March 4, 1947. E. S. BUCKLEY 2,416,736

ELECTRICAL CIRCUIT MAKING AND BREAKING DEVICES

Filed Feb. 25, 1944

FIG. 1.

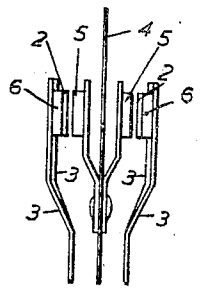


FIG. 3.

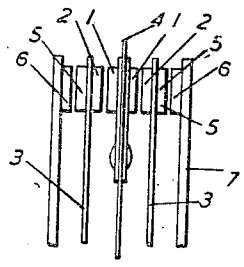


FIG. 2.

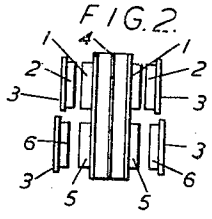


FIG. 4.

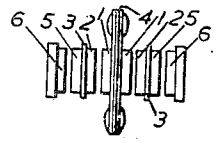
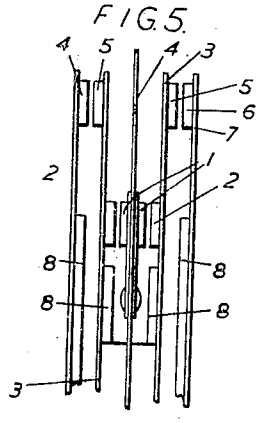


FIG. 5.



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ELECTRICAL CIRCUIT MAKING AND BREAKING DEVICES

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3 Claims. (Cl. 200—1)

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This invention relates to electrical circuit making and breaking devices and in particular to circuit interrupters or vibrators having main and auxiliary contacts.

It is well known that these "synchronous" or self-rectifying vibrators, in addition to providing automatic rectification, offer certain other advantages.

One of these advantages is that, inasmuch as its auxiliary or secondary contacts may be, and usually are, arranged to make a short time after and break a short time before the main or primary contacts, the load may, in effect, be applied and removed from the input source under a low current and a high voltage condition by the auxiliary contacts, rather than under high current and low voltage conditions by the main contacts as would otherwise occur. Consequently, since the main contacts have then only to carry the load current after good contact has been established, and not interrupt it, they may have a much longer life for a given power handling capacity, or alternatively it may be possible to increase their power handling capacity for a given life.

In any case, it is desirable in rectifying systems, even where the advantage of secondary load removal is not necessarily required, that the correct sequential make and break of the contacts should be observed, and it is the object of the present invention to provide an article of this class wherein this desirable contact timing will be ensured throughout the life of the device.

In the conventional synchronous or self-rectifying vibrator, the relevant sets of main and auxiliary contacts are usually arranged in two lines side-by-side, the difference in timing being achieved by spacing the auxiliary contacts to be used for the secondary circuits somewhat farther apart than the main contacts used for the primary circuit.

According to my invention I so arrange the main and auxiliary contacts that closure of the main contacts is followed by positive closure of the auxiliary contacts by the movement of the main contacts.

The invention consists of circuit making and breaking devices having more than one set of contacts required to be closed in sequence, characterised in that closure of the second or subsequent set of contacts is mechanically effected by and is dependent on the closure of the first or preceding set of contacts.

The invention further comprises circuit interrupters or vibrators having main and auxiliary

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contacts required to be closed and opened in sequence, characterised in that the auxiliary contacts are closed by mechanical pressure which can only be applied after the main contacts are engaged.

In order that the invention may be clearly understood reference is made to the accompanying drawings, wherein:

Figure 1 is an elevational view, and

Figure 2 a plan view of the conventional arrangement of the contacts of a synchronous vibrator;

Figures 3 and 4 are similar views of the contact arrangement according to my invention, and

Figure 5 is a view of a modified arrangement according to my invention.

Referring to Figures 1 and 2, the numerals 1 and 2 designate the main contacts, the contact 1 being carried by the contact blade attached to the usual vibrating reed 4 and the contact 2 being carried on the contact blades 3. The auxiliary contacts 5 and 6 are similarly mounted. It will be seen that the auxiliary contacts 5 and 6 are separated by a slightly greater space than the main contacts 1 and 2 and in operation the main contacts 1 and 2 make first and the auxiliary contacts 5 follow up and make contact with the contact 6 as soon as the contact 1 has caused the blade 3 to yield sufficiently to permit this. On the breaking of contact, of course, the reverse occurs, the auxiliary contacts being the first to open.

Since the difference in spacing between the main and auxiliary contacts to achieve the time difference normally required is small, such systems are comparatively difficult to adjust. Furthermore, under the varying conditions encountered, and the possibilities of contact wear, it is difficult to ensure that the desired conditions are retained constantly throughout the life of the device.

These disabilities are avoided in vibrators according to my invention which are illustrated in Figures 3, 4 and 5.

Referring first to Figures 3 and 4 which show the application of the invention to that type of interrupter which does not require isolation of its input and output circuits, the moving main contacts 1 are mounted on the reed 4 by any of the normal means. In operation they engage with the other main contacts 2. These contacts 2 are mounted on definitely yielding blades or carriers 3. Mounted upon or otherwise mechanically linked with these yielding blades or carriers are the relevant individual auxiliary contacts 5. Un-

der the yielding of the blades or carriers 3, consequent upon the pressure of the engaging contacts 1 and 2, the auxiliary contacts 5 are subsequently caused to make with the outer auxiliary contacts 6, which themselves are mounted on blades or carriers 7—which may be yielding or not as desired—by the direct action of the main contacts. Thus the auxiliary contacts cannot make until after the main contacts have made.

On breaking the main contacts will accordingly not open until the auxiliary contacts have separated. The precise time difference between the making and breaking of the main and auxiliary contacts may be controlled by the gaps normally separating the contacts and the amplitude of the reed vibration. Hence it will be seen from the foregoing that the engaging of the main contacts is relied upon to supply the closing force to the auxiliary contacts, and the main contacts must therefore be in firm mechanical contact before the auxiliary contacts make.

In the arrangement described, the outer auxiliary contacts is in effect making with the outer main contact and not the reed direct but this, of course, is of no consequence since the effective result is the same.

The arrangement shown in Figure 5 operates on the same principle, the only difference being that the main and auxiliary contacts while being in the same vertical plane are in different horizontal planes, whereby the width of gaps between the contacts for a given time difference may be varied by a lever action.

With either of the examples described any of the intermediate or outer contact carrying blades may, if necessary, be arranged to have a definite natural frequency relative to each other, or to the reed so as to assist or otherwise modify the rate of make and break, or mechanical bounce. The adjustment of this natural frequency of any of the intermediate or outer blades may be effected either by means of a weight, which if desired can be movable for adjustment purposes, attached to the blade or to any contact or other component mounted thereon, or by suitably lightening or increasing the weight of the blade, contact, or other component by the removal or addition of material. Alternatively damping or backing blades 8 may be fitted, or yet again the intermediate blade or carrier 3 may be mechanically linked to the reed in certain positions.

The system may be applied to interrupters which have several pairs of primary contacts, arranged to work either in parallel or into separate transformer primaries. Here the yielding of one or all of the main contact carriers may operate one or more sets of auxiliary contacts.

Arrangements may also be made for the electrical isolation of the primary and secondary circuits.

An incidental advantage of the invention is that since high currents have not to be interrupted, recourse may if desired be had to contact materials having advantages in other directions.

What I claim and desire to secure by Letters Patent is:

1. A circuit interrupter comprising, an oscillatable member; a resilient strip adjacent to said oscillatable member; contact means mounted on said member and contact means mounted on said strip, said contact means being disposed so that the contact means on the member engage and disengage with the contact means on the strip when said member is oscillated toward and away from said strip, said strip being flexible by said oscillatable member; and a contact member disposed adjacent said strip and adapted to be engaged by said contact means on said strip when the strip is flexed by said oscillatable member.

2. A circuit interrupter comprising, an oscillatable member; a resilient strip adjacent to said oscillatable member; a contact mounted on said oscillatable member; a contact mounted on said strip, said contacts lying in substantially the same plane, said plane extending parallel to the direction of oscillation of said oscillatable member whereby the contact mounted on said member is engaged and disengaged with the contact mounted on said strip when said member is oscillated toward and away from said strip, said strip being flexible by said oscillatable member; a contact member disposed adjacent to said strip, and a contact member mounted on said strip, the last two mentioned contact members lying in a plane spaced from and parallel with the first mentioned plane and being engageable when said strip is flexed by said oscillatable member.

3. A circuit interrupter comprising, an oscillatable member; a resilient strip adjacent to said oscillatable member; a contact mounted on said oscillatable member; a contact mounted on said strip, said contacts lying in substantially the same plane, said plane extending parallel to the direction of oscillation of said oscillatable member whereby the contact mounted on said member is engaged and disengaged with the contact mounted on said strip when said member is oscillated toward and away from said strip, said strip being flexible by said oscillatable member; a contact member disposed adjacent to said strip, and a contact member mounted on said strip, said contact members lying substantially in the first mentioned plane and being engageable when said strip is flexed.

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