Nov. 27, 1928. 1,693,491

C. E. OGDEN

VIBRATOR FOR ALTERNATING CURRENT RECTIFIERS

Filed Oct. 2, 1922

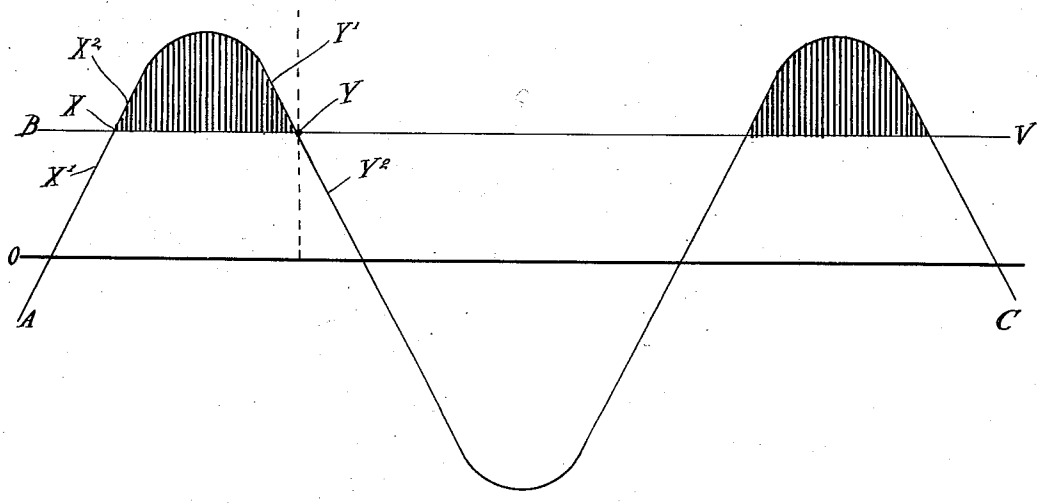


Fig. 1.

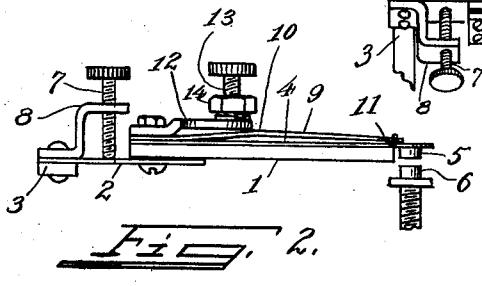


Fig. 2.

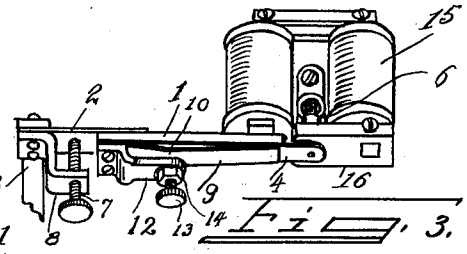


Fig. 3.

INVENTOR:

Clarence E. Ogden,

BY Arthur V. Ewald,

ATTORNEY.

Patented Nov. 27, 1928. 1,693,491

UNITED STATES PATENT OFFICE.

CLARENCE E. OGDEN, OF CINCINNATI, OHIO.

VIBRATOR FOR ALTERNATING-CURRENT RECTIFIERS.

Application filed October 2, 1922 Serial No. 591,865.

My invention relates to improvements in vibrators for alternating current rectifiers for battery charging purposes.

Magnetic rectifiers of alternating current of the vibrating type are dependent in operation upon a vibrating armature operating in synchronism with the alternating current supply, and so tuned as to close the battery charging circuit when the supply current alternation is of proper polarity and of voltage exactly equal to the battery voltage, and to reopen the battery circuit when the alternating voltage again drops to the battery voltage as the alternation progresses. It is most important that the battery circuit be opened and closed at exactly the points mentioned, as otherwise either serious sparking occurs at the contacts or a fraction of the alternation of less efficiency than attainable is used, thus impairing the efficiency of the device and where sparking occurs shortening the life of the contact points. The present invention has therefore for its principal object the provision of simple and effective means for timing the opening and closing of the cooperating contacts, that is the frequency of vibration, thereby assuring efficiency and sparkless operation.

In the drawings:—

Figure 1 is a diagrammatic exemplification of the principles of effective operation of a vibrating rectifier;

Figure 2 is a plan view of a vibrator assembly in accordance with this invention;

Figure 3 is a perspective of the vibrator in assembly with the electromagnets of a rectifier.

A vibrator constructed in accordance with this invention comprises an armature 1 secured to a leaf spring 2 the free end of said spring being adapted to be mounted in a post 3. Secured to the inner end of the armature is a vibrator spring 4, the outer end of said spring being loose and adapted to move independently of the armature 1, and being provided with a contact point 5 arranged to make contact with a second point 6 on a rectifier for closing the charging circuit thru a battery. A set screw 7 operating in an arm 8 is arranged to abut against the spring 2 for adjusting the distance between the points 5 and 6. Secured to the armature 1 above the vibrator spring 4 is a tension spring 9, said spring being raised as shown at 10 intermediate its ends and the free end being arranged to bear against the vibrator spring as shown at 11 approximately over the free end of the armature 1. A raised arm 12 is secured to the armature 1 and springs and extends over the raised portion 10 of the spring 9. The outer end of said arm is adapted to receive a set screw 13 which is arranged to bear on the raised portion of spring 9 in order to adjust the tension thereof against the vibrator spring 4, a lock nut 14 secures the spring 9 in desired adjustment.

In Figure 3 the vibrator assembly just described is shown in relation with electromagnets 15 and a pole piece 16, of a rectifier, said parts being in accordance with the construction shown and described in my co-pending application, Serial No. 489,048, filed August 1st, 1921.

In Figure 1, line O represents the mean or zero point of the alternating current cycle. The curve AC represents the alternating-voltage delivered by the rectifier transformer the same having equal opposite maximum values. Line B—V represents the battery voltage which is of constant value and polarity. The shaded portion of the curve AC between said curve and the line B—V represents the period during each cycle when the contacts 5 and 6 should be closed in order to obtain the maximum charging value from the alternating voltage as well as sparkless operation. In order to obtain this efficient and sparkless operation the contacts 5 and 6 should close exactly at the point X of the alternating voltage of proper polarity, said point being that where the alternating voltage exactly equals the battery voltage, and the contacts should again open at the point Y of the alternating voltage, that is when said alternating voltage again exactly equals the battery voltage.

It has been found from experiments and oscillograph tests that with an armature of proper weight and springs 4 and 2 of the proper thickness and tension to secure a normal period of vibration approximately equal to the line on which the rectifier is to operate, the closing point on the curve AC of Figure 1 is determined by the distance apart of the contact points 5 and 6; the closer these contacts are set the earlier this closing point occurs in the alternation and vice versa. The distance apart between the contacts 5 and 6 is adjusted by means of the set screw 7 whereby the proper closing point X on the alternating voltage curve may be obtained. If the contacts close at any point in the alternating

curve of lower voltage than the battery voltage represented by line B—V in Figure 1, as for instance at X^1, there is a resulting discharge from the battery until the alternating voltage equals the battery voltage. Where the closing point on the curve AC is at a point of higher voltage than the battery voltage, as for instance X^2, only a fraction of the available voltage of the alternation is taken advantage of for battery charging. In either case the charging rate is less than the maximum available from the alternating voltage delivered by the transformer, resulting in impaired efficiency of the rectifier.

The point of separation of the contact points 5 and 6 is governed by the tension of said spring 4. Where the cutting out or opening point of the contacts 5 and 6 is on the curve AC at a point of higher voltage than the battery voltage, as for instance at the point Y^1 destructive sparking occurs between the contacts 5 and 6. If at a point of lower voltage than the battery voltage, as for instance the point Y^2, a discharge from the battery takes place. In either event there is a resultant lower general efficiency and performance of the rectifier.

Since it is impracticable to manufacture steel of uniform thickness and tension in large quantities it has heretofore been necessary to provide a spring having initial tension greater than required and then to remove the excess tension little by little by flexing the spring until the proper tension is empirically attained. This method is obviously quite slow and expensive and it is further exceedingly difficult to remove exactly the proper amount of tension, and if too much tension is removed the value of the spring for the purpose is destroyed. By means of the tension spring 9 of my device and the screw adjustment, the outer end of the tension spring bearing on the vibrator spring above the end of the armature 1, the tension of the vibrator spring may be very simply and expeditiously adjusted thru a wide range, and the initial tension of the vibrator spring is therefore a matter of little if any importance. It is thus possible to use vibrator springs of varying thickness and initial tension, and such springs are not subject to destruction thru adaptation to the intended use.

It will thus be seen that by the provision of an auxiliary tension spring in connection with means for adjusting the distance between battery charging contacts I have made it possible to control by means of very simple operations the points of closing and opening of such contacts relative to the alternating voltage, thus synchronizing the vibrator oscillations with the supply line frequency. As such adjustments may be varied within a wide range it is possible to take care very readily of any variation in the vibrator frequency caused by deterioration arising from heat or other causes.

Having thus fully described my invention what I claim to be new and desire to secure by Letters Patent is:—

1. In a vibrating rectifier, the combination with a magnet and a contact point, of a vibrator comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and means for adjusting the tension of said member.

2. In a vibrating rectifier, the combination with a magnet and a contact point, of a vibrator comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, a tension spring arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and means for adjusting the tension of said spring.

3. In a vibrating rectifier, the combination with a magnet and a contact point, of a vibrator comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and a set screw arranged to bear against said tension member whereby the tension thereof may be adjusted.

4. In a vibrating rectifier, the combination with a magnet and a contact point, of a vibrator comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, a tension spring arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and a set screw arranged to bear against said tension spring whereby the tension thereof may be adjusted.

5. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, means for adjusting the distance between said contact points, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said

spring, and means for adjusting the tension of said member.

6. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, means for adjusting the distance between said contact points, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, a set screw for adjusting the tension of said member.

7. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, means for adjusting the distance between said contact points, a tension spring arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and means for adjusting the tension of said spring.

8. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising an armature, a vibrator spring mounted and having one of its ends secured on said armature, a contact point on the free end of said vibrator spring arranged to make contact with said first mentioned point, means for adjusting the distance between said contact points, a tension spring arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, a set screw for adjusting the tension of said spring.

9. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising a leaf spring, an armature secured to said leaf spring, a vibrator spring mounted on said armature, a contact point on said vibrator spring arranged to make contact with said first mentioned point, means arranged to bear against said leaf spring for adjusting the distance between said contact points, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and means for adjusting the tension of said member.

10. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising a leaf spring, an armature secured to said leaf spring, a vibrator spring mounted on said armature, a contact point on said vibrator spring arranged to make contact with said first mentioned point, a set screw arranged to bear against said leaf spring for adjusting the distance between said contact points, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and means for adjusting the tension of said member.

11. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising a leaf spring, an armature secured to said leaf spring, a vibrator spring mounted on said armature, a contact point on said vibrator spring arranged to make contact with said first mentioned point, means arranged to bear against said leaf spring for adjusting the distance between said contact points, a tension member arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and a set screw for adjusting the tension of said member.

12. In a vibrating rectifier in combination with a contact point, a vibrator assembly comprising a leaf spring, an armature secured to said leaf spring, a vibrator spring mounted on said armature, a contact point on said vibrator spring arranged to make contact with said first mentioned point, a set screw arranged to bear against said leaf spring for adjusting the distance between said contact points, a tension spring arranged to bear against said vibrator spring at a point approximately opposite the contact on said spring, and a set screw for adjusting the tension of said spring.

CLARENCE E. OGDEN.