hereinafter referred to as the inner end) is so carried by the operating member that on movement of said member between one limiting position and the other, the arm will be rocked about its outer end through a dead centre across the gap between the two fixed contacts, the arrangement being such that in one limiting position of the operating member the outer end of the arm abuts on both fixed contacts and in the other limiting position it abuts on only one fixed contact.

The rocking arm may be spring-controlled to provide a snap-action between the limiting positions.

According to the invention, the switch operating member is a slide, e.g. in the form of a plunger, mounted for rectilinear movement alongside the fixed contact elements between two limiting positions. There may be two rocking arms symmetrically arranged on opposite sides of the movable slide, one or each of said arms constituting a movable contact element. In order to provide a snap-action the two arms may be controlled by independent springs, or a single control spring may be employed.

Some examples embodying the foregoing and other features of the invention will now be described, with reference to the accompanying drawings, which are to some extent diagrammatic and in which—

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Figure 1 is an elevation showing the switch mechanism according to the first example;

Figures 2 and 3 are elevations, similar to Figure 1, showing successive positions assumed by the operating parts when the switch is moved from "on" to "off";

Figure 4 is a plan of the switch shown in Figures 1 to 3, the left half of the Figure being in section;

Figure 5 is a partial elevation showing a modified arrangement of spring control;

Figure 6 is a partial elevation showing a modification providing a single-pole single throw switch;

Figure 7 is an elevation of a switch mechanism embodying a further example;

Figure 8 is a view (similar to Figure 7) showing a modification providing an intermediate control switch.

In the first example (Figures 1 to 4), the switch, which is of double-pole single-throw pattern, comprises a rectangular base 20 of insulating material having at opposite sides integral arcuate flanges 21 in which are formed D-shaped holes in alignment for accepting a movable operating plunger 22 of a corresponding cross-section. Mounted on the base 20 on opposite sides respectively of, and parallel to, the operating plunger 22 are two pairs of fixed contacts 23, 24. Between each pair of the fixed contacts there is a small air gap 25. The fixed contacts 23, 24 are rigidly secured to the insulating base 20 by screws 26 and each contact is provided with a hole 27 and a terminal screw 28 for securing the ends of the cable of the circuit to be controlled. The base 20 is provided with a pair of slightly elongated counter-bored holes 29 for accepting the screws for fastening the switch to a wall or other support. Adjacent the elongated fixing holes 29 are threaded holes for co-operating with screws 30 by which a domed cover 31 is secured in position between the base flanges 21 after the switch has been connected up and secured to the wall surface. The cover 31, when in position, completely encloses the electrical conductors and contacts within the switch base.

The operating plunger 22, for convenience in assembly, is in two parts which are secured together intermediate in the length of the plunger as a whole by a screw 32, in the region of which a compartment is formed within the plunger for accepting and housing a pair of locating pins 33, two torsion springs 34 associated therewith, and the inner ends of two rocking arms 35 which to-

gether constitute the movable contact member of the double-pole switch. The fixing screw **32** which connects the two plunger parts together has a plain shank extending beyond its threaded portion so as to engage with a slot **36** in the base **20**. The length of the base slot **36** thus limits the movement of the operating plunger **22** in each direction. The outer end of each rocking arm **35** is of ball or roller shape and has a floating engagement with a trough-like bearing provided in the region of the air gap **25** between the two co-operating fixed contacts **23, 24** and provided in part by one fixed contact **23** and in part by the other fixed contact **24** and the tongue **24a** projecting therefrom which closely approaches contact **23**. Each torsion spring **34** has an eye which engages over the corresponding locating pin **33** and two arms splayed apart at an acute angle, one being a short arm **37** and the other a long arm **38**. The short arms **37** of the torsion springs are pivotally articulated to the inner ends of the rocking arms **35**. The long arms **38** of the torsion springs, which are located on opposite sides respectively of the plunger fixing screw **32**, bear on the opposite end walls of the intermediate plunger compartment.

The following is a description of the operation of the switch according to the first example, assuming it to be fixed to a wall surface with the operating plunger **22** disposed vertically and in its lowermost position. When the switch parts are in this position (shown in Figure 1)—which is the "on" position of the switch—the reactions of the torsion springs **34** are such that the plunger **22** is forced downwardly to the limit of its travel while the rocking arms **35** are forced upwardly and outwardly into engagement with both fixed contacts **23, 24**, thereby electrically connecting the switch contacts on each side of the switch. If the operating plunger **22** is now pushed upwardly against the spring reactions each rocking arm **35** will turn about an axis coincident with the centre of the ball- or roller-shaped portion at the outer end of the arm, and while doing so the outer end of the arm will make effective rubbing contact against both its co-operating fixed contacts **23, 24**. As the plunger **22** continues to be pushed upwardly, a position is eventually reached when each rocking arm **35** passes a dead centre position (shown in Figure 2) with the result that the spring reactions automatically continue the upward movement of the plunger and, at the same time, force the rocking arms **35** downwardly and outwardly into positions (shown in Figure 3) in which the outer end of each arm bears only on the co-operating fixed contact **24**. In this way the electrical connection between the fixed contacts on each side of the switch is broken. It will be appreciated that when movement of the plunger **22** carries the spring reactions over the dead centre position (Figure 2), the plunger automatically continues its movement and so also do the rocking arms **35** so that in either direction of movement the double-pole movable contact, constituted by the two rocking arms, makes and breaks the circuit with a snap action.

The foregoing example, which is that of a double-pole singe-throw assembly, may readily be modified, by a simple change in the arrangement of fixed contacts and without entailing any change in the moving parts, to provide single-pole, intermediate control and other patterns of switch. Thus to provide a single-pole single-throw switch, as illustrated in Figure 6, the fixed contacts on one side of the operating plunger **22** are omitted and a simple fixture **41** to provide a bearing for the outer end of the rocking arm **35** on that side of the operating plunger is attached to the insulating base **20**.

Instead of providing separate torsion springs to control the two rocking arms, a single spring common to both arms may be employed providing the arms are electrically insulated one from the other. An arrangement of this kind is shown in Figure 5 where the levers **35** are controlled by a single compression spring **40**.

In a further example (Figure 7) the outer end of each rocking arm **35** is in the form of a rotatable roller **42** which on movement of the switch between the "on" and "off" positions makes rolling contact with the surfaces of the co-operating fixed contacts. In this example the rocking arms are controlled by U-shaped springs **43**.

In Figure 8 the switch illustrated is a modified form of that shown in Figure 7, the modification being for the purpose of providing a so-called "intermediate control" switch. The two pairs of main fixed contacts **23, 24** are retained and in association with each pair there is furnished a third or auxiliary fixed contact **50**. The location of each auxiliary fixed contact **50** is such that in one position of the corresponding rocking arm **35** it electrically connects the auxiliary contact **50** with the fixed contact **23** and in the other position (shown in Figure 8) it electrically connects the two main fixed contacts **23, 24**. The auxiliary fixed contacts **50** are cross-connected at the back of the switch with main fixed contacts on opposite sides of the operating plunger **22**.

Similarly in order to furnish a single-pole double-throw switch, the following modification (as in Figure 7) may be made. On one side of the plunger **22** the fixed contacts **23, 24** are reversed in position compared with the fixed contacts on the other side of the plunger, and one fixed contact is not provided with a cable terminal hole and this fixed contact is cross-connected (preferably at the back of the switch) to the fixed terminal diagonally opposite. This arrangement is such that in one limiting position of the plunger **22**, the outer end of the rocking arm **35** on one side of the plunger connects the corresponding pair of fixed contacts while the corresponding end of the rocking arm **35** on the other side of the plunger is in the "off" position.

In the above way it will be appreciated that using the same movable switch unit comprising the rocking arms, control springs and operating plunger, a variety of patterns of switch may selectively be obtained merely by incorporating, during the switch assembly process, the appropriate arrangement of fixed contacts. This is an important feature of the present invention which accordingly includes a method for the production in large quantities of electric switches of the single-pole, double-pole and intermediate pattern which is characterised by the manufacture of a switch movement and actuating mechanism therefor as herein described common to all of the aforesaid patterns of switch and by selectively providing the particular pattern required by the association with the common movement and actuating mechanism of different fixed switch contacts appropriate respectively to the different patterns.

I claim:

An electric snap-action switch comprising a base, two contacts fixed to the base with a gap between them, a switch operating plunger mov-

able in a rectilinear path between two limiting positions in guides provided on the base, a movable contact element in the form of a rocking arm one end of which has a floating bearing in a housing provided in part by one of the fixed contacts and in part by the other fixed contact and a torsion spring carried by the plunger for bodily movement therewith having a coiled eye with two arms extending therefrom, the eye fitting over a locating pin in the plunger with one spring arm attached to the other end of the movable element and the other spring arm engaging a reaction surface on the plunger, the arrangement being such that on initial movement of the plunger from one limiting position towards the other limiting position the element will be rocked about the bearing end aforesaid and the spring will be loaded until a dead-centre position of the element is reached and passed when the movement of the plunger to the other limiting position will be completed by the spring and the bearing end of the element will be moved by a sliding motion under the action of the spring in a direction across the gap so that in one limiting position of the plunger the bearing end of the element abuts on both fixed contacts and in the other limiting position it abuts on only one of the fixed contacts.

FRANCIS CECIL FUKE.

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