Oct. 22, 1940. L. J. WAHL 2,218,837

ELECTROMAGNETICALLY DRIVEN MOTOR

Filed July 19, 1939 2 Sheets-Sheet 1

Fig. 1.

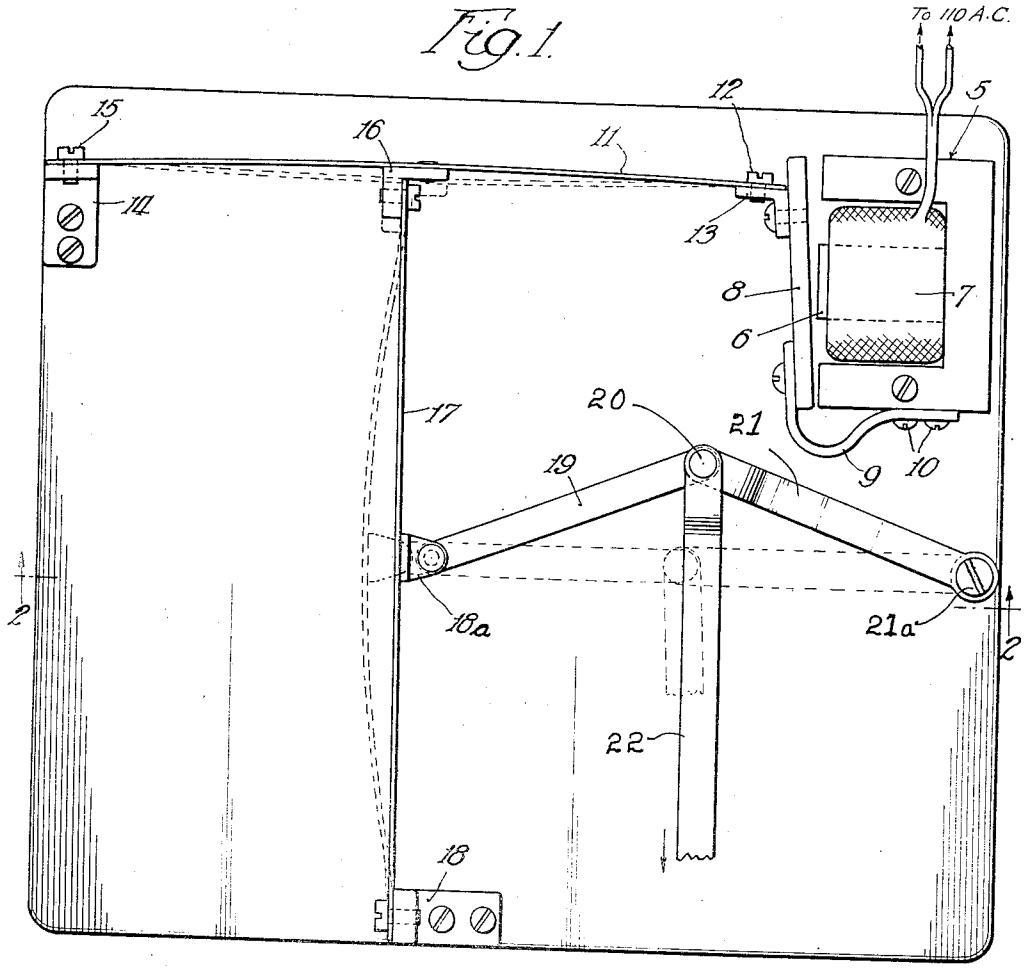
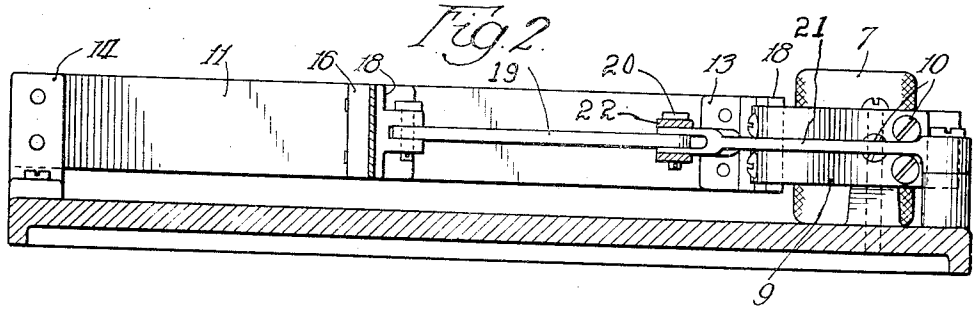


Fig. 2.



Inventor.
Leo J. Wahl
By: Fabel Barlow Heitzman & Wells
Attys

Oct. 22, 1940. L. J. WAHL 2,218,837

ELECTROMAGNETICALLY DRIVEN MOTOR

Filed July 19, 1939 2 Sheets-Sheet 2

Fig 3.

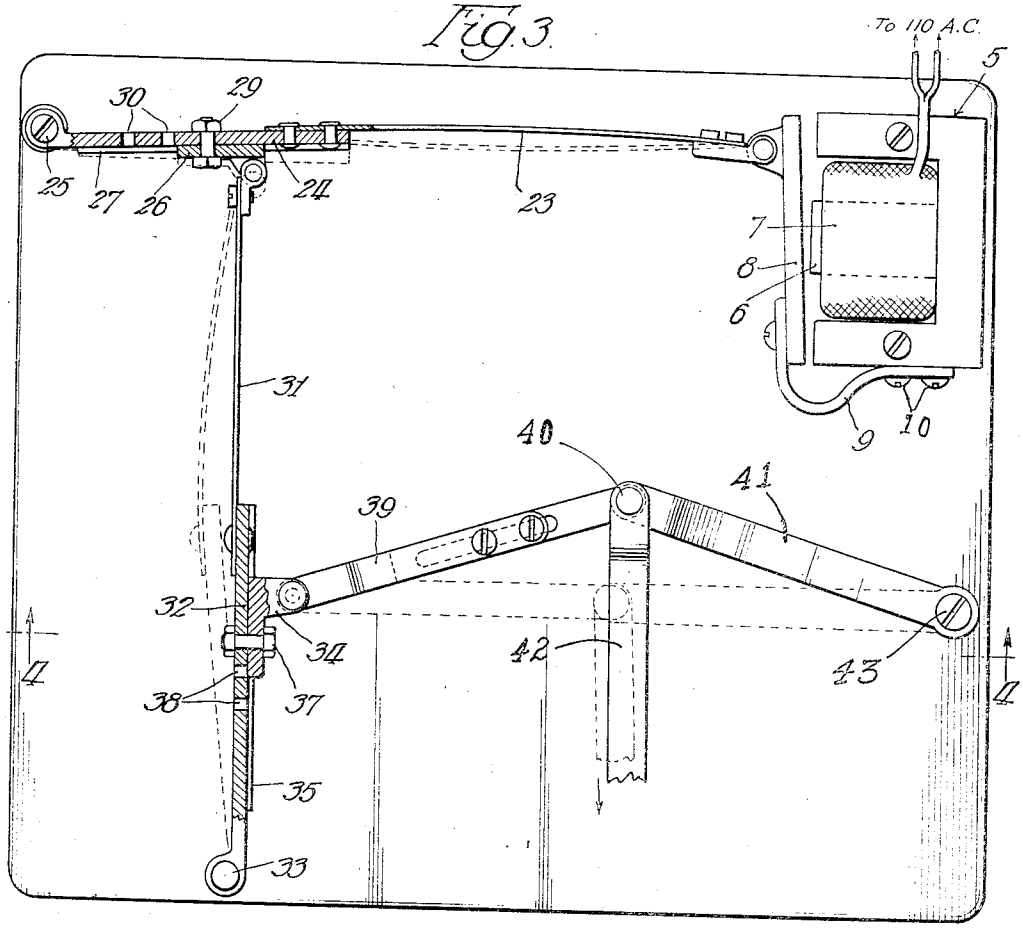
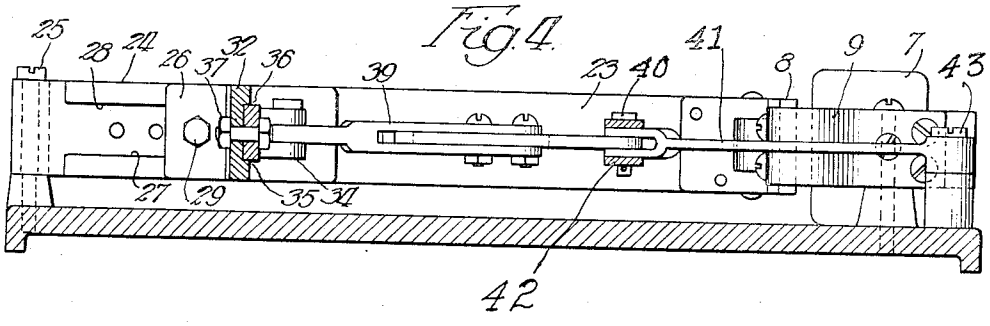


Fig 4.



Inventor
Leo J. Wahl
By: Zabel Carlson Griffin Campbell & Wells
Attys.

Patented Oct. 22, 1940

2,218,837

UNITED STATES PATENT OFFICE

2,218,837

ELECTROMAGNETICALLY DRIVEN MOTOR

Leo J. Wahl, Sterling, Ill.

Application July 19, 1939, Serial No. 285,314

8 Claims. (Cl. 172—126)

The present invention relates to means for operating a work tool by power obtained from the oscillations of the armature of an electromagnet. It is the principal purpose of this invention to provide a device whereby the high frequency oscillations of the armature of an electromagnet energized by alternating current can be utilized to produce oscillations of a much lower frequency and of an amplitude which may be varied to suit the work desired.

The present invention contemplates a device of this character wherein the armature is adapted to bend a resilient strip which extends in the direction of oscillation of the armature, and the strip, in turn, is connected to the work operating mechanism. The construction is such that between the armature and the work there is interposed somewhere a body having sufficient moment of inertia to cause the strip to bow first in one direction and then in the other direction as pressure is applied to it endwise by the armature.

The invention further contemplates a device including the features hereinbefore mentioned and embodying means for further lowering the frequency of oscillation by a repetition of the action of the resilient strip in succeeding stages, which may include a resilient strip or a simple toggle arrangement. Adjustment of the amplitude of oscillation is also provided.

The features and advantages of the present invention will appear more fully as the description proceeds, reference being had to the accompanying drawings wherein a preferred form of the invention is shown. It is to be understood, however, that the drawings and description are illustrative only, and are not to be taken as limiting the invention except insofar as it is limited by the claims.

In the drawings, Fig. 1 is a plan view illustrating generally a device embodying the present invention;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a view like Fig. 1 of a modified form of the invention wherein provision is made for varying the amplitude of the work performing oscillations, and

Fig. 4 is a sectional view on the line 4—4 of Fig. 3.

Referring now in detail to the drawings, the present invention is embodied in a device which employs an electromagnet 5 as a source of power. The electromagnet has a core 6 and an energizing coil 7 which is adapted to receive current from a suitable source of alternating current supply. The electromagnet includes an armature 8 which is supported by a spring 9. The spring 9, as shown, is fastened to the core 6 of the electromagnet by suitable screws, as indicated at 10. As is well-known in the art, the electromagnet when energized will attract the armature 8 once for each one-half wave of alternating current passing through the coil 7. This attraction will cause storing of energy in the spring 9 so that between attractions by the electromagnet the armature 8 will be moved outwardly by the spring 9.

On ordinary sixty cycle alternating current, this means that the armature 8 is attracted and moves outwardly to complete a cycle 120 times per second. This rate of vibration is much too rapid for many purposes, and the present invention is directed to a means whereby the frequency of oscillation of the armature 8 can be reduced to one-half, one-fourth or less.

In the present invention I provide a straight spring strip 11 which is connected to the armature 8, preferably by a screw 12 mounted in a bracket 13 on the armature. The spring strip 11 extends in the direction of oscillation of the armature 8. It is mounted at a distance from the armature 8 upon a support 14. It is desirable that this support be also in the form of a bracket adapted to receive a mounting screw 15 that is fixed to the end of the strip 11. It will be noted that the spring strip 11 is free to bow or bend in either direction when pressure is applied to it by means of the armature 8. When the armature is attracted by the electromagnet 5 it permits the spring strip 11 to take its natural straight form, the length of the spring strip being preferably just such as to permit a full attraction stroke for the armature.

On the return stroke of the armature away from the electromagnet, it is necessary that the spring 11 bend in one direction or the other. Means are provided whereby to control the direction in which the strip 11 shall bend, and thus obtain a movement at one-half the frequency of the movement of the armature 8. This means comprises a member 16 fixed to the spring strip 11 between its ends and having sufficient inertia or weight to cause the strip 11, after it is bowed in one direction, to swing past the straight line between the armature and the support and bow in the other direction upon the next succeeding outward movement of the armature 8. In other words, when the armature 8 is first attracted the strip 11 is drawn straight, then when the armature moves out, the strip 11 bows in an upward

direction, as shown in Fig. 1, carrying with it the member 16. When the armature 8 is again attracted, the strip 11 and the member 16 move downward, as shown in Fig. 1. Now, however, when the armature again moves outward, the inertia of the member 16 or of some element connected to it, is sufficient to cause the member 11 to continue to move downward, as shown in Fig. 1, so that it now bows downwardly instead of upwardly. The result is that the strip 11 oscillates only one-half as fast as the armature 8.

The strip 11 is shown as connected by the member 16 to a second spring strip 17 which is fastened to a fixed support 18. The strip 17 has a connecting member 18a intermediate its ends which member is connected by means of a link 19 to a pin 20. The pin 20 is shown as connecting link 19 to a second link 21 and a reciprocating link 22 which may operate any suitable reciprocating tool. The link 21 is pivoted on a post 21a. It will be understood, of course, that this illustration is merely for the purpose of indicating how work may be performed by the electromagnet after the oscillations of its armature have been changed to oscillations of a much lower rate. In this case, the oscillations of the spring strip 17 will be at a speed one-fourth that of the armature 8.

It is obvious that the amplitude of oscillations will vary and become greater as the frequency of the oscillation is reduced. Thus the amplitude of oscillation of the strip 11 is greater than the amplitude of oscillation of the armature 8. Likewise, the amplitude of oscillation of the strip 17 will be greater than that of the strip 11. There is, of course, sufficient inertia in the links 19, 21 and 22 and the connecting parts to cause the strip 17 to bow first in one direction and then in the other, as pressure is applied to it from the strip 11.

It is not necessary to utilize a spring for the entire distance between the armature 8 and the support 14. In Figs. 3 and 4, I have shown a modification of the invention wherein the armature 8 has a spring strip 23 pivoted thereto. This spring strip connects at its other end rigidly to a bar 24 which, in turn, is pivoted upon a post 25. The bar 24 thus forms an extension of the spring strip 23 and swings to and fro as the spring 23 bends in response to oscillation of the armature 8. The bar 24 has a bracket 26 adjustably mounted thereon by means of guides 27 and 28, a bolt 29 and apertures 30. The bracket 26 can be moved closer to or further from the pivot 25 and held in place by passing the bolt 29 through one of the apertures 30. A second spring strip 31 is pivoted to the bracket 26 and has its other end fixed to a bar 32. The bar 32, in turn, is pivoted upon a post 33. It is obvious that the strip 31 may be bowed elternately in opposite directions just as the strip 23 is bowed. However, the amount the strip 31 will be bowed depends upon the position of the bracket 26 with respect to the mid-point between the armature 8 and the pivot 25. The bracket 26 is shown as close to the pivot 25 so that the amplitude of movement transferred to the strip 31 is considerably less than it would be if the bracket 26 were at the mid-point between the pivot 25 and the armature 8.

The bar 32 adjustably supports a bracket 34 by means of guides 35 and 36, a bolt 37 and apertures 38. The bracket 34, in turn, is connected by a link 39 to a pin 40. The pin 40 connects the link 39 with another toggle link 41 and a reciprocating link 42. The link 41 is pivoted on the post 43. The link 39 is adjustable in length. If the amplitude of vibration of the bar 32 and strip 31 is of the proper amount, the link 42 may be reciprocated and thus drive a reciprocating work piece.

It will be appreciated that while I have shown two stages of frequency reduction in oscillation, the invention is not limited as to the number of stages. Furthermore, it has been found unnecessary in the case of two or more stages to have more than one spring strip. A simple toggle arrangement like the links 39 and 41 and the pin 40 can be substituted in the place of the second strip 31, as will be readily apparent. It is necessary to the proper functioning of the apparatus as shown to have a device with sufficient inertia somewhere in the line of power transmission between the spring strip 31 or the strip 23 and the work to carry the strip past its mid-point so as to obtain alternate movements in opposite directions for succeeding cycles of the armature 8. This inertia may be obtained from a rotating member driven by the device or from a weight directly mounted on the strip 31, like the member 16.

From the foregoing description it is believed that the construction and operation of the present device will be readily apparent to those skilled in this art. Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A device of the character described, comprising an electromagnet including a spring mounted element adapted to vibrate to and fro in one direction, a link member having one end connected to said element and extending from the element in the direction of its vibration, said member being composed, at least in part, of a spring strip, a support for the other end of said member resisting endwise movement of the member whereby to cause said spring strip to bow intermediate its ends in response to the oscillations of said spring mounted movable element, a work performing device and means connecting said device to an intermediate point of said member including a body having a substantial inertia.

2. A device of the character described, comprising an electromagnet, a vibrating armature, a link member having one end connected to said armature and extending in the direction of oscillation of said armature, said member being composed, at least in part, of a resilient strip, a support for the other end of said member resisting endwise movement of the member by oscillation of said armature, the member being substantially equal in length to the distance from said support to the point of oscillation of said armature that is most remote from said support, and a work operating connection to said member between its ends, said connection including a weight, the inertia of which is sufficient to cause bending of said resilient strip alternately in opposite directions as the armature oscillates.

3. A device of the character described, comprising an electromagnet, a vibrating armature, a support spaced from said armature, means connecting said armature with said support including a spring strip adapted to bend to allow the armature to approach the support and recede from it as the armature oscillates, and a work connection from said last named means, said device including a body of sufficient inertia to

cause said strip to alternately bow in opposite directions as the armature oscillates.

4. A device of the character described, comprising an electromagnet, a vibrating armature, a support spaced from said armature, means connecting said armature with said support including a spring strip adapted to bend to allow the armature to approach the support and recede from it as the armature oscillates, a work connection from said last named means, said work connection including a second spring strip extending in the direction of oscillation of said first named strip, and a support for the other end of said second spring strip, said device including a body of sufficient inertia to cause said strip to alternately bow in opposite directions as the first named armature oscillates.

5. A device of the character described, comprising an electromagnet, a vibrating armature, a support spaced from said armature, means connecting said armature with said support including a spring strip adapted to bend to allow the armature to approach and recede from the support as the armature oscillates, and a work connection from said last named means, there being sufficient inertia in the parts moved by the bending of said strip to cause said strip to alternately bow in opposite directions as the armature oscillates.

6. A device of the character described, comprising an electromagnet, a vibrating armature, a support spaced from said armature, means connecting said armature with said support including a spring strip adapted to bend to allow the armature to approach and recede from the support as the armature oscillates, and a work connection from said last named means, there being sufficient inertia in the parts moved by the bending of said strip to cause said strip to alternately bow in opposite directions as the armature oscillates, the work connection being adjustable lengthwise of said connecting means.

7. A device of the character described, comprising an electromagnet, a vibrating armature, a support spaced from said armature, means connecting said armature with said support including a spring strip adapted to bend to allow the armature to approach and recede from the support as the armature oscillates, and a work connection from said last named means, there being sufficient inertia in the parts moved by the bending of said strip to cause said strip to alternately bow in opposite directions as the armature oscillates, said connecting means being pivoted to the armature.

8. A device of the character described, comprising an electromagnet, a vibrating armature, a resilient strip having one end connected to said armature and extending in the direction of oscillation of said armature, a support for the other end of said strip resisting endwise movement of the strip by oscillation of said armature, the strip being substantially equal in length to the distance from said support to the point of oscillation of said armature that is most remote from said support, and a work operating connection to said strip intermediate its ends, said connection including a weight, the inertia of which is sufficient to cause bending of said strip alternately in opposite directions as the armature oscillates, said strip being pivoted to the armature.

LEO J. WAHL.