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RECTIFIER WITH A CHANGE-OVER SWITCH

Filed April 4, 1922

Fig. 1.

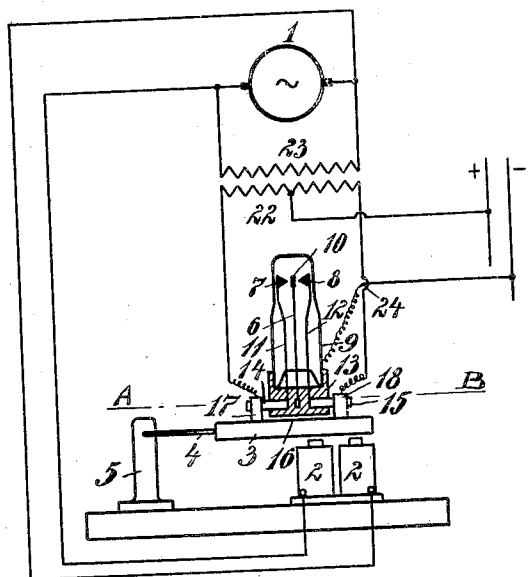
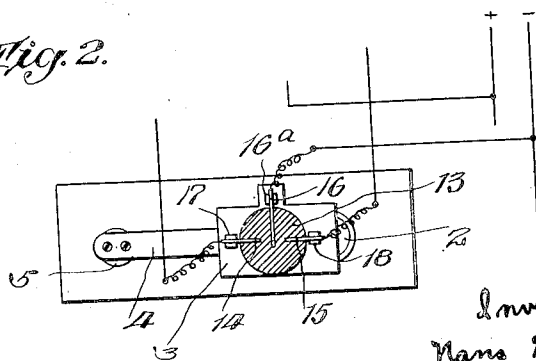


Fig. 2.



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UNITED STATES PATENT OFFICE.

HANS GERDIEN, OF BERLIN-GRUNEWALD, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, AKTIENGESellschaft, OF SIEMENSSTADT, NEAR BERLIN, GERMANY, A GERMAN CORPORATION.

RECTIFIER WITH A CHANGE-OVER SWITCH.

Application filed April 4, 1922. Serial No. 549,630.

To all whom it may concern:

Be it known that I, HANS GERDIEN, a citizen of the German Empire, residing at Berlin-Grünwald, Germany, have invented certain new and useful Improvements in a Rectifier with a Change-Over Switch, of which the following is a specification.

It is well known that alternating current can be converted into continuous current by changing-over the circuit terminal connections after the lapse of each half period. It is customary to employ for this purpose an oscillating armature for the operation of the change-over switch, this armature being polarized and alternately attracted and repelled by an electromagnet, energized by the alternating current to be converted.

Such arrangements, as employed heretofore for this purpose, have several disadvantages. Firstly, the weight of the oscillating parts is comparatively great and, thereby, disturbing acceleration and retardation forces are created. Besides, the comparatively high rate of oscillation required with the usual frequency of alternating-currents, results in a quick wear of the contacts inasmuch as sparks can hardly be avoided.

The present invention has for its object to overcome these disadvantages, for which purpose the change-over switch is provided with contacts which are all carried by and fixed to the oscillatory armature. One of these contacts is yieldingly connected with the armature while one or more additional counter-contacts are rigidly connected with the armature. If the natural frequency of the flexible contact coincides approximately with the frequency of the alternating-current, the flexible contact oscillates at large amplitudes even with a small movement of the armature itself. The oscillating parts, as far as they have an appreciable weight, need thus perform only small motion amplitudes, while the flexible contact, which must perform the actual physical switching motion, can be very light.

A great advantage resides, moreover, in the fact that the flexible contact, together with

its counter-contacts, can be enclosed in an airtight casing and combined into an easily interchangeable unit of the switching mechanism.

I have illustrated in the accompanying drawings a form in which my invention may be reduced to practice. In these drawings:

Figure 1 represents an elevation of the device, partly in section; and

Figure 2 represents a horizontal section through the device on the line A—B in Figure 1.

An alternating-current source 1 feeds the two electromagnets 2, which face one pole of a permanent magnet 3 carried by a spring 4, which is mounted on a bracket 5. The flexible contact tongue 6 is molded into the base of a glass envelope 9, and carries a contact member 10, which co-operates with the counter-contacts 7 and 8 fixed in the interior of the glass envelope 9. The leads 11 and 12 to these counter-contacts are also molded into the base of the glass envelope 9, the latter being, like the bulb of an incandescent lamp, surrounded at its base by a cap 13 of non-conducting material. Cap 13 carries three contact blades 14, 15 and 16 to which the leads 11 and 12 and the flexible tongue 6 are connected. The contact blades 14 and 15 are clamped between corresponding prongs 17 and 18, which are mounted on, but insulated from the magnet armature 3. Contact blade 16 similarly engages a contact prong 16^a as shown in Fig. 2. The forks 17 and 18 are connected with the two terminals of the secondary winding 22 of a transformer, of which the primary winding 23 is connected with the alternating-current source 1. The central point of the secondary winding 22 leads to one of the continuous-current service-mains. The other direct current main is connected through conductor 24 to the contact prong 16^a of the contact blade 16.

It will be observed that thus the contact unit may easily be removed by withdrawing the blades from their respective prongs and

replaced by a new unit, in case the contacts are worn out. Thus by this novel arrangement it becomes possible to manufacture these units like incandescent lamps and they may readily be kept in reserve and quickly inserted into the rectifier. The glass envelope may be exhausted or filled with nitrogen or any other suitable inert gas in order to prevent oxidation of the contacts.

The contacts 7, 8 and 10 may be made of tungsten or any other metal having a high melting-point and a low vapor-pressure.

The tongue 6 carrying the contact 10 is mechanically tuned to the frequency of the oscillatory magnet armature 3 and performs, therefore, corresponding to its small mass, comparatively large switching strokes even at very small amplitudes of the magnet armature 3.

For maintaining the contacts 7, 8 and 10, it is essential that the circuit breaks take place at the moment at which the alternating current value is zero. In order to bring about this effect, the phase of the oscillations of the tongue 6 must be in proper relation to the phase of the alternating-current. To avoid a disturbance of this proper phase-relation by slight variations in the frequency of the alternating-current, it suffices to impart a comparatively great damping to the oscillatory system. Of course, as is well known the changes in phase at a certain frequency variation are the smaller the greater the damping. Therefore care should be taken that the damping of the device does not go below a certain value. Ordinarily the natural damping of the oscillating system, caused by air friction, eddy currents and the like is sufficient for this purpose. If it should not be sufficient additional damping may be easily produced for instance by giving the contact plate 10 of tongue 6 a sufficient area transversely to the direction of movement of the tongue by which the air friction and thus the damping is increased.

What I claim, is:

1. A rectifier for alternating current comprising an electromagnet structure adapted to be energized by the alternating current to be rectified, a base carrying said electromagnet structure, a permanently polarized magnet armature for said structure yieldingly supported on said base and adapted to oscillate at a periodicity determined by the frequency of said alternating current, a pair of rectifier contact elements rigidly fixed to said armature and a flexible contact element attached to said armature and disposed between said rigid contacts to alternately cooperate with them when the armature oscillates.

2. A rectifier for alternating current comprising an electromagnet structure adapted to be energized by the alternating current

to be rectified, a base carrying said electromagnet structure, a permanently polarized magnet armature for said structure yieldingly supported on said base and adapted to oscillate at a periodicity determined by the frequency of said alternating current, a pair of rectifier contact elements rigidly fixed to said armature and a flexible contact element attached to said armature and disposed between said rigid contacts to alternately cooperate with them when the armature oscillates, and a gas-tight envelope surrounding all of said contacts.

3. A rectifier for alternating current comprising an electromagnet structure adapted to be energized by the alternating current to be rectified, a base carrying said electromagnet structure, a permanently polarized magnet armature for said structure yieldingly supported on said base and adapted to oscillate at a periodicity determined by the frequency of said alternating current, a pair of rectifier contact elements rigidly fixed to said armature and a flexible contact element attached to said armature and disposed between said rigid contacts to alternately cooperate with them when the armature oscillates, the natural period of the flexible contact element being tuned to the period of the alternating current to be rectified, to produce a large motion amplitude for a comparatively small motion amplitude performed by said armature.

4. A rectifier for alternating current comprising an electromagnet structure adapted to be energized by the alternating current to be rectified, a base carrying said electromagnet structure, a permanently polarized magnet armature for said structure yieldingly supported on said base and adapted to oscillate at a periodicity determined by the frequency of said alternating current, a gas-tight envelope removably attached to said armature and containing two fixed contacts and a flexible, reed fashioned contact disposed between said fixed contacts and adapted to oscillate between them and thereby alternately cooperate with said contacts when the armature oscillates, and suitable outside terminal connections on said envelope leading to the several aforesaid cooperating contacts, by which the envelope is attached to said armature.

5. A rectifier for alternating current comprising an electromagnet structure adapted to be energized by the alternating current to be rectified, a base carrying said electromagnet structure, a permanently polarized magnet armature for said structure yieldingly supported on said base and adapted to oscillate at a periodicity determined by the frequency of said alternating current, a gas-tight envelope attachable to said armature and containing two fixed contacts and a flexible, reed fashioned contact disposed be-

tween said fixed contacts and tuned to the frequency of the alternating current to be rectified, said flexible contact adapted to thereby alternately cooperate with said fixed
5 contacts at a large motion amplitude for a comparatively small motion amplitude of said armature, and suitable outside terminal connections on said envelope leading to the several aforesaid cooperating contacts, by which the envelope is attached to said arma- 10
ture.

In testimony whereof I affix my signature.

HANS GERDIEN.