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T. TERJESEN

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CONTACT ARM FOR CIRCUIT CONTROLLING DEVICES

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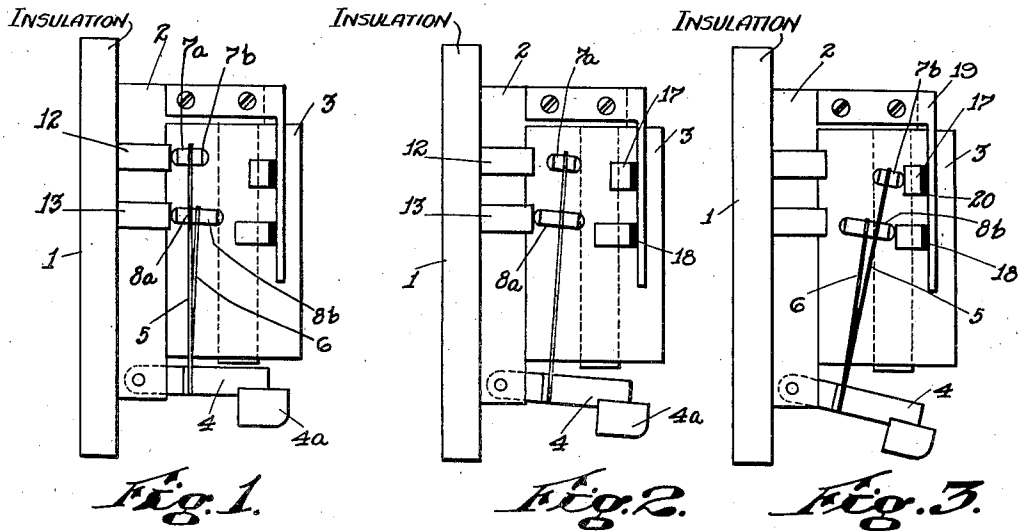
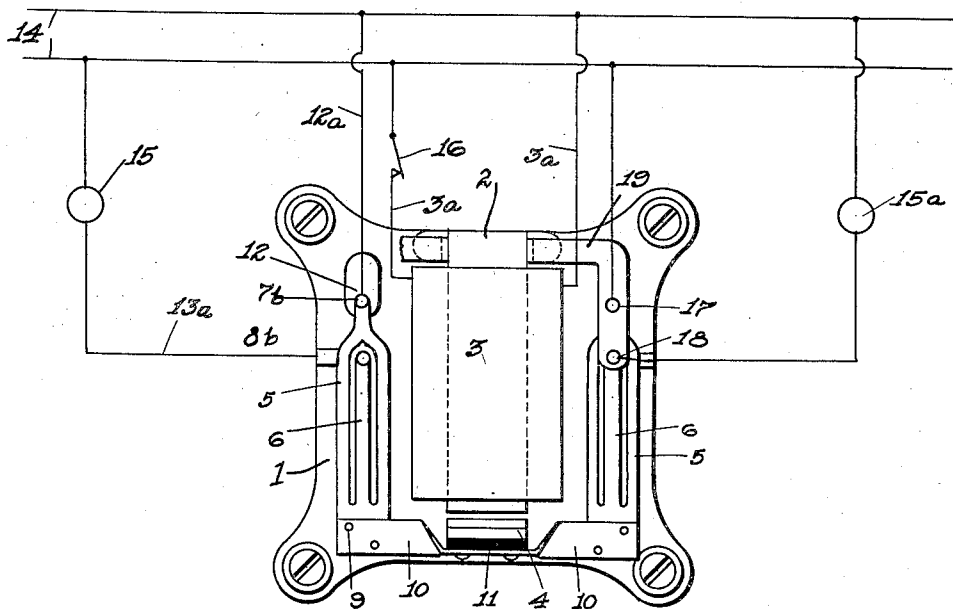


Fig. 4.

Inventor:
 Tellef Terjesen
 By *Orley W. Kennedy*
 Attorney

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CONTACT ARM FOR CIRCUIT CONTROLLING DEVICES

Tellef Terjesen, Hoboken, N. J., assignor to Signal Engineering & Manufacturing Company, New York, N. Y., a corporation of Massachusetts

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4 Claims. (Cl. 200—166)

The present invention relates to circuit controlling devices, and has for its object to provide an improved contact arm for devices of this character that is adapted to handle the flow of heavy electrical currents without destructive arcing.

The device of the present invention relates particularly to a circuit controller of the type employing a pivoted magnetic armature adapted by its movement to carry a contact arm into and out of engagement with cooperating stationary contacts, the improved contact arm in its operation being characterized by the substantial elimination of arcing, high current carrying capacity, as well as the absence of any flexible leads for conducting current to the movable contact member. The above and other advantageous features of the invention will hereinafter more fully appear from the following description with reference to the accompanying drawing, in which:—

Fig. 1 is a view in side elevation of a circuit controlling device embodying the invention, with its contact arm in one extreme position.

Fig. 2 is a view similar to Fig. 1, showing the contact arm in an intermediate position.

Fig. 3 is a view similar to Fig. 1, showing the contact arm in a second extreme position.

Fig. 4 is a view in front elevation of the device of Fig. 1, illustrating diagrammatically the circuit connections thereof.

Like reference characters refer to like parts in the different figures.

Referring first to Figs. 1 and 4, the invention is shown for purposes of illustration as being embodied in a circuit controlling device of the relay type, the essential elements of which comprise an insulating base 1 carrying a U-shaped magnetic core 2, the shorter leg of which is surrounded by an energizing winding 3. A magnetic armature 4 pivotally supported by the lower end of the longer core leg is adapted to be raised upon energization of the winding 3 and held in the position of Fig. 1, deenergization of the winding 3 permitting the armature 4 to fall back into the position of Fig. 3 under the influence of gravity.

The armature 4 carries one or more upwardly extending contact arms 5, which as best shown in Fig. 4, are identical in construction. Each contact arm 5 is made of resilient material, such as sheet metal, and portions thereof are cut away intermediate its ends to provide a tongue 6 extending longitudinally of the arm for the major portion of its length. The end portion

of the arm 5 above the tongue 6 is reduced to substantially the same width as the tongue itself, while the arm portions on opposite sides of the tongue 6 are at least one-half the width of the tongue. The upper ends of both the narrowed portion of the arm 5 and tongue 6 are provided with oppositely projecting contact tips 7a and 7b and 8a and 8b respectively, while the lower end of the arm is secured by rivets 9 to a cross bar 10 carried by the armature 4 and insulated therefrom at 11.

As best shown in Fig. 1, the insulating base 1 carries a pair of contacts 12 and 13 spaced apart substantially the same distance as the contact tips 7a and 8a respectively. As indicated diagrammatically in Fig. 4, current from suitable supply mains 14 is supplied to the stationary contacts 12 and 13 through conductors 12a and 13a respectively, an electrical load 15 represented by any current consuming device being connected in one of the conductors 12a or 13a. The terminals of the energizing winding 3 are also shown as being connected to the source 14 through conductors 3a, a control switch 16 being provided in one of the conductors 3a, whereby the winding 3 may be energized, or deenergized, at will.

Assuming that the parts occupy the position of Fig. 1, that is, with the winding 3 energized due to closure of the switch 16, it is evident that the contact tips 7a and 8a are held in engagement with the contacts 12 and 13 respectively, with the tongue 6 being deflected from the plane of the arm 5. In this position of parts, current is flowing from the source 14 through the load 15, the current flowing through the tongue 6 in one direction, while it divides and flows in the opposite direction in the portions of the arm 5 on opposite sides of the tongue. Obviously, the current is conducted to and from the arm 5 without any possibility of loose connections interrupting the current flow, since both sides of the load circuit represented by the contacts 12 and 13 are positively engaged by the contact tips 7a and 8a, respectively.

Upon deenergization of the winding 3, as by opening the switch 16, the armature 4 is free to move downwardly under the influence of gravity, aided by a weight 4a at the end of the armature, and the tendency of the deflected contact tongue 6 to resume its normal unflexed condition. As the armature starts its downward movement, the contact tip 7a leaves the stationary contact 12, while the contact tip 8a on the tongue 6 still remains in engagement with

the stationary contact 13, as indicated in Fig. 2. Under conditions of current flow through the load 15, there naturally exists a tendency for an arc to be drawn between the contact tip 7a and the stationary contact 12 as the tip 7a leaves the latter, but with the improved contact arm of the present invention, this arc is quickly extinguished before it attains sufficient intensity to be destructive to the contact surfaces, owing to the separation of the contact tip 8a from the other stationary contact 13.

In considering the operation of the contact arm as described above, it has been found that the breaking of heavy currents can be accomplished without destructive arcing, because when the contact tip 7a first starts to leave the stationary contact 12, the rate of downward movement of the armature is at a minimum, with the armature speed increasing rapidly from zero as it falls. Therefore, any arc between the contact tip 7a and the contact 12 is formed at the time of their first separation when the air gap in the circuit is relatively small. But before any such arc can reach a destructive intensity, the air gap is suddenly increased at another point in the circuit by the separation of the tongue contact tip 8a from the contact 13 at a speed very much greater than the initial speed of separation of the contact tip 7a from contact 12. In other words, by the time the contact tip 8a leaves the contact 13, the freely falling armature 4 has accelerated to the point where the separation between these contact surfaces occurs at relatively high speed, and this accelerated increase in the air gap breaks the load circuit without appreciable arcing.

As the armature 4 falls to its lowermost position following deenergization of the winding 3, the contact tips 7b and 8b engage a pair of spaced stationary contacts 17 and 18 respectively. These contacts 17 and 18 are carried by a bracket 19 mounted on the core 2 with insulation 20 separating them. As indicated diagrammatically in Fig. 4, the contacts 17 and 18 are connected to the two sides of a circuit, including a load 15a, so that engagement of the contact tips 7b and 8b therewith bridges the gap in the circuit between the contacts 17 and 18. With the armature 4 in its lower position, the pull of the weight 4a is sufficient to cause the contact pressure to deflect the tongue 6 from the plane of the contact arm 5 in substantially the same manner as described with reference to Fig. 1. Therefore, when the armature 4 is raised upon re-energization of the winding 3, the contact tip 7b leaves the contact 17 in advance of separation of the contact tip 8b from the contact 18. Therefore, the load circuit is broken without appreciable arcing due to the creation of a second air gap in the circuit at an accelerated rate.

From the foregoing, it is apparent that by the present invention there is provided a circuit controlling device characterized by the provision of a contact arm adapted to handle heavy electrical currents with a minimum of destructive arcing at its contacts, due to the provision of means inherent within the arm for successively creating

gaps in the load circuit at an increasing rate. As a result, a circuit controlling device embodying the contact arm of the present invention is adapted to handle heavier currents than prior devices employing movable contact arms to which current is led by flexible conductors.

I claim,

1. In a device of the class described, the combination with spaced stationary contacts, of a movable contact arm having integrally formed and independently flexible portions lying in the same plane at different distances from said stationary contacts when disengaged therefrom and means for moving said arm in one direction to cause the free end thereof to engage one of said stationary contacts accompanied by flexure of an intermediate portion of said arm upon engagement with the other of said contacts, to establish a circuit between said contacts, while movement of said contact arm in the other direction results in disengagement of its free end from one of said contacts with engagement still maintained between the other of said stationary contacts and the deflected portion of said arm.

2. In a circuit controlling device, spaced stationary contacts, a contact arm having integrally formed and independently flexible portions normally lying in the same plane when in an unflexed condition, contact tips carried by said arm portions at different distances from said stationary contacts, and a pivotally mounted member carrying said contact arm, movement of said member serving to engage first one and then another of said contact tips on said arm with said stationary contacts to establish a circuit therebetween accompanied by different degrees of flexure of said contact arm portions.

3. In a circuit controlling device, spaced stationary contacts, a contact arm having integrally formed and independently flexible portions normally lying in the same plane when in an unflexed condition, at different distances from said stationary contacts, and a pivotally mounted member carrying said contact arm, movement of said member in one direction serving to engage first one and then another portion of said arm with said stationary contacts to establish a circuit therebetween accompanied by different degrees of flexure of said contact arm portions and movement of said member in another direction serving to successively disengage said contact arm portions from said stationary contacts at different rates of contact separation.

4. In a circuit controlling device, the combination with opposed pairs of spaced stationary contacts, of a movable contact arm having integrally formed and independently flexible portions lying in the same plane when said arm occupies a position intermediate the pairs of stationary contacts, and contact tips carried by said arm portions at different distances from said stationary contacts, movement of said arm towards either pair of stationary contacts serving to engage first one and then another of said contact tips on said arm with a pair of contacts to establish a circuit therebetween accompanied by different degrees of flexure of said contact arm portions.

TELEF TERJESEN.