Dec. 30, 1952 H. S. CLARK 2,623,965

VIBRATOR

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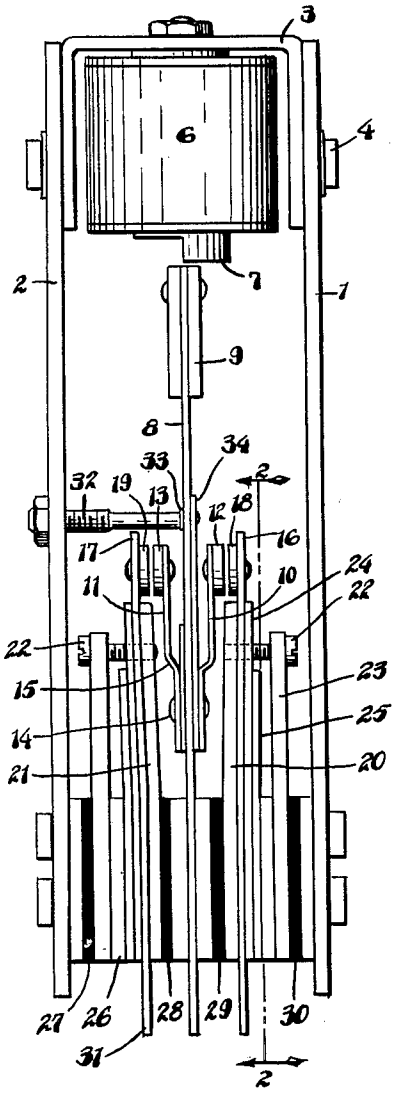


Fig. 1.

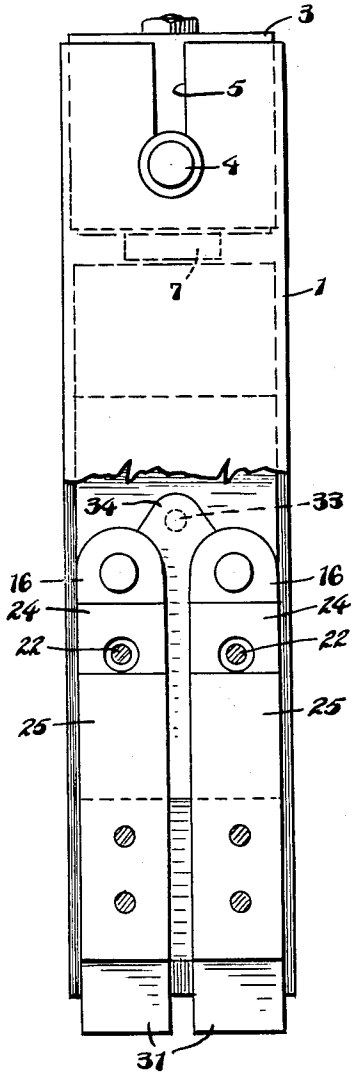


Fig. 2.

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VIBRATOR

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The present invention relates to improvements in vibratory interrupters and more particularly to that type of vibratory interrupters for operating converters and inverters and designed to operate at extremely high frequency and wherein the vibrating contact means is driven by an electric magnet.

In vibratory interrupters of the prior art and particularly vibratory interrupters of the commercial art, the life of the interrupters is relatively short. One of the reasons for the shortened life of the interrupter is the tendency for excessive arcing by the contacts during the operation of the vibrator.

It is accordingly one of the objects of my invention to provide a vibratory interrupter wherein the arc between the contacts during the operation of the vibrator is reduced to a minimum and to a large extent practically eliminated.

A further object of my invention is to provide a vibratory interrupter wherein the frequency of the vibrating reed may be varied within a relative wide range by varying the voltage or power supplied to the driving magnet.

Other objects and advantages of my invention will appear hereinafter in the accompanying specifications and claims.

For the purpose of disclosing my invention I have illustrated an embodiment thereof in the accompanying drawings in which:

Fig. 1 is an end elevation of the vibratory interrupter embodying my invention;

Fig. 2 is a side elevation, partially in section, the section being taken on the line 2—2 of Fig. 1.

In the embodiment illustrated, I provide a suitable frame comprising the side members 1 and 2. Between these side members, at one end thereof, a U-shaped yoke 3 is secured by a suitable clamp bolt 4 extending through slots 5 in the side members. This yoke 3 supports a driving magnet 6 having a pole piece 7 extending inwardly.

A vibratory spring member or reed 8 having an armature 9 is adapted to be vibratingly driven by the magnet 6. It is to be noted that the pole piece 7 is offset from the armature 9. This vibrating reed 8 carries on its opposite faces contact carrying arms 10 and 11 carrying respectively contacts 12 and 13. These arms are preferably formed of resilient material and are secured at their lower ends to the vibrating reed 8 by rivets 14, the arms 10 and 11 are bent outwardly away from the vibrating arm 8 as at 15 to suitably space the upper ends of the arms from the reed. The contacts 12 and 13 respectively are arranged in pairs as illustrated in Fig. 2.

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Disposed on opposite sides of the vibrating reed 8 are relative fixed contact carrying arms 16 and 17 arranged in pairs and carrying contacts 18 and 19 adapted to be engaged by the contacts 12 and 13 during the vibration of the reed. The movement of the contact carrying arms 16 and 17 in one direction is limited by the rigid stop arms 20 and 21, the ends of which stop just below the bottom edge of the contacts. The spacing between the contacts 18 and 12 and 19 and 13 may be adjusted by adjusting the upper ends of the stop arms 20 and 21 through the medium of adjusting screws 22 which are secured in the upper ends of the rigid supporting arms 23. The contact carrying arms 16 and 17 are provided with suitable center openings to permit the passage therethrough of the adjusted screws for threaded engagement with the stop arms 20 and 21.

Each of the contact carrying arms 16 and 17 is backed by a resilient flat spring 24 stopping somewhat short of the end of the contact carrying arm with its end coinciding with the end of the stop arm 20 and 21 and by a second back spring 25 stopping somewhat short of the end of the spring 24. In effect each contact carrying arm and its associated backing arms comprises a laminated structure with the laminations decreasing in length from front to rear.

The parts above described are secured between the lower ends of the side members 1 and 2 by a suitable stack consisting of a spacer member 26. Certain of these members as 27, 28, 29 and 30 are formed of insulation material to insulate the respective parts from one another. The lower ends of the vibrating reed and contact carrying arms are provided with tail pieces as at 31 to which are adapted to be connected the various leads for connecting the vibrator to the parts to be controlled thereby as for instance the terminals of a converter or inverter.

The circuit through the driven magnet 6 is controlled through the medium of a stationary contact carried on contact arm 32 supported in the frame and adapted when the vibrating reed moves in one direction to engage a contact 33 mounted on a spring arm 34 which lies parallel to and in contact with the vibratory reed 8. The vibratory reed 8 is provided with an opening to accommodate the passage of the contact arm 32 therethrough so that as the reed vibrates in one direction its movements in that direction will not be interfered with by the contact arm, permitting the contact on the arm 32 to engage with the contact arm 34.

When, however, the reed 8 is moved in the

opposite direction it will carry with it the arm 34 separating the contact carried thereby from the contact 32 whereby the circuit of the drive magnet 6 is alternately opened and closed.

By the arrangement of the backing arms 24 and 25 for the contact carrying arms 16 and 17 I find that increased efficiency of the operation of the vibrator is attained. I have found that by making the contact carrying arms 16 and 17 of relatively thin gauge material with the thickness of each of the backing arms 24 and 25 of relatively greater magnitude, extremely efficient results are obtainable. In practice the contact carrying arms 16 and 17 are preferably formed of spring material .012 inches in thickness. The backing spring 24 is formed of spring material .017 inches in thickness and the backing spring 25 is formed of spring material .020 inches in thickness.

As a result, when the contacts 12 and 13 respectively engage the contacts carried by the arms 16 and 17 these arms will initially flex or bend at their upper ends under the pressure applied thereto by the engagements of the contacts. This flexing action diminishes as the spring arm 24 comes into operation and still further diminishes as the spring arm 25 comes into effect. As a result the contacts 12 and 13 when moved into engagement with their respective contacts 18 and 19 under the vibratory movement of the reed 8 met with relative little resistance and the tendency for the contacts 12 and 13 to rebound upon engagement with their respective contacts 18 and 19 is reduced to a minimum.

Furthermore I have found that by increasing the voltage or power delivered to the driving magnet 6 and thereby increasing the amplitude of the vibratory reed 8 the frequency of the reed may be increased, due to the rebound action of the springs 24 and 25 as the relative stiffness of these rebound springs effects a more rapid return to normal position and accordingly effect a more rapid rebound of the reed in its return direction. Accordingly the frequency of the reed may be varied over a relatively wide range by varying the input power or voltage to the drive magnet 6. In actual practice I have found that this frequency may be varied as much as from 1½ to 3 cycles.

I claim as my invention:

1. A vibratory interrupter comprising, in combination, a vibratory reed clamped at one end and carrying an armature at its free end, contacts supported on the opposite sides of said reed, relatively flexible contact carrying arms disposed on the opposite sides of said reed, clamped at one end and carrying contacts at their free ends adapted to be engaged by the contacts carried by said reed, a plurality of flexible backing arms disposed in stacked face to face contact relation against the rear face of each of said contact carrying arms clamped at one end and extending parallel with and in continuous engagement with said contact carrying arm, the relative length of said backing arms decreasing in accordance with their relative distance from the contact carrying arm, and the first of said backing arms bearing on the contact carrying arm throughout its length and having its free end stopping short of the free end of the contact carrying arm, and a driving magnet under the control of said reed for imparting a vibratory movement to said reed.

2. A vibratory interrupter comprising, in combination, a vibratory reed clamped at one end and carrying an armature at its free end, contacts supported on the opposite sides of said reed, relatively fixed flexible contact carrying arms disposed on the opposite sides of said reed and clamped at one end and carrying contacts at their free ends adapted to be engaged by the contacts carried by said reed, a plurality of flexible backing arms clamped in stacked relation against the rear face of each of said contact carrying arms and in face to face contact with one another throughout their length, said backing arms decreasing in length and relative flexibility in accordance with their relative distance from the companion contact carrying arm, the first of said backing arms bearing on the contact carrying arm throughout its length and having its free end stopping short of the free end of the contact carrying arm, and a driving magnet under the control of said reed for imparting a vibratory movement to said reed.

3. A vibratory interrupter comprising, in combination, a vibratory reed clamped at one end and carrying an armature at its free end, contacts supported on the opposite sides of said reed, relatively fixed flexible contact carrying arms disposed on opposite sides of said reed, clamped at one end and carrying contacts at their free ends adapted to be engaged by the contacts carried by said reed, a rigid stop arm for each of said contact carrying arms clamped at one end and extending parallel with its companion contact carrying arm for limiting the movement of said contact carrying arm in one direction, the free end of said stop arm extending to within close proximity to the bottom edge of the contact on the contact carrying arm, a plurality of flexible backing arms disposed in stacked relation on the opposite side of each of said contact carrying arms, the relative length of said backing arms decreasing in accordance with their relative distance from their companion contact arm and being clamped at one end and being in face to face contact with one another throughout their length, the first of said stacked backing arms contacting its companion contact carrying arm along the length of said contact carrying arm into close proximity with the contact carried thereby and the free end of said first backing arm coinciding with the free end of said stop arm, and a driving magnet under the control of said reed and imparting vibratory movement to said reed.

4. A vibratory interrupter comprising, in combination, a vibratory reed clamped at one end and carrying an armature at its free end, contacts supported on the opposite sides of said reed, relatively fixed flexible contact carrying arms disposed on the opposite sides of said reed, clamped at one end and carrying contacts at their free ends adapted to be engaged by the contacts carried by said reed, a plurality of flexible backing arms disposed in stacked relation for each of said contact arms and clamped at one end and extending parallel with and in face to face contact throughout their length with the contact arms, the relative thickness of said backing arms increasing and the relative length thereof decreasing in accordance with their distance from the companion contact arm and the first backing arm being in face to face contact with its companion contact carrying arm throughout its length and being of greater thickness than the contact carrying arm and shorter than said contact carrying arm, and a driving magnet under the control of said reed and imparting a vibratory movement to said reed.

5. A vibratory interrupter comprising, in combination, a vibratory reed clamped at one end

and carrying an armature at its free end, contacts supported on the opposite sides of said reed, relatively fixed laminated contact carrying structures disposed on the opposite sides of said reed, each structure comprising a plurality of laminations in face to face contact throughout their length, the first lamination carrying a contact adapted to cooperate with a contact on the vibrating reed, and the relative length of the laminations decreasing from the contact carrying lamination in accordance with their distance from the contact carrying lamination said vibrating reed being clamped at one end and carrying said contacts adjacent said one end, and a driving magnet under the control of said reed for imparting vibratory movement to said reed.

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