

May 12, 1931.

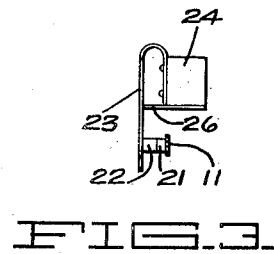
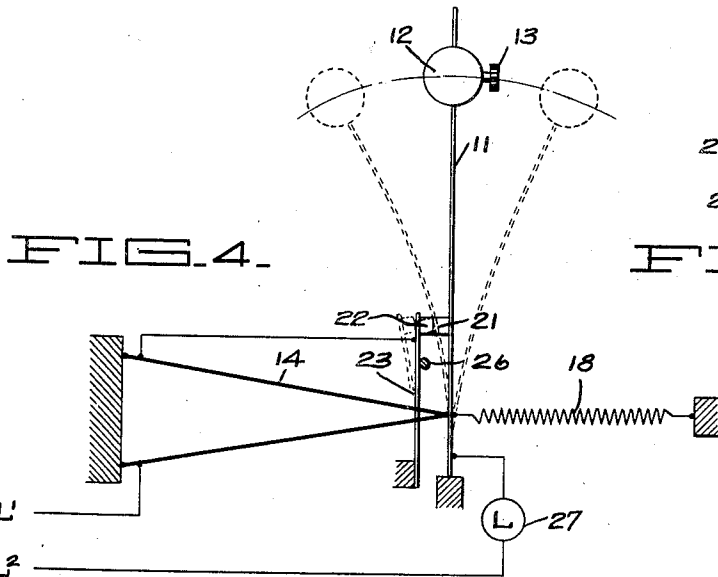
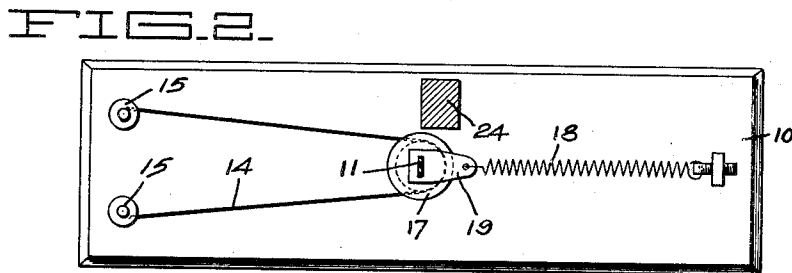
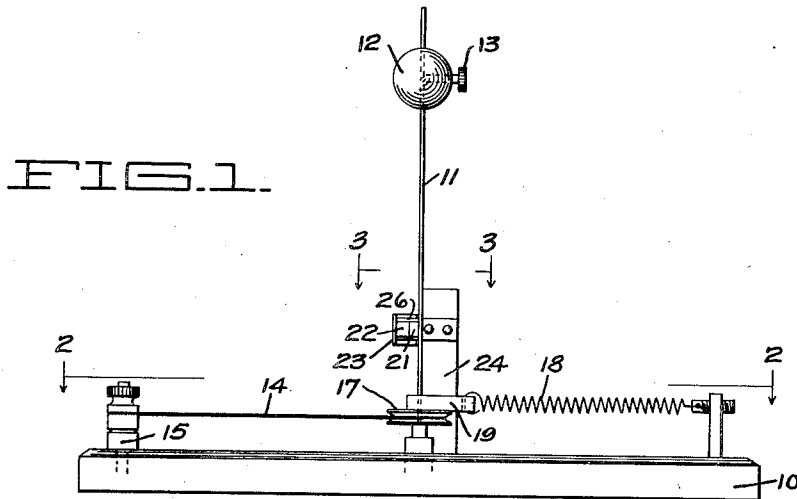
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1,804,709

THERMOMOTIVE DEVICE

Filed Jan. 23, 1928

3 Sheets-Sheet 1



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FIG. 5.

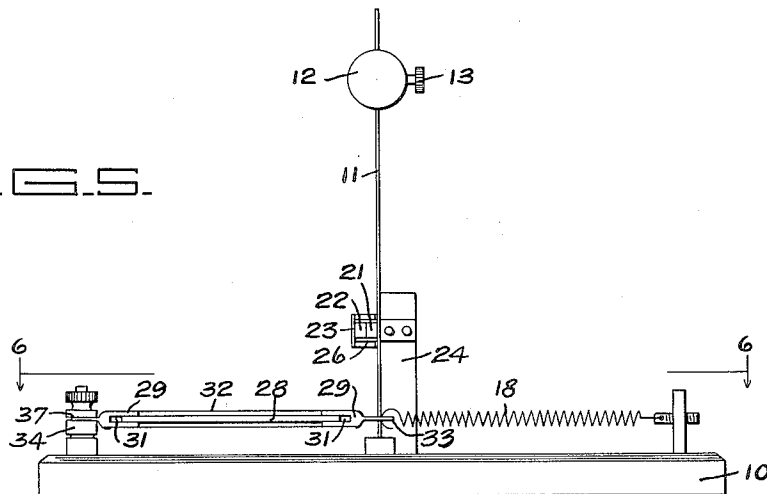


FIG. 6.

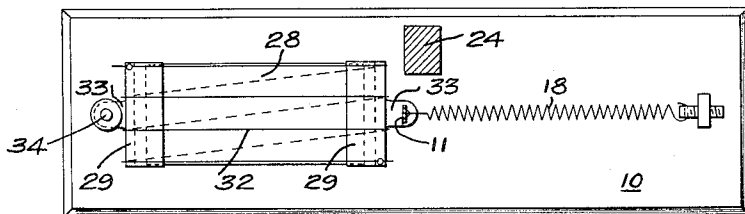


FIG. 8.

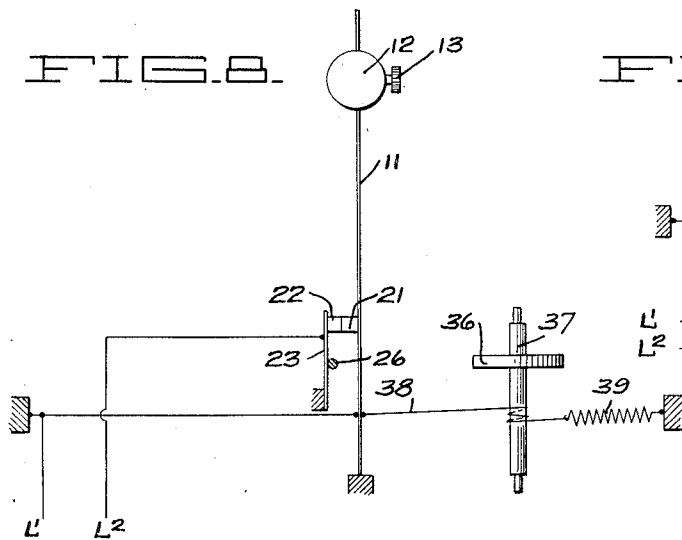
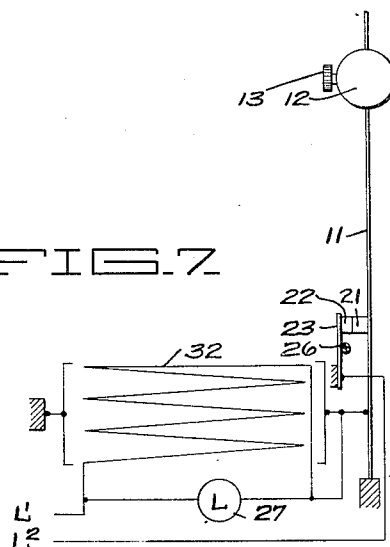


FIG. 7.



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FIG. 9.

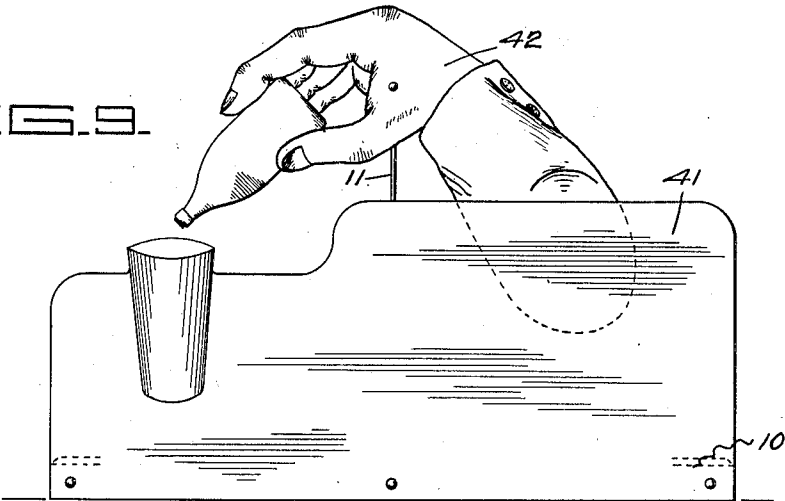


FIG. 10.

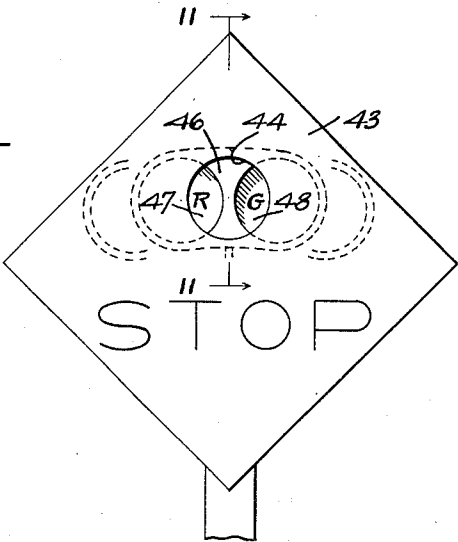


FIG. 11.

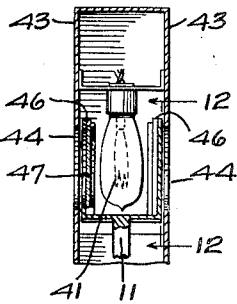
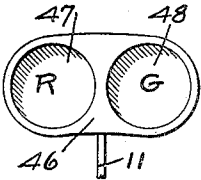


FIG. 12.



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UNITED STATES PATENT OFFICE

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THERMOMOTIVE DEVICE

Application filed January 23, 1928. Serial No. 248,956.

This invention relates generally to devices for converting electrical current to energy of motion. It relates particularly to devices in which the expansion of a resistance element is utilized to produce a useful motion.

It is an object of this invention to devise a thermal electric motive device of simple construction which will be sufficiently reliable in operation for commercial use.

It is a further object of this invention to device a thermal electric motive device which may be utilized for flashing lamps or for interrupting electrical circuits.

It is another object of this invention to devise a simple form of thermal electric motive device which may be incorporated with advertising or display devices which utilize oscillatory motion.

Further objects of the invention will appear from the following description in which I have set forth the preferred embodiments of my invention. It is to be understood that the appended claims are to be accorded a range of equivalents consistent with the state of the prior art.

Referring to the drawings:

Figure 1 is a side elevational view of a thermoelectric device constructed in accordance with this invention.

Fig. 2 is a cross sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a detail taken along the line 3—3 of Fig. 1 and illustrating the construction of the compact means for the thermoelectric motor.

Fig. 4 is a circuit diagram illustrating schematically the device shown in Figs. 1 to 3 inclusive.

Fig. 5 is a detail illustrating an electrical thermal device similar to that shown in Figs. 1 to 3 inclusive, but having a modified form of resistance element.

Fig. 6 is a cross sectional view taken along the line 6—6 of Fig. 5.

Fig. 7 is a circuit diagram illustrating schematically how the device of Figs. 5 and 6 may be utilized for flashing an electrical lamp.

Fig. 8 is a schematic diagram illustrating

an electrothermal motor for securing rotary motion.

Fig. 9 illustrates an advertising device incorporating the invention.

Fig. 10 is a side elevation view of a boulevard stop sign incorporating the invention.

Fig. 11 is a cross sectional detail taken along the line 11—11 of Fig. 10.

Fig. 12 is a detail showing the oscillating screen utilized in the sign of Fig. 10.

In the drawings I have illustrated a number of embodiments of the invention but it will be obvious from the following detail description that these embodiments have certain inventive features in common. Referring to Fig. 1 I have shown a support 10 to which is secured a lever arm 11. Lever 11 is preferably made of a spring strip of metal and has its one end, preferably the lower end, rigidly secured to the support 10. Carried by the lever 11, there is a suitable weight 12 adjustable along the lever as by means of a set screw 13 so that it may be positioned at various distances from the support.

The arrangement of lever 11 and weight 12 has a natural oscillatory period of its own, that is it will swing back and forth in the manner of a pendulum when set into motion. If impulses are applied to the lever 11 in time or in synchronism with the natural period of the lever, the lever may be started and kept in oscillating condition. In this invention I provide synchronized impulses by means of a resistance wire 14 which has a substantial temperature coefficient of expansion. For example I may employ a nickel chromium alloy, or a resistance material commonly known as German silver. The nickel chromium alloy gives good results since it has relatively high mechanical strength and will not readily oxidize. The element formed by this resistance wire has its one end anchored and its other end connected to the lever 11 a short distance from the point where this lever is secured to the support 10. For example in Figs. 1 and 2 I have shown resistance wire 14 as having its ends secured to support 10 by means of binding posts 15, while the intermediate looped portion is entrained about a suitable insulating member 17, this

member being secured to the lever 11 adjacent to the connection between this lever and support 10. I prefer to keep the wire 14 in tensioned condition, and for this purpose I may utilize the resilient nature of the lever 11, but I prefer to employ an additional spring 18. One end of this spring is shown as secured to support 10 while the other end is secured to an insulating member 19 which in turn is secured to the lever 11 adjacent the point of connection of the resistance wire 14.

The resistance 14 is periodically heated by means of electrical current, and this current is controlled by means of a pair of electrical contacts 21 and 22. These contacts are opened and closed in time with the swinging of weight 12, and for this purpose I have shown contact 21 as being mounted upon lever 11 a substantial distance above the support 10, while the cooperating contact 22 has been shown as carried by the end of a spring arm 23. Spring arm 23 is carried by a suitable support as is indicated by the standard 24 secured to the support 10.

The length of the resistance wire 14 is preferably such that when it is in normal unenergized and in cool condition, lever 11 is in such a position as to effect the closing of contacts 21 and 22. As will be presently explained, these contacts and the wire 14 are included in an electrical circuit, and the wire is expanded to permit contacts 21 and 22 to open. Upon opening of these contacts, wire 14 is deenergized and permitted to cool and contract to pull lever 11 toward contact 22. At the time when the contacts 21 and 22 separate, contact 22 is apt to be sent into vibration if carried by a free spring arm. Such vibration would be objectionable as it would cause sparking between the contacts upon the make and break. To prevent such vibrating, I provide a stop member 26 which is positioned in such a manner as to engage the free portion of spring arm 23, when the contact 21 is moved away from contact 22. This stop 26 effectively dampens out all vibration of arm 23, and thus materially reduces sparking.

As I have shown in the circuit diagram of Fig. 4, one simple way of connecting the elements of my device, is to connect the wire 14 and the contacts 21 and 22 in series with current supply lines L_1 and L_2 . Where the resistance 14 is too low for connection directly across the lines L_1 and L_2 , I may insert another series resistance as has been indicated for example by the series electrical lamp 27. This arrangement is of advantage in that it provides a convenient method of flashing an electrical lamp.

While the operation of the device is obvious from the above description, it may be explained that when contacts 21 and 22 are closed, current will be supplied to resistance

wire 14 to heat and thus expand the same. Expansion of wire 14 permits contacts 21 and 22 to open by virtue of the tension of spring 18. However when these contacts are open, resistance wire 14 is deenergized and permitted to cool and again contract to close contacts 21 and 22. Presuming that the weight 12 is initially stationary, it will be immediately set into motion and this motion will increase until the energy dissipated from the pendulum arrangement is substantially equal to the energy applied by the resistance wire 14. When in normal operation the weight 12 may take a relatively wide sweep, or in other words it greatly amplifies the relatively small increments of elongation of the wire 14. The effective center of the swing changes when weight 12 swings to the left, since spring arm 23 causes flexing of lever 11 after contacts 21 and 22 have closed. The rigid connection between the lever 11 and the support 10 is a feature of importance in that it not only greatly simplifies the construction, but it also makes the device rugged and dependable in operation. While thermal electric motors have previously been known which utilize an expanding and contracting resistance wire, I believe that I have been the first to produce a device of this kind which is sufficiently reliable for commercial purposes.

In Figs. 5 and 6 I have illustrated a modification of the resistance element shown in Figs. 1 and 2. In this case I utilize a plurality of loops of resistance wire which are disposed upon a suitable support. For example I have shown a strip 28 which is preferably made of some good heat conducting material such as a suitable metal, upon the ends of which are disposed the insulating members 29. Members 29 are bifurcated or are formed with slots 31 to slidably receive the ends of strip 28. The resistance wire 32 in this case is looped around insulating members 29 a plurality of times, and has its ends suitably secured thereto. Members 29 may be provided with suitable lugs 33 whereby the resistance unit so formed may be detachably secured to the support 10 as by means of binding post 34 and to the lever 11. A resistance element of this kind is advantageous in that it not only provides a relatively large contracting force, but it may be made up in resistances sufficiently large for connection directly across a current supply line. Furthermore the unitary construction permits ready removal of an element in case of a burned out resistance wire.

In Fig. 7 I have shown the manner in which the resistance element shown in Figs. 5 and 6 may be electrically connected with the contacts of the electrothermal device. The resistance wire 32 is connected in series with contacts 21 and 22 and this series arrangement connected directly across the current

supply lines L_1 and L_2 . If it is desired to flash a lamp, this lamp 27 may be connected directly in shunt with the resistance wire 32. This arrangement for flashing a lamp gives good results since its operation does not depend upon the resistance of the lamp. In other words it will function for a wide variety of lamp sizes.

In Fig. 8 I have shown how the pendulum movement may be converted to rotary motion. In this instance a rotary member indicated by the wheel 36 is suitably journaled as by means of shaft 37. Suitable clutching means is employed for periodically applying a turning torque to the wheel 36 according to the oscillatory movements of the lever 11. Such a clutching means may consist merely of a cord or other flexible element 38 having its one end connected to a movable portion of lever 11, and which is wrapped one or more times about the shaft 37. The other end of this cord is tensioned as by means of a spring 39. With the illustration of Fig. 8, when lever 11 is swinging to the right, the convolutions of the cord 38 slips around the shaft of wheel 36 and spring 39 takes up the slack, and when lever 11 is swinging to the left, the convolutions of cord 38 tighten to grip the shaft of wheel 36 and turn the same. By means of this arrangement I can provide a relatively slow turning movement of the wheel 36 and the rate of this turning movement may be varied by changing the position of the weight 12. With a relatively small current consumption, sufficient turning force may be developed to operate a relatively large rotary display table.

It is obvious from the above description that I have provided an electrical thermal motive device of great utility and extreme simplicity. It may be applied for a variety of uses to take the place of more expensive and less reliable electromagnetic devices. It may be used universally with alternating and direct current and is self starting. It may be utilized for the purpose of flashing lamps in the manner described above, or additional contacts may be associated with the swinging lever 11 to control separate lamp circuits or other devices. When used for flashing lamps, it will produce a uniform flashing period and may break relatively heavy currents.

A suitable advertising device utilizing the invention is shown in Fig. 9. In this instance the display card 41 masks the principal parts of an electrothermal motor and the lever 11 carries an element 42 which is intended to be oscillated and which is the equivalent of the weight 12. The oscillating movement of the lever may be employed to simulate movements to attract attention, as for example to simulate shaking of a bottle as shown.

In Figs. 10, 11 and 12, I have shown a

flashing boulevard stop signal. A flashing or moving effect in this instance is produced continuously to attract attention. For example as shown in Figs. 11 and 12, such a stop sign may utilize spaced plates 43 forming an enclosure to house the thermal electric motor and other moving parts of the sign. Plates 43 have windows 44 through which may be viewed one or more oscillating screens 46. In the present instance these screens are provided with different colored lenses 47 and 48, as for example red and green lenses, and are carried by the end of the oscillating lever 11. Between the screens 46 I may mount an electric lamp 41 so that the oscillatory movement of screen 46 will cause the sign to present a change in color and a flashing effect. In place of using an electric lamp, the lenses 47 and 48 may be omitted and the screen 46 merely coated with a luminous substance. Because of the small current consumption of my motor device, and because of its reliability, a boulevard stop signal incorporating the same may be operated continuously at small expense.

I claim:

1. In a device of the class described, a lever made of a spring strip, a support to which one end of said strip is rigidly secured, a weight carried by said strip, thermal electric means imparting a pendulum movement to said lever, and means for automatically changing the effective lever arm of said strip during each complete swing of said weight.

2. In a device of the class described, a lever, a support to which one end of said lever is secured, a weight carried by said lever, thermal electric means serving to impart an oscillatory pendulum movement to said lever and weight, said means including an expansible resistance element having its one end fixed and its other end secured to said lever, and a spring for normally tensioning said element.

3. In a device of the class described, a relatively stationary support, a resilient lever arm having one end secured to said support whereby its other end may swing periodically, a mass carried by said arm, and electrothermal means for periodically actuating said arm in time with the natural pendulum period of the same, said means including an electrical contact carried by said arm, another cooperating contact, a spring arm carrying said other contact, and means for minimizing vibration of said spring arm when said contacts are separated.

4. In a device of the class described, a relatively stationary support, a resilient lever arm having one end secured to said support whereby its other end may swing periodically, a mass carried by said arm, and electrothermal means for periodically actuating said arm in time with the natural pendulum period of the

same, said means including an electrical contact carried by said arm, another cooperating contact, a spring arm carrying said other contact, and a stop limiting movement of the spring arm in one direction.

5 5. In a device of the class described, a lever arm of substantial length, a mass carried by said arm, an end portion of said arm being formed of a resilient spring strip, a support,
10 a rigid connection between the support and said end portion, an elongated resistance having a substantial temperature coefficient of expansion, one end of said resistance being fixed with respect to said lever and the other
15 end having a physical connection to said lever arm, said last named connection being near the connection between said support and said lever arm, a movable electrical contact carried by said lever arm, another contact adapted
20 to cooperate with the movable contact, and electrical connections between said contacts and said resistance whereby opening and closing of said contacts is caused to control energization of the resistance.

25 6. In a thermal electric motive device, a lever movably secured to a support, a weight carried by said lever, and means including an expansible resistance element for effecting swinging movement of said lever, said element comprising a strip, insulating members
30 slidably disposed upon the ends of said strip, and a resistance wire having a substantial temperature coefficient of expansion looped about said members and said strip.

35 In testimony whereof, I have hereunto set my hand.

MILTON H. SHOENBERG.

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