March 1, 1949. E. L. COE, JR., ET AL 2,463,020

STARTING SWITCH

Filed April 16, 1948 2 Sheets-Sheet 1

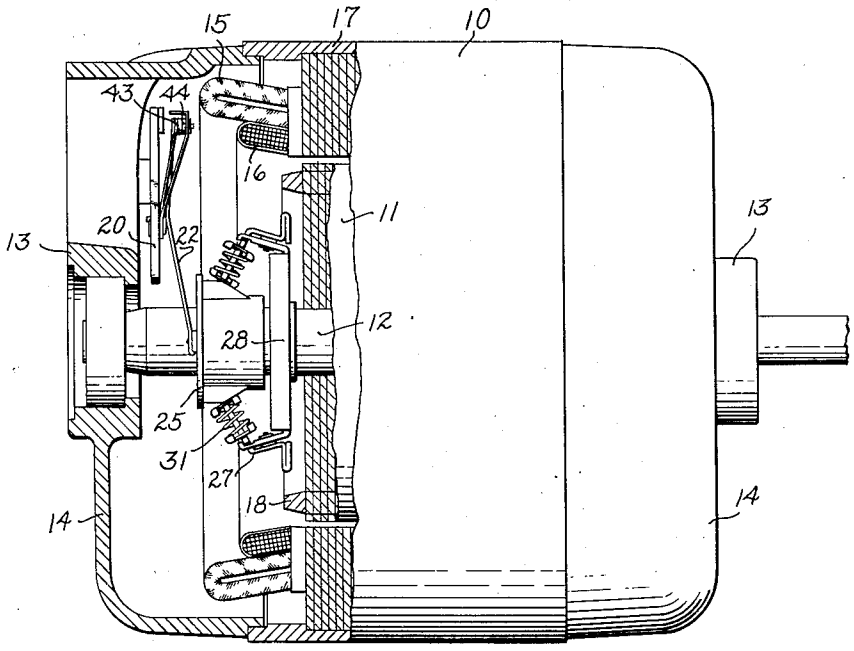


Fig. 1.

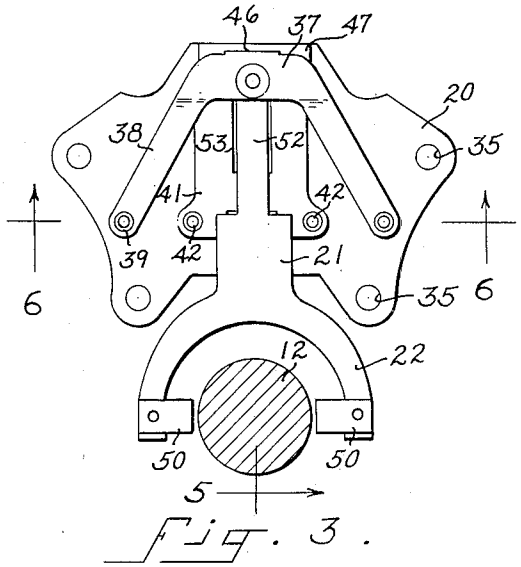


Fig. 3.

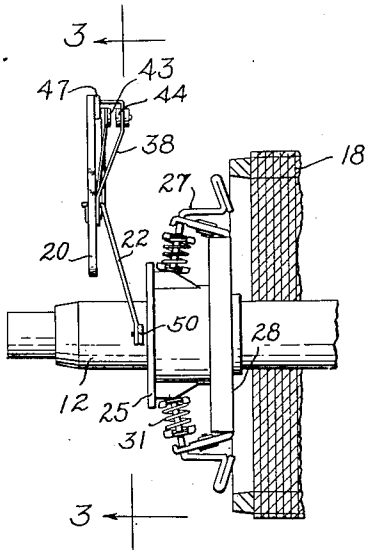


Fig. 2.

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Filed April 16, 1948 2 Sheets-Sheet 2

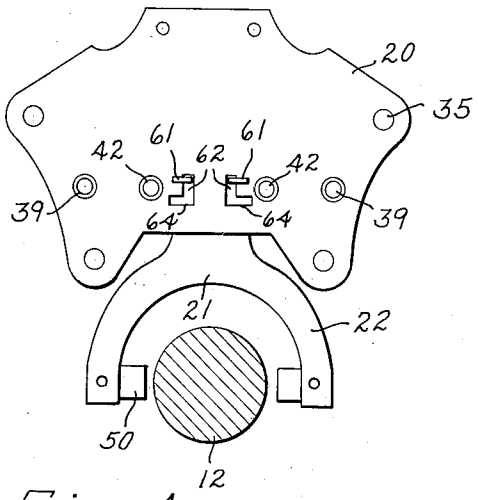


Fig. 4.

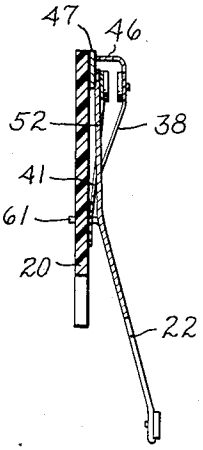


Fig. 5.

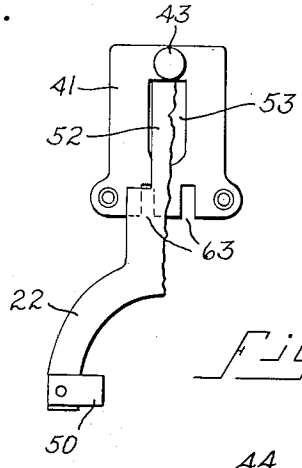


Fig. 7.

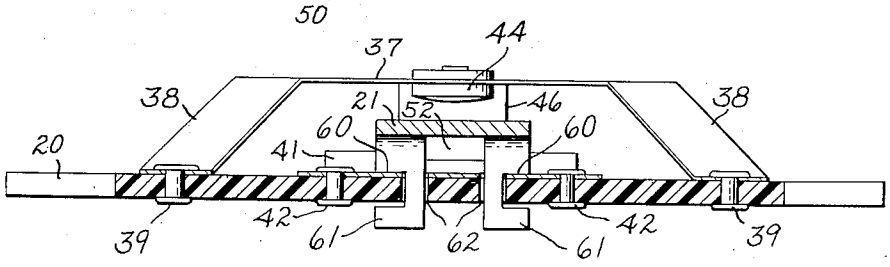


Fig. 6.

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UNITED STATES PATENT OFFICE

2,463,020

STARTING SWITCH

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Application April 16, 1948, Serial No. 21,367

16 Claims. (Cl. 200—80)

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The present invention relates to switches and, while not necessarily limited thereto, the switches are particularly suitable for use in dynamo-electric machines in combination with centrifugal operating devices for controlling the circuit of starting windings in single phase induction motors, or other electrical devices in which it is desired to control the circuits thereof in accordance with the speed of rotation of the machine or device.

It is a principal object of the present invention to provide an improved switch structure which is simple in design, of low cost manufacture, and reliable in operation.

A further object of the invention is to provide a new and improved switch structure particularly suitable for use with centrifugal operating devices and which consists of relatively few parts of rugged design and which is compactly arranged so as to require a minimum of space such as within a machine housing.

In accordance with the illustrated embodiment, the switch structure comprises a base plate of insulating material having a pair of elongated leaf spring members secured at one end thereto and with the free ends thereof biased toward the base plate by the inherent resiliency of the leaf spring material. The free ends of the spring members overlap each other and are provided with electrical contacts on their facing surfaces. The upper spring member is provided with a stop portion for limiting the movement of the free end thereof toward the base plate and normally to hold the contacts in an open cercuit position. An operating member is provided having a lever portion at one end which is secured to the free end of one of the spring members, and outstanding shoulder portions intermediate its ends forming a fulcrum for the operating lever upon the base plate. The opposite outer end portion of the operating member is provided with a yoke for cooperative engagement by the centrifugal operating device which may be associated therewith. The invention resides primarily in the novel construction and arrangement of parts whereby improved operation results but with substantial reduction in cost.

Further objects and advantages of the invention will become apparent from the following description referring to the accompanying drawings, and the features of novelty will be pointed out with greater particularity in the appended claims forming a part of this specification.

In the drawings, Fig. 1 is a side elevational view of a dynamo-electric machine partially broken

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away to illustrate a switch structure embodying the invention in accordance with one form thereof; Fig. 2 is a fragmentary side elevational view illustrating the switch structure in a different position from that shown in Fig. 1; Fig. 3 is an enlarged plan view of the switch structure and taken along the line 3—3 of Fig. 2; Fig. 4 is a plan view showing the reverse side of the switch structure of Fig. 3; Fig. 5 is a vertical cross-sectional view taken along the line 5—5 of Fig. 3; Fig. 6 is a horizontal cross-sectional view, further enlarged, taken along the line 6—6 of Fig. 3; Fig. 7 is a plan view illustrating one of the spring members incorporated in the switch structure.

In the drawings, the improved switch structure is illustrated in its application to a centrifugal switch combination for connecting and disconnecting the starting winding of a capacitor or split phase motor. However, it is to be understood that the switch construction may be employed wherever it is desired to open or close a circuit in response to movement of a suitable operating mechanism.

Referring more particularly to Figs. 1 and 2, a dynamo-electric machine is shown having a stationary member 10 and a rotatable member 11 mounted on a shaft 12 which is supported in suitable bearings 13 in the opposite end bells 14. The dynamo-electric machine illustrated is a single phase induction motor and the excitation is provided by a single phase main field exciting winding 15 and a starting field exciting winding 16, which windings are arranged in slots provided therefor in the core 17 of the stationary member and are adapted to induce electrical currents in a squirrel cage winding 18 arranged in slots in the rotatable member 11.

In this type of induction motor, it is desirable that the starting field exciting winding should be energized during the period when the motor starts to operate, or under such operating conditions that the speed of the motor is reduced below a predetermined value and that this field exciting winding be de-energized when the speed of the motor exceeds a predetermined value. In order to accomplish this, a control switch is provided having electrical contacts connected to the energizing circuit of the starting field exciting winding 16. The control switch is mounted upon a mounting plate 20 suitably secured to the adjacent end bell 14 of the motor. The switch structure includes an operating member defining a yoke 22 at one end straddling the shaft 12 and which is adapted to be cooperatively engaged by the axially movable collar 25 slidably mounted

upon the shaft 12. The collar 25 is operatively connected to the inner ends of operating arms of the flyweight units 27 pivotally mounted upon the support member 28. The flyweight units 27 include weighted portions which, under centrifugal force, shift outwardly to cause axial movement of the collar 25 toward the support member 28 to the position shown in Fig. 2. In the condition of rest of the centrifugal operating mechanism, the collar 25 is biased away from the support member 28 by means of the springs 31 arranged around the operating arms of the flyweight units and into engagement with the ends of the yoke member 22 holding the switch in the closed circuit position. As shown in Fig. 2, when the collar 25 is moved inwardly toward the support 28 upon outward movement of the flyweights 27, the collar 25 disengages the yoke 22 of the switch structure permitting the contacts thereof to move to the open circuit position. It is to be understood that the centrifugal operating mechanism for the switch structure may be of any suitable type, and the embodiment illustrated in Figs. 1 and 2 forms no part of the present invention and is separately described and claimed in the copending application Ser. No. 21,482 filed concurrently herewith.

Referring now to Figs. 3 to 6, inclusive, the details of the switch structure will now be described. The base plate 20 may be made of any suitable insulating material and is provided with a plurality of holes 35 along its opposite outer edge portions for fastening the same within the end bell of the motor. A first U-shaped spring member is mounted upon the upper surface of the base plate 20, the spring member comprising a closed end portion 37 and relatively widely separated and diverging leg portions 38. The outer ends of the leg portions 38 are suitably stationarily fastened to the upper surface of the base plate 20 such as by means of eyelet rivets 39. A second relatively wide and elongated spring member 41 is mounted upon the base plate 20 and secured stationarily thereto at one end at a pair of spaced apart points by means of eyelet rivets 42. Attention is directed to the fact that the rivets 42 are in transverse alignment with the rivets 39 securing the first spring member to the base plate. The free end of the spring member 41 extends beneath the closed end portion 37 of the first spring member, and cooperating electrical contacts 43 and 44 are suitably secured upon the facing surfaces of the overlapping portions of the two spring members. The two leaf spring members may be stamped from any suitable material such as bronze and are both biased toward the base plate 20 by their inherent resiliency. Means are provided for limiting the movement of the closed free end portion 37 of the upper spring member toward the base plate, and, as shown, the outer end portion of the spring member is provided with a tab 46 which is bent at right angles with respect to the portion 37 toward the base plate beyond the end of the lower member 41. The tab 46 normally supports the contact 44 in a spaced, or open circuit, relation with respect to the contact 43. For reduction of noise, a pad 47 of suitable sound absorptive material, such as felt, is secured to the upper surface of the base plate 20 beneath the free end portions of the two spring members and against which the end portions of the two spring members will engage upon movement thereof to the open circuit position.

The outer ends of the bifurcated portions of yoke 22 are provided with inwardly extending wear pads 50 which are adapted to be engaged by the sliding collar 25 of the centrifugal operating mechanism. The opposite end of the yoke operating member is provided with a lever portion 52 which extends through the cooperating elongated opening 53 provided in the spring member 41, the end of the lever portion 52 being suitably secured to the lower side of the upper end of the spring member 41. For convenience, the stud projecting from the rear side of the contact 43 extends through aligned cooperating openings in the end portion of the spring member 41 as well as the end of the lever 42 thereby accomplishing the dual purpose of mounting the contact 43 in place as well as securing the lever 52 to the spring member 41.

The operating member 22 is fulcrumed intermediate its ends for pivotal rocking movement relative to the base plate 20. Opposite edge portions of the operating member are bent downwardly at right angles as shown more clearly in the sectional views of Figs. 4 and 5 defining a pair of shoulders 60 adapted to bear against the upper surface of the stationary portion of the spring member 41 between the eyelet rivets 42 and headed prong portions 61 adapted to extend through cooperating slots 62 in the base member. Referring to Fig. 7, it will be explained that the lower end of the spring member 41 is provided with a pair of notches 63 having a width substantially equal to the minimum width of the prong portions 61 and in the assembly of the switch structure the prong portions 62 are first inserted into the slots 63 before the end of the lever portion 52 is secured to the outer end of the spring member 41 by means of the contact stud as previously described. The enlarged heads of the prongs 61 are then inserted through the enlarged lower ends 64 of the slots 62 in the base plate and then moved upwardly into the narrow portions of the slots 62 before the eyelet 42 are inserted through the cooperating openings in the base plate for securing the spring member 41 thereto. Upon fastening of the spring member 41 to the base plate, the heads of the prongs 61 are retained against withdrawal from the slots 62 within the base plate and the operating member is thus effectively secured in position yet free to rock about the pivotal fulcrums defined by the shoulder portions 60. Durable, wear resistant bearing surfaces for the fulcrum shoulders 60 are provided by the portions of the spring member 41 adjacent the sides of the slots 63.

Electrical connections may be made to the switch contact bearing spring members by soldering the ends of conductors in the eyelet rivets 39 and 42 which form suitable terminals.

The operation of the switch structure will be obvious from the description given. Due to the resiliency of the spring members 38 and 41, the switch contacts are normally biased to the open circuit position shown in Fig. 2. The switch is operated to the closed circuit position by engagement of the operating element of the centrifugal device with the ends of the yoke 22. Upon exertion of pressure against the end of the yoke, the operating member 22 is caused to pivot about the fulcrum shoulders 60 whereupon contact 43 upon the free end of the contact spring 41 is carried into contacting engagement with contact 44 upon the upper spring 38. Depending upon the extent of axial movement of the collar 25 of the centrifugal operating device, the outer ends of the two spring members and their contacts are carried away from the base as shown in Fig. 1. Due to

the bias of the upper spring member 38 toward the base, firm engagement between the contacts is insured during any condition of overtravel of the operating member 22. Upon movement of the collar 25 of the centrifugal operating device out of engagement with the yoke 22 the contacts of the switch structure are quickly restored to the open circuit condition shown in Fig. 2 but without any appreciable noise due to the felt backing element 47 against which the free ends of the spring member will engage.

Having described the invention in what is considered to be a preferred embodiment thereof, it is desired that it be understood that the specific details shown are merely illustrative and that the invention may be carried out with considerable variation without departing from the true spirit and scope of the invention.

We claim:

1. In a switch mechanism of the kind described, a base of insulating material, a first U-shaped spring member having a closed end portion and a pair of relatively widely separated leg portions, means stationarily securing the outer ends of said leg portions to said base, an elongated relatively wide second spring member, means stationarily securing one end of said second spring member to said base at a pair of widely spaced apart points in transverse alignment with the secured end portions of said first spring member, the free end of said second spring member underlying the closed end portion of said first spring member, the free ends of both of said spring members being biased toward said base by the resiliency thereof, a pair of cooperating contacts secured to the facing surfaces of the overlapping portions of said two spring members, stop means for limiting the movement of said closed end of said first spring member toward said base whereby the contact on said first spring member is normally supported in an open circuit condition with respect to the contact on said second spring member, a longitudinal operating member including a lever portion secured to the free end of said second spring, said operating member including means defining a fulcrum for said lever engaging the surface of said second spring member between the spaced apart fastening points for said second spring member.

2. In a switch mechanism of the kind described, a base plate of insulating material, a first U-shaped leaf spring having closed end and leg portions, the outer ends of said leg portions being fixedly secured to said base plate whereby the closed end of said spring is resiliently biased toward said base plate, means on the closed end of said first spring extending toward said base plate for limiting movement of said closed end toward said base plate to a predetermined limit position, a second elongated leaf spring, one end of said second spring being secured to said base plate between the legs of said first spring and at points in alignment with the secured ends of said first spring, the free end of said second spring extending beneath the closed end of said first spring, cooperating facing contacts secured to the ends of said first and said second spring, an operating member including a yoke at one end and an operating lever at the opposite end, said operating member including a pair of angularly extending shoulder forming portions on the opposite sides thereof, said shoulder portions forming a fulcrum with the upper surface of said base plate in transverse alignment with fastening points of said springs, a longitudinal centrally disposed opening in said second spring member, the outer end of said operating arm extending through said opening and secured to the lower surface of said second spring member opposite the contact mounted thereon, and a sound deadening means secured to said base plate beneath the movable ends of said first and said second spring members.

3. In a switch mechanism of the kind described, a base plate of insulating material, a first leaf spring member having a substantially U-shape and including longitudinal leg portions and a closed end portion, means fastening the outer ends of said leg portions to said base plate, said first leaf spring member being biased by its own resiliency toward said base plate, the outer edge of said closed end portion including a portion extending at right angles therefrom toward said base plate and spacing said closed end a predetermined distance from said base plate, a second elongated, relatively wide leaf spring member, a pair of spaced apart means securing one end of said second spring member to said base plate in transverse alignment with said fastening means for said first spring member, the free end of said second spring member being biased by the resiliency thereof toward said base plate, the free end of said second spring member extending between the closed end of said first spring member and said base plate, a pair of cooperating contacts mounted on the facing surfaces of the end portions of said first and second spring members, said contacts being normally biased to the open circuit position, an operating member pivotally mounted on said base plate, said operating member including a yoke forming portion at one end and a lever forming portion at the opposite end, a pair of spaced apart portions extending from the opposite edges of said operating member toward said base plate having a pair of shoulders defining fulcrums engaging the upper surface of said base plate and about which said operating member may be rocked and also including a pair of prongs extending through cooperating openings in said base plate, the outer ends of said prongs being offset to preclude withdrawal of said prongs through said openings, an elongated opening in said second spring member, the lever forming portion of said operating member extending through said last mentioned opening and beneath the uppermost end of said second spring member, and means securing the free end of said lever to the free end of said second spring member, and a pad of sound absorptive material secured to the upper surface of said base plate beneath the free ends of said first and said second spring members.

4. In a switch mechanism of the kind described, a base plate of insulating material, a U-shaped spring member having the outer ends of its legs fixedly secured to said base plate, a portion of said spring at the closed end thereof being bent inwardly toward said base plate and spacing the closed end of said spring from said base plate, a first contact secured to the closed end of said spring on the side thereof facing said base plate, a second elongated spring secured at one end thereof to said base plate between the legs of said first spring, a contact secured to the upper surface of said second spring on the side thereof facing said first spring, an operating lever having a yoke formed on one end thereof and fulcrumed on said base plate between the outer ends of said first spring, the opposite end of said lever being secured to said second spring for effecting movement of the contact on said second spring

into engagement with said contact on said first spring.

5. In a switch mechanism of the kind described, a base plate of insulating material, a first U-shaped leaf spring member, means fastening the ends of the legs of said spring member to said base plate, a second leaf spring member, means fastening one end of said second leaf spring member to said base plate in transverse alignment with the fastening means for said first spring member, both of said spring members being biased toward said base member by the inherent resiliency thereof, means spacing the closed end of said first spring member from said base plate, the free end of said second spring member being disposed in spaced relation beneath the closed end of said first spring member, cooperating contacts mounted on the facing surfaces of said two spring members, and lever operating means for said second spring member.

6. In a switch mechanism of the kind described, a base, a first U-shaped spring including a closed end portion and a pair of relatively widely separated legs, means stationarily securing the outer ends of said legs to said base, a relatively wide elongated second spring, means stationarily securing one end of said second spring at a pair of spaced apart points to said base between and spaced from the outer ends of the legs of said first spring, the free ends of both of said springs being biased toward said base by the resiliency thereof, the free end of said second spring underlying the close end portion of said first spring, a pair of cooperating contacts mounted on the facing surfaces of the overlapping portions of said two spring members, means for limiting movement of the closed end portion of said first spring member toward said base whereby said contacts are normally supported in an open circuit condition and lever means connected to the free end of said second spring for effecting movement thereof into closed circuit condition.

7. In a switch mechanism of the kind described, a base, a U-shaped spring member including a closed end portion and a pair of diverging leg portions, means stationarily securing the outer ends of said leg portions to said base, a second elongated relatively wide spring member, means stationarily securing one end of said second spring member to said base at spaced apart points in alignment with the secured ends of said first spring member, the closed end portion of said first spring member overlapping the free end of said second spring member, the legs of said first spring member straddling and spaced from said second spring member, cooperating contacts mounted on the facing surfaces of the overlapping portions of said two spring members, an outer portion of the closed end of said first spring member extending angularly toward said base for restraining movement of the closed end of said first spring toward said base and for supporting the contact on said first spring out of engagement with the contact on said second spring.

8. In a switch mechanism of the kind described, a base plate of insulating material, a first U-shaped leaf spring member, means securing the outer ends of the legs of said member to the said base plate, an elongated second spring member, means securing one end of said second spring member to said base plate in transverse alignment with the securing means for said first spring member, the free end of said second spring member extending in spaced relation beneath the closed end of said first spring member, both of said spring members being biased toward said base plate by the resiliency thereof, cooperating contacts mounted on the facing surfaces of said two spring members, and an operating lever operatively connected to said second spring member and pivotally mounted on said base plate.

9. In a switch mechanism of the kind described, a base, a pair of substantially flat leaf springs, means stationarily securing one end of each of said springs to said base, the end of the first of said springs overlapping the free end of the second of said springs, cooperating contacts mounted on the facing surfaces of the overlapping portions of said two springs, both of said springs being biased toward said base by the resiliency thereof, said first spring including a portion extending toward said base and defining a stop for limiting movement of the contact thereon toward said base whereby said contacts are normally spaced apart, an elongated operating member having an angularly extending portion intermediate the ends thereof, said portion defining a fulcrum shoulder and a prong, an opening through the stationary end of said second spring and said base therebeneath, said prong extending through said opening and said shoulder engaging with the upper surface of said stationary portion of said second spring, and means securing the free end of said operating member to the free end portion of said second spring for precluding withdrawal of said prong through said opening.

10. In a switch mechanism of the kind described, a base, a pair of leaf springs, means stationarily securing one end of each of said leaf springs to said base, said springs being biased toward said base by the resiliency thereof, the free end portion of the first of said springs overlapping the free end portion of the second of said springs, a pair of cooperating contacts mounted on the facing surfaces of said overlapping portions of said springs, the outermost portion of the free end of said first spring extending angularly toward said base beyond the end of said second spring and defining a stop for limiting movement of said first spring toward said base, and a cushion element secured to said base and adapted to be engaged by the free ends of both of said springs.

11. In a switch mechanism of the kind described, a base, a pair of elongated leaf springs, means securing one end of each of said leaf springs to said base, the free ends of said leaf springs being biased toward said base by the resiliency thereof, the free end of the first of said springs overlapping the free end of the second of said springs, means defining a stop for limiting movement of the free end of the first of said springs toward said base, cooperating contacts mounted on the facing surfaces of the overlapping portions of said springs, an elongated opening in the second of said springs, an operating lever having one end portion extending longitudinally through said opening and secured to the lower side of the free end of said second spring, and means defining a fulcrum for said lever intermediate the opposite ends thereof and engaging with the upper surface of said second spring adjacent the stationary end thereof.

12. In a switch mechanism of the kind described, a base, a pair of elongated leaf springs, means fixedly securing one end of each of said leaf springs to said base adjacent one end thereof, the free ends of said leaf springs being biased toward said base by the resiliency thereof and extending toward the opposite end thereof, the

free end of the first of said springs overlapping the free end of the second of said springs, means defining a stop for limiting movement of the free end of the first of said springs toward said base and said second spring, cooperating contacts mounted on the facing surfaces of the overlapping portions of said springs, an operating lever having one end portion extending longitudinally of said second spring and secured to the lower side of the free end of said second spring, and means on said operating lever defining a pivotal fulcrum for said lever intermediate the opposite ends thereof against the upper surface of said base adjacent the fixed ends of said springs.

13. In a switch mechanism of the kind described, a base, a pair of elongated leaf springs, means securing one end of each of said leaf springs to said base adjacent one end thereof, the free ends of said leaf springs extending toward the opposite end of said base and being biased toward said base by the resiliency thereof, the free end of the first of said springs overlapping the free end of the second of said springs, means defining a stop for limiting movement of the free end of the first of said springs toward said base, cooperating contacts mounted on the facing surfaces of the overlapping portions of said springs, an operating lever having one end portion secured to the free end of said second spring, and means defining a fulcrum for said lever intermediate the opposite ends thereof and adjacent the fixed end of said second spring.

14. In a switch mechanism of the kind described, a base plate, a first leaf spring member, means fastening one end of said first spring member to said base plate, a second leaf spring member, means stationarily fastening one end of said second spring member to said base plate adjacent the stationary end of said first spring member, the free ends of said two spring members being biased toward said base plate, means limiting the movement of the free end of said first spring member in the direction toward said plate to a predetermined spaced apart distance from said base plate, the free end of said second spring member being disposed normally in spaced relation beneath the free end of said first spring member, cooperating fixed contacts mounted on the facing surfaces of said two spring members, an operating member having a yoke portion at one end and a lever portion at the opposite end, means connecting said lever portion to the free end of said second spring member, means extending outwardly from one side of said member defining a pivotal fulcrum for said member, said fulcrum bearing against the upper surface of the stationary end portion of said second spring member.

15. In a switch mechanism of the kind described, a base plate, a pair of leaf spring members, means fixing one end of each of said spring members to said base plate, the free ends of said two spring members being biased toward said base plate, the free end of the first spring member being normally disposed in spaced relation above the free end of the second spring member, cooperating contacts fixedly mounted on the facing surfaces of said two spring members, an operating member having a lever portion at one end fixedly connected to the free end of said second spring member, and means extending outwardly from one side of said member intermediate its ends defining a pivotal fulcrum for said operating member, said fulcrum bearing against the upper surface of the stationary end portion of said second spring member.

16. In a switch mechanism of the kind described, a base plate, a pair of leaf spring members defining a pair of electrical conductors, terminal means securing one end of each of said spring members to said base plate, the free ends of said two spring members being biased toward said base plate, and the free end of a first spring member being normally disposed in spaced relation from the free end of the second spring member, cooperating fixed contacts mounted on the facing surfaces of said two spring members, an operating member having a lever portion at one end fixedly connected to the free end of one of said spring members, and means defining a pivotal fulcrum for said operating member upon said base plate, said operating member being retained in position upon said base plate by said connection with said one spring member.

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The following references are of record in the file of this patent:

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2,305,441	Pepper	Dec. 15, 1942

Certificate of Correction

Patent No. 2,463,020. March 1, 1949.

EVERETT L. COE, JR., ET AL.

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 34, for "cercuit" read *circuit*; column 3, line 63, after the word "lower" insert *spring*; column 4, line 13, for "lever 42" read *lever 52*; line 41, after "eyelet" insert *rivets*; column 7, line 33, claim 6, for "close" read *closed*; column 10, line 30, claim 16, for "plate, and the" read *plate, the*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of June, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

Certificate of Correction

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[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.