May 12, 1942. S. D. VIGREN ET AL 2,282,687

SET OF CONTACT SPRINGS FOR ELECTRICAL SWITCHING APPARATUS

Filed July 19, 1938

Fig. 1.

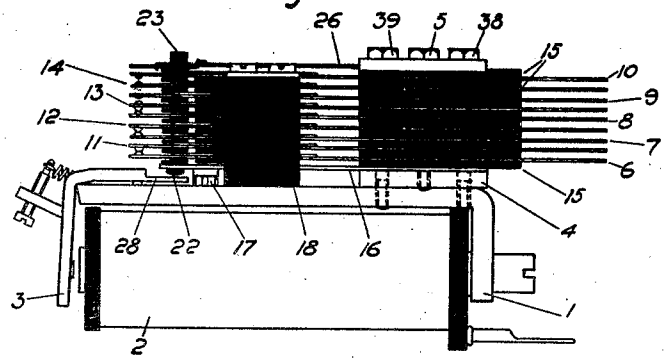


Fig. 2.

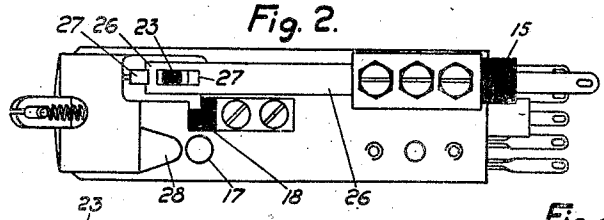


Fig. 3.

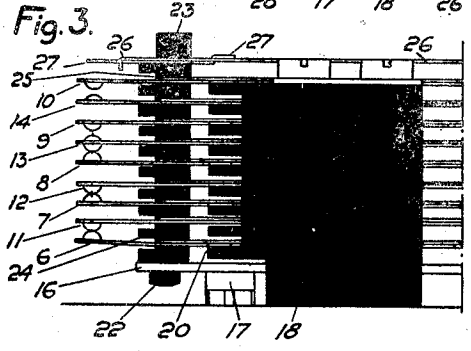


Fig. 4.

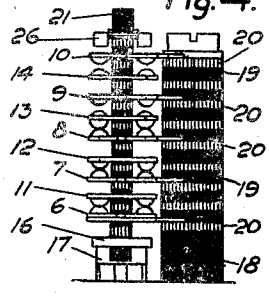


Fig. 5.

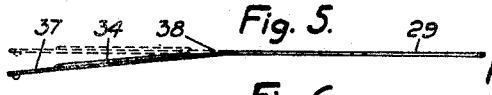


Fig. 6.

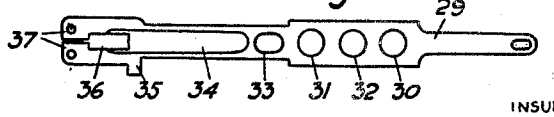


Fig. 7.

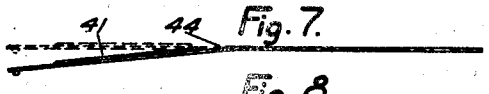


Fig. 8.

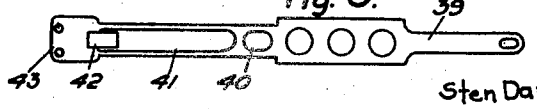


Fig. 9. Fig. 10.

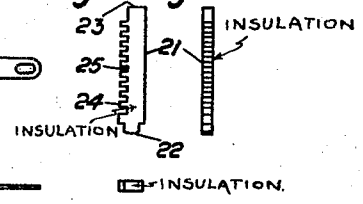


Fig. 11.

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2,282,687

SET OF CONTACT SPRINGS FOR ELECTRICAL SWITCHING APPARATUS

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Application July 19, 1938, Serial No. 219,944
In Great Britain June 13, 1938

2 Claims. (Cl. 200—1)

The present invention relates to electrical switching apparatus of the type employing a plurality of metal leaf contact springs mounted together to form a set of contact springs. Such apparatus are commonly employed in telephone and other electrical signalling systems and serve, for example, as relays, selectors, cross-bar switches and the like.

As is well known, great difficulty has hitherto been experienced in effecting the proper adjustment of contact springs in switching apparatus provided with sets of contact springs forming a plurality of contact combinations. The adjustment of the individual pretension of each contact spring and the contact pressure in each individual contact combination in such a set has been difficult, arduous and exceedingly costly.

In certain known relays, for example in the standard British post office type of relay, the adjustment of individual contact springs to provide the proper contact pressure in a contact combination has been particularly arduous, due to the fact that all the movable springs are interconnected by means of lifting studs of metal and/or insulating material. Said construction causes several inconveniences of which a few will be here mentioned:

Different kinds of metal and insulating studs are needed for different contact combinations. As the stud, for example, of an upper movable contact spring rests upon the adjacent lower movable spring and the stud of the lowest movable spring rests on the movable armature of the relay, no free movement of the armature is obtained. Such a construction calls for more energy and more liberal dimensioning of the electromagnet in order to lift all the springs than if the armature were free during its initial movement. The contact pressure of a particular spring is added by means of its stud to all the other springs, so that the contact pressures of the different contact combinations are interdependent. Such an interdependence of the different contact pressures makes the adjustment of the springs highly difficult.

In order to solve the above-mentioned difficulties this invention provides electric or electromagnetic switching apparatus having a set of contact springs which includes a number of movable contact springs wherein these movable contact springs are arranged to be actuated by a common movable operating member which is provided with slots and teeth for engaging the said movable contact springs and which passes through openings in the contact springs of the set, the dimensions of the openings being such that the operating member, when moved by the armature of the electromagnet or otherwise, passes freely through the fixed contact springs but engages the movable contact springs with its teeth, a locking device being provided to fix the operating member laterally with respect to the movable contact springs.

The operating member is operable by the armature of the switching apparatus and is guided by guiding means located preferably at both ends of the said operating member. The said guiding means can, at one end of the operating member, consist of a leaf spring provided with a hole adapted to receive the end of the said member and at the other end by a stiff metal strip also provided with a hole to receive the said other end of the said member.

One of the guiding means, preferably the means at the upper or outer end of the operating member, is provided with a locking device to fix the operating member laterally with respect to the guiding means and to the contact springs.

The height of the slot between two consecutive teeth is advantageously made large with respect to the thickness of the corresponding spring to be engaged by a tooth of the fixed stud or of the movable operating member.

By this arrangement the surprising result is obtained that the contact pressure of any contact combination is entirely independent of the contact pressures of the other contact combinations of the set.

The number of the slots and of the teeth and the distance between any two consecutive teeth is substantially the same in the supporting stud and in the operating member. In position of rest or normal position the supporting stud and the operating member are so located with respect to each other in the contact spring set that the teeth of the supporting stud are located in line with the slots of the operating member.

By merely using a standard fixed stud and a standard operating member according to this invention any desired kind of contact combination can easily be built up in a single set with a minimum of work and of adjustment.

On account of the high and roomy slots the additional surprising result can be obtained that any of the contact combinations in a set can easily be arranged in the form of an early or a late make-or-break contact merely by bending the contact tip of one of the corresponding springs upwards or downwards.

Preferably, the fixed contact springs are provided with lugs adapted to rest on the teeth of the fixed stud. The contact springs, both fixed and movable, are preferably constructed as described in Patent No. 2,156,465, granted May 2, 1939 to Vigren et al. All springs are preferably mounted in such a way that they have a tendency to press in the direction towards the armature, so that each spring would rest, if free to do so, on the top of the corresponding tooth.

The invention is illustrated by way of example in the accompanying drawing in which—

Fig. 1 is a side elevation of a relay having a plurality of contact combinations provided by pretensioned metal leaf contact springs.

Fig. 2 is a top plan view of the relay of Fig. 1.

Fig. 3 is an enlarged part side elevation of the arrangement of Fig. 1, showing in detail the exact position of the fixed and movable springs in relation to the fixed supporting stud and to the movable operating member.

Fig. 4 is a front elevation corresponding to Fig. 3.

Fig. 5 is an elevational view of a preferred form of fixed contact spring.

Fig. 6 is a plan view of the spring shown in Fig. 5.

Fig. 7 is an elevation of a preferred form of movable contact spring.

Fig. 8 is a plan view of the movable spring shown in Fig. 7.

Fig. 9 is a side elevation of the movable operating member for the operation of the movable contact springs.

Fig. 10 is a front elevation of the operating member shown in Fig. 9, and

Fig. 11 is a top plan view of the operating member shown in Fig. 9 and Fig. 10.

In Figs. 1 and 2 1 is a heel piece which carries the electromagnet 2, its armature 3 and a plurality of contact springs, arranged in a plurality of contact combinations, stacked in a set arranged on one side of the heel piece. For the sake of clarity only one set is shown, although another set can be placed on the other side of the heel piece. 4 is a metal support, fixed to the heel piece, which serves as a carrier for the said set of contact spring combinations, all the springs being fastened to said support 4, which is detachable from the heel piece for inspection or in order to change the springs in the contact combination.

In Figs. 1 to 4, 6, 7, 8, 9 and 10 are fixed metal leaf contact springs, 11, 12, 13 and 14 are movable metal leaf contact springs. Each spring is separated and insulated from the adjacent ones by means of insulating strips 15.

Between the lowest insulating strip 15 and the support 4 there is mounted a stiff metal bridge 16, supported next its forward extreme end by a metal stud 17 which is screwed into the relay frame 1 and is adjustable in the vertical direction to raise or lower the forward end of the bridge 16 and thereby vary the initial normal position of the operating member 21 with respect to the positions of the movable and fixed contact springs in the respective contact combinations. 18 is a supporting insulating stud fixed to the relay frame 1 at the side of the set of metal contact springs, stacked on one side of the said relay frame. If two such sets are mounted on the same frame the same supporting insulating stud 18 can serve for both sets.

The supporting insulating stud 18 is provided in this case with 8 equally high slots 19, and 9 protruding teeth 20, all of the same size, whereby the distance between any two consecutive teeth is the same. 21 is a movable operating member provided with a lower peg 22 which passes freely through a guiding hole at the end of the metal bridge 16. 23 is an upper peg of the operating member which passes through a hole in a pretensioned metal spring 26 and is locked laterally with respect to this metal spring 26 by a locking device 27.

The operating member 21 is provided with 10 teeth 24 and 9 slots 25 with the same distance between two consecutive teeth as between the teeth of the fixed supporting stud 18. It is understood that the operating member and the supporting stud can be provided with any number of slots and teeth to accommodate corresponding number of metal leaf contact springs.

The armature of the relay is provided with two tongues 28 of which the upper surface of each one (when two sets of springs are mounted on the heel piece 1) is located at a small distance from a peg 22 of an operating member 21.

In Figs. 5 and 6 which show a fixed metal leaf spring 29, of the kind which is preferably used with the invention, 30 and 31 are holes for admitting screws 38 and 39. 32 is a hole to receive screw 5 for centering the springs in the set. 33 is a hole whereby the spring is given a reduced cross-section adjacent its anchoring position and 34 is a reinforcement along the major part of the free length of the contact spring to prevent vibrations and uncontrollable bending of same. 35 is a lug to hold the spring in proper position in a contact combination, the lug being arranged to enter a slot 19 of the fixed supporting stud 18 and rest upon one of the teeth 20 of the latter. 36 is a hole large enough to allow the operating member 21 and its teeth 24 to pass freely through. 37 are two contact carrying lips of the spring. The spring is bent at 38 at or adjacent to the weaker portion 33, so that the spring is divided into two parts inclined to each other, but it is straightened out and thus pre-tensioned when mounted in the contact combination.

In Figs. 7 and 8 is shown a movable contact leaf spring 39 which is provided with holes for anchoring and fastening means in the same way as in the fixed spring 29. 40 is a hole whereby the spring is given a reduced cross-section adjacent its anchoring position. 41 is a reinforcement along the major part of the free length of the contact spring to prevent vibrations and uncontrolled bending. 42 is a hole which is only large enough to allow the operating member 21 to be introduced but, when locked in position, the leaf spring will slip into one of the slots 25 and the corresponding tooth 24 will engage and move the spring upon operation of the armature 3. 43 is the contact carrying lip of the spring. The spring is bent at 44 at or adjacent the weaker portion 40 of the leaf spring, so that the spring is divided into two parts inclined with respect to each other whereby, when the spring is straightened out upon being mounted in the contact combination, the spring is pre-tensioned.

It is to be understood that the switching apparatus and set of contact springs according to the invention is not limited to the construction shown in the accompanying drawing. Known contact springs can be used in the contact combinations, but it is preferred to use the pre-tensioned springs here shown and which are described in Patent No. 2,156,465, hereinbefore referred to. A set of contact springs is most desirably assembled in the following manner: After the fixed and movable springs have been provided with a bend corresponding to the desired contact pressure, the springs are assembled and separated by insulating strips as shown in Figs. 1 to 4.

The fixed contact springs are placed in position with their lugs in the corresponding slots 19 of the stud 18, these lugs resting respectively on the upper surface of the corresponding tooth

20. The operating member 21 is passed through the holes 36 of the fixed springs and holes 42 of the movable springs. When the movable springs are located in front of the corresponding slots of the operating member, this member is, in the construction shown, moved forward, whereby a tooth of the operating member will be located below the part of a movable contact spring which borders or limits the front part of the hole 42 in the spring, with the object of engaging and moving said spring when the operating member is moved upwards.

The operating member 21 passes freely through the fixed springs and operates independently of them, but engages and moves the movable springs, when the armature is energized.

The contact combinations shown in Figs. 1, 3 and 4 by way of example are the following:

1 make-contact, 1 make and break-contact, 1 early break-contact, 1 late break-contact.

In the enlarged Figures 3 and 4 it can be observed that the fixed contact springs 10, 9, 8, 7 and 6 all rest with a certain pre-tension with their lugs 35 on the corresponding tooth 20 in the fixed stud, while of the movable springs, which also are provided with a certain pre-tension, the movable spring of a break-contact, for example spring 13, 12 or 11, does not rest on its corresponding tooth of the operating member until after this member has started to move. The movable spring of a make-contact on the other hand, for instance spring 14, does rest on the tooth of the operating member with which it is associated and starts to move simultaneously with the said operating member.

By giving, for example, the movable spring 6 of a break-contact combination 6—11 an extra bend upwards, at the tip or lip from the hole 42 towards the contact end, the break-contact will be adjusted to open later than, for example, the break-contact 7—12 which has no extra bend at the tip. This possibility of easily arranging different contact combinations in the same set and in the same relay to open or to close at different time intervals is a very important one and not obtained heretofore in any similar contact combination.

It should be noticed that the operating member 21 does not rest directly on the armature, as there is a small air gap between the lower peg 22 of the operating member and the tongue 28 of the armature so that an initial free movement of the armature is obtained and this results in a fast and positive operation of the break- and make-contacts.

A great advantage provided by the invention consists in the fact that the contact pressure of each contact combination of the set is entirely independent of any other contact combination of the same set.

The assembly of a set comprising a plurality of various kinds of contact combinations is exceedingly easy and the work astonishingly simplified. By using standard pre-tensioned contact springs, bent to a certain degree before mounting, the desired contact pressure is automatically obtained as soon as mounted. No arduous adjustment work is needed, wherefore this new kind of switching apparatus is cheap to make and to adjust when compared with the switching equipment used heretofore.

What we claim is:

1. In a circuit controlling device, a plurality of normally stationary contact springs, a plurality of movable contact springs, all of said springs being insulatedly supported at one end with their contact ends pretensioned in the same direction and arranged in make and break contact combinations, an actuating member of insulating material, a stationary support of insulating material, said actuating member and said support each having notches of equal width and equal spacing and equal in number to the total number of springs whereby the stationary and movable springs may be interchanged with respect to the notches of either said actuating member or said support, each notch of said actuating member and support being wider than the thickness of the associated spring to permit freedom of movement of the associated spring within said notch, a lower adjustable spring for guiding and supporting the lower end of said actuating member, an upper spring for guiding the upper end of said actuating member having an aperture therein through which said actuating member may be inserted and moved to engage the movable contact springs in its notches, a locking device having a tongue insertable in the aperture of said upper guide spring and having an aperture tightly embracing the upper end of said actuating member, and ears on the end of said upper guide spring embracing the outer end of said locking device, whereby said locking device and said lower guide spring hold said actuating member in its assembled position with respect to said movable springs.

2. In a circuit controlling device, a plurality of normally stationary contact springs, a plurality of movable contact springs, all of said springs being insulatedly supported at one end with their contact ends pretensioned in the same direction and arranged in make and break contact combinations, and each spring having an axially disposed aperture therein adjacent its contact end, an actuating member of insulating material insertable through the aligned apertures of said springs, a stationary support of insulating material, said actuating member and said support having notches of equal width and equal spacing and equal in number to the total number of springs whereby the stationary and movable springs may be interchangeably positioned with respect to the notches of either said actuating member or said support, each notch of said actuating member and support being wider than the thickness of the associated spring to permit freedom of movement of the associated spring in said notch, a lower adjustable spring for guiding and supporting the lower end of said actuating member, an upper spring for guiding the upper end of said actuating member having an aperture therein through which and the apertures of said springs said actuating member may be inserted and moved to engage the movable contact springs in its notches, a locking device having a tongue insertable in the aperture of said upper guide spring and having an aperture tightly embracing the upper end of said actuating member, and ears on the end of said upper guide spring embracing the outer end of said locking device, whereby said locking device and said lower guide spring hold said actuating member in its assembled position with respect to said movable springs while permitting it to move freely through the apertures of said stationary springs.

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