United States Patent

Vecchio

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[45] **May 23, 1972**

[54] THERAPEUTIC VIBRATING PAD

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[21] Appl. No.: **20,720**

[52] **U.S. Cl.** **128/24.2,** 128/41

[51] **Int. Cl.** **A61h 24/00**

[58] **Field of Search** 128/24.1, 24.2, 33, 41

[56] **References Cited**

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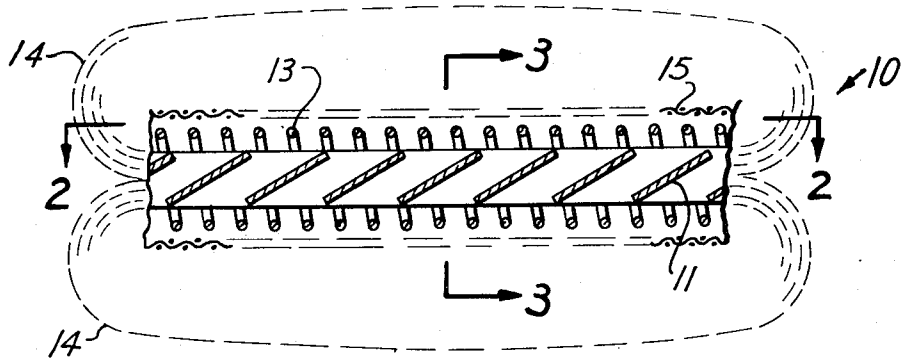
Primary Examiner—L. W. Trapp

Attorney—Angus & Mon

[57] **ABSTRACT**

A therapeutic pad with an armature having a plurality of extended strips in spaced, overlapping relation. Magnetie field means provides an alternating magnetic field in the armature to vibrate the strips by successively inducing and removing magnetic flux into each strip so that adjacent strips successively pull together and relax.

11 Claims, 11 Drawing Figures



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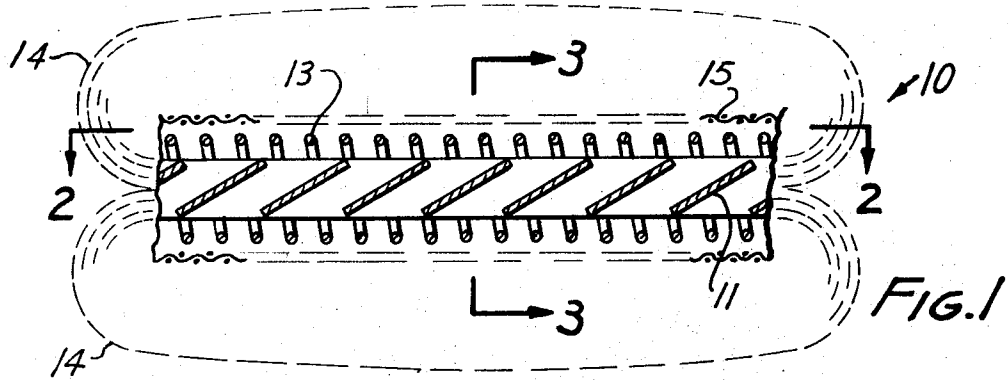

FIG. 1

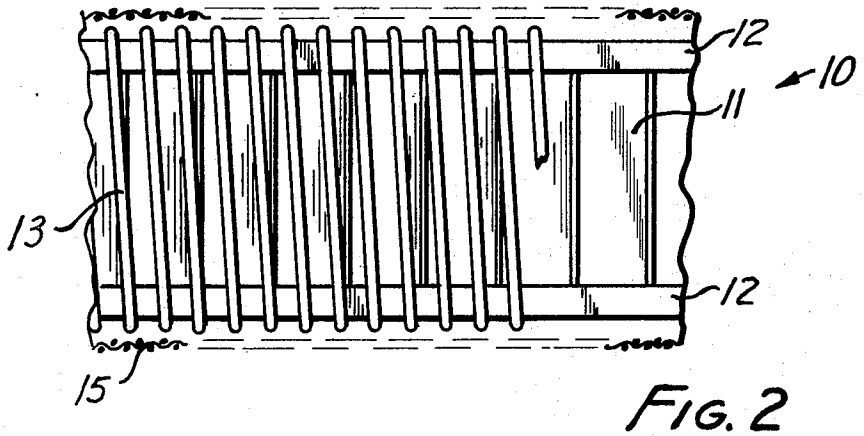

FIG. 2

FIG. 3

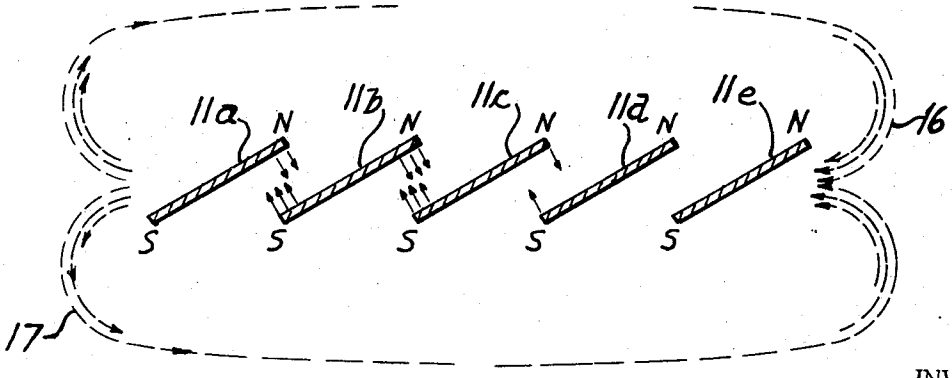

FIG. 4

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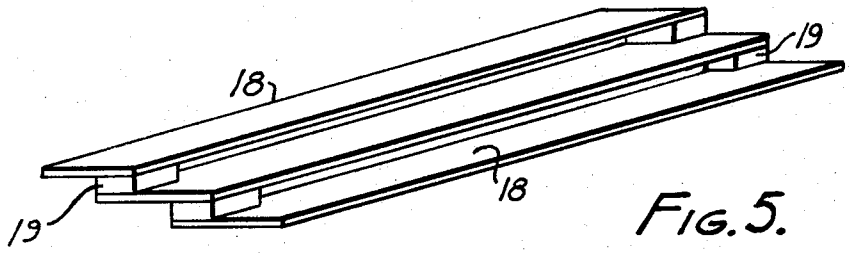

FIG. 5.

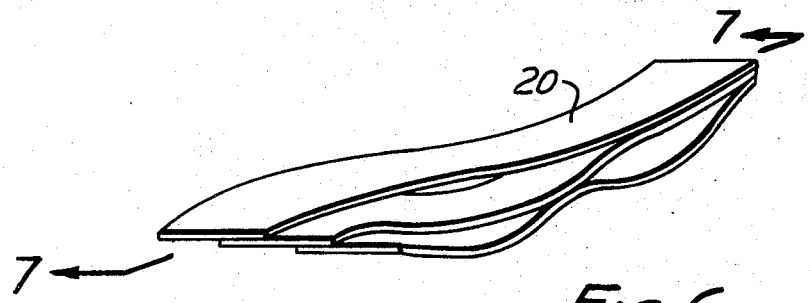

FIG. 6

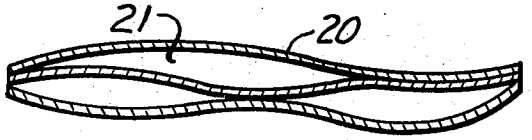

FIG. 7

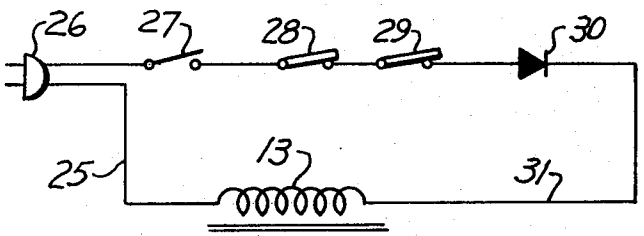

FIG. 8

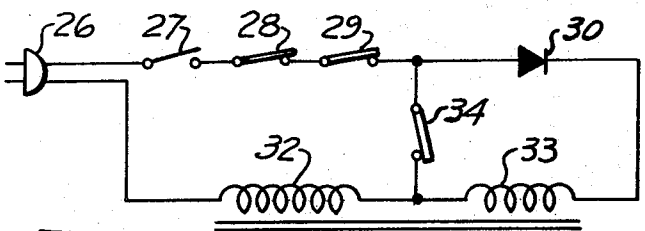

FIG. 9

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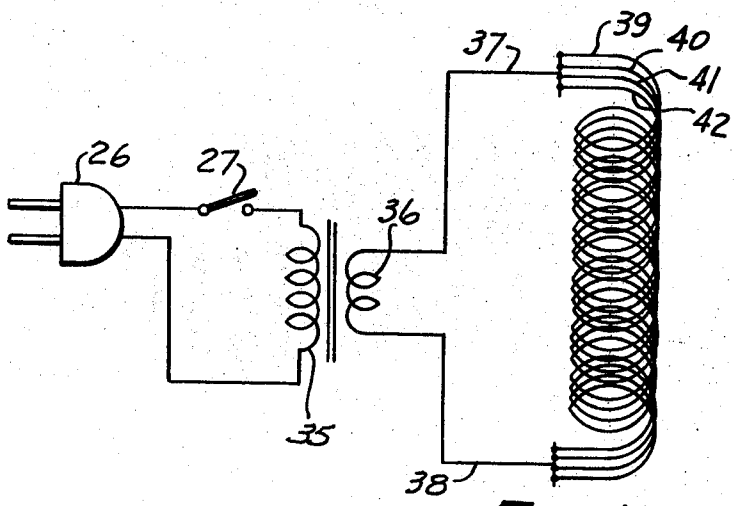

FIG. 10

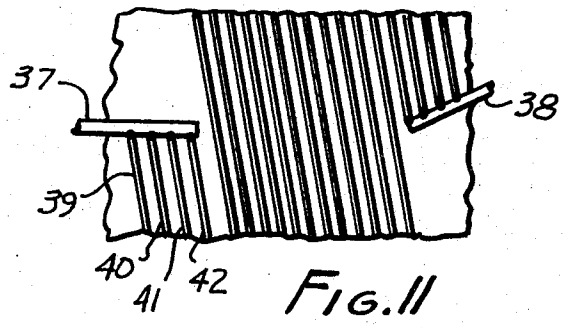

FIG. 11

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THERAPEUTIC VIBRATING PAD

This invention relates to therapeutic pads, and particularly to therapeutic pads capable of vibrating.

Most vibrating therapeutic pads utilize armatures which are vibrated under the influence of an alternating or pulsating magnetic field. These are ordinarily constructed of a relatively rigid spring metal so that the armatures could be vibrated about a relaxed or normal position. Heretofore, vibrator armatures have been constructed in a predetermined shape depending upon the intended use for the pad. Prior pads could not be bent or shaped into any other configuration than that to which it was fabricated. A need exists, however, for a therapeutic pad which can be deformed so that it can fit the contour of the body. For example, it is desirable to be able to wrap a therapeutic pad about a limb, such as an arm or leg, for therapeutic value, a feature which could not be accomplished by prior pads.

Another disadvantage of prior vibrator therapeutic pads resided in the fact that prior pads did not make effective use of the pulsating or alternating magnetic field. Particularly, a substantial portion of the magnetic flux developed in prior therapeutic pads was not used to excite the armature and hence, was lost energy.

It is an object of the present invention to provide a flexible armature for therapeutic pads whereby the user may vary the shape of the pad as desired.

Another object of the present invention is to provide a therapeutic pad having an armature which makes more effective use of the magnetic field.

Another object of the present invention is to provide a flexible therapeutic pad which can be wrapped into a cylindrical configuration, as, for example, about a user's limb.

A therapeutic pad according to the present invention utilizes a plurality of overlapping strips which are separated from from each other and located in a magnetic field so that the magnetic field vibrates each strip independently of the others. The strips are assembled in the pad so that the pad may be wrapped or otherwise bent into various configurations.

In accordance with one feature of the present invention, the magnetic field is provided by a pulsating or alternating current passing through a coil wrapped around the strips.

In accordance with another optional and desirable feature of the present invention, thermostat means may be utilized so to prevent over-heating of the coil.

In accordance with another optional and desirable feature of the present invention, thermostat means is so associated with the coil that maximum power is provided to a portion of the coil for an initial period of time to assure rapid heating of the coil.

The above and other features of this invention will be more fully understood from the following detailed description and the accompanying drawings, in which:

FIG. **1** is a side view elevation in cut away cross-section of a portion of a therapeutic pad in accordance with the presently preferred embodiment of the present invention;

FIG. **2** is a section view taken along line **2—2** in FIG. **1**;

FIG. **3** is a section view taken along line **3—3** in FIG. **1**;

FIG. **4** is an illustration of the principle of operation of the therapeutic pad in accordance with the present invention;

FIG. **5** is a perspective view of a portion of a therapeutic pad in accordance with a modification of the present invention;

FIG. **6** is a perspective view of a portion of a therapeutic pad in accordance with another modification of the present invention;

FIG. **7** is a section view taken along line **7—7** of FIG. **6**;

FIG. **8** is a diagram of one embodiment of a circuit for use with the therapeutic pad in accordance with the present invention;

FIGS. **9** and **10** are diagrams of other circuits for use with a therapeutic pad in accordance with the present invention;

and FIG. **11** is a fragmentary plan view showing another coil construction useful in this invention.

Referring to the drawings, in particular FIGS. **1–3**, there is illustrated a therapeutic pad **10** in accordance with the

presently preferred embodiment of the present invention. Pad **10** includes a plurality of spaced, overlapping, metal strips **11** whose ends are held in frame **12**. Strips **11** may, for example, be constructed of suitable spring steel or other ferrous material which is capable of being vibrated. Spring steel is particularly useful in the construction of strips **11** because it is sufficiently rigid so as to return to its shape, and yet is capable of being deformed under the influence of a magnetic field to enable the strips to vibrate under a pulsating or alternating magnetic field to impart a therapeutic value to the pad. Frame **12** is preferably constructed of a flexible insulating material such as soft rubber or plastic. Strips **11** are assembled to frame **12** to form the armature assembly for the therapeutic pad. Coil **13** is wrapped around the armature assembly in such a manner that the coil is wrapped in the general direction along the length of each strip **11** and the axis of the coil extends across the widths of the assembled strips. When an electric current flows through coil **13**, magnetic lines of flux **14** pass through the armature assembly. Cloth **15**, such as gauze or other cloth, is applied, preferably as a wrapping, about the armature assembly and coil to form the completed pad. Also, and as will be more fully understood hereinafter, coil **13** may be a heating coil so that the pad will heat as well as vibrate.

FIG. **4** illustrates the operation of the armature assembly in accordance with the present invention. In FIG. **4** a plurality of ferrous metal strips **11***a*, **11***b*, **11***c*, **11***d*, and **11***e* are illustrated in overlapping spaced relation. Lines of magnetic flux **16** are illustrated entering the assemblage from the right (as illustrated in FIG. **4**) to magnetically charge each strip with a north and south magnetic pole. Flux lines continue from the south pole of each strip to the north pole of the next strip, and so on through the assembly. The lines of flux loop back (outside of the coil which is not shown in FIG. **4**) to close the loop.

With the north and south magnetic poles formed in each of the strips, the edge representing a north pole of one strip is attracted to the edge of successive strips to pull together. If the magnetic field is thereafter relaxed, the strips return to their original relaxed position. If the magnetic field is then reversed, the strips again pull together in a manner illustrated in FIG. **4** except that the magnetic poles induced as each strip will be edge reversed. If a pulsating magnetic field is applied to the strips, the strips will pull together during each pulse of the pulsating magnetic field and will separate during each null of the magnetic field. On the other hand, if an alternating magnetic field is applied to the strips, the strips will pull together during each half cycle of the field, and will tend to relax only as the magnetic field passes through zero or nullity.

With a coil wrapped around the strips and with an alternating current passing through such a coil, the strips will vibrate at a frequency dependent upon the frequency of the alternating current plassing through the coil. Hence, if a half-wave rectified 60 Hertz alternating current is passed through coil **13** in FIG. **1–3**, the strips will vibrate at a frequency of 60 c.p.s. However, if the 60 Hertz alternating current is not rectified, the strips will tend to vibrate at 120 cycles per second.

FIG. **5** illustrates a modification of an armature in accordance with the present invention wherein armature strips **18** are spaced apart by spacers **19**. The spacers, which may, for example, be constructed of suitable flexible plastic or rubber, may be adhesively bonded to adjacent strips and may be sandwiched between the ends of the adjacent strips. In this manner, the strips **18** are maintained in a separate configuration to enable them to pull together and separate in accordance with the pulsations of the magnetic field. FIG. **6** and **7** illustrate yet another modification of an armature arrangement for the present invention wherein a plurality of ferrous strips **20** are bonded or riveted together at their ends. Each strip **20** is normally warped so that spaces **21** are formed between the adjacent strips when they are in their relaxed position. When under the influence of a magnetic field, the edges of the separated strips tend to pull together so that each edge portion is pulled toward the oppositely-poled edge of the next strip thereby inducing mechanical vibrations into the assembly.

The armature strips may be held together in any convenient assembly which results in the armature strips being in overlapping relation and capable of vibrating as described. Hence, the ends of the strips may be held in a frame as described in connection with FIGS. 1–3, or they may be fastened together as described in connection with FIGS. 5–7. As yet another alternative, the strips may be elongated flat strips fastened together in overlapping relation as illustrated in FIG. 4 by loose or over-sized rivets so that the strips are capable of vibrating. It is to be understood that in the case of extended strips, it may be desirable to loosely fasten, or fasten in spaced relation, the strips together at intervals along their length so that the entire assembly retains its shape.

FIG. 8 illustrates the preferred embodiment of a circuit for use in exciting coil 13 in accordance with the present invention. Coil 13 is connected via lead 25 to one side of plug 26, and other side of plug 26 is connected through the series connection consisting of manually operable switch 27, thermostat switches 28 and 29 and rectifier 30. The opposite side of rectifier 30 is connected via lead 31 to the opposite side of coil 13.

In the operation of the circuit illustrated in FIG. 8, and assuming thermostatic switches 28 and 29 are closed, closure of manually operable switch 27 causes alternating current to be delivered to rectifier 30 where it is rectified so that only half-wave rectified current is delivered to coil 13. Each pulse of half-wave rectified current generates a pulse of magnetic flux through the armature. Accordingly, each strip 11 of the armature is magnetically induced with north and south poles and the edges of adjacent strips will pull together, thereby inducing mechanical vibration into the assembly. When the current returns to zero, such as when the alternating current is not passed by the rectifier, the induced magnetic charge dissipates from the magnetizeable armature strips and the strips relax to their normal position.

Thermostatic switches 28 and 29 are provided to shut off power to coil 13 in the event that coil 13 should become too hot. Thus, if coil 13 overheats, at least one of thermostatic switches 28 and 29, which are in close proximity with the coil, opens to prevent further power from being delivered to the coil.

FIG. 9 illustrates a modification of the circuit illustrated in FIG. 8 wherein the coil consists of a plurality, such as two, serially connected coils 32 and 33 which are magnetically coupled together and which are in series with diode 30. Coils 32 and 33 are preferably heating coils and are wound together about the armature such as illustrated by coil 13 in FIGS. 1–3. Thermostatic switch 34 is connected to the junction between thermostatic switch 29 and diode 30 and to the junction between coils 32 and 33. Thermostatic switch 34 is adapted to open at a temperature which is within the operating range of coil 32 and at a temperature substantially lower than safety thermostatic switches 28 and 29.

In operation of the circuit illustrated in FIG. 9, thermostatic switches 28, 29 and 34 are initally closed because the coils are relatively cool. Manually operable switch 27 may be closed to deliver power to coil 32. Full power is delivered to coil 32 through normally closed thermostatic switch 34 which shorts out diode 30 and coil 33. Coil 32, under the influence of unrectified alternating current induces an alternating magnetic field into the region of the armature strips which in turn causes the strips to vibrate at a rate of 120 cycles per second (assuming 60 c.p.s. power) as heretofore explained. Also, full power is delivered to coil 32 to cause the coil to heat rapidly. Coil 32 heats rapidly until thermostatic switch 34, which is in close proximity with coil 32, opens thereby opening the short circuit across diode 30 and coil 33. With switch 34 open, further current is half-wave rectified and is delivered to the series combination of coils 32 and 33. The half-wave rectified current generates a pulsating magnetic field to vibrate the strips at 60 c.p.s. (Assuming a 60 c.p.s. source). Also, the half-wave rectified current represents one-half of the power of the previously unrectified current so the power to the coils is reduced to one-half which is sufficient for maintaining the temperature of the pad at the therapeutic value achieved during the initial heating stage.

The circuit illustrated in FIG. 9 is particularly useful in connection with heating coils for heating the therapeutic pad. The circuit illustrated in FIG. 9 provides rapid heating of the heating coil by delivering full power to the heating coil before reducing the power through diode 30.

FIGS. 10 and 11 illustrate the circuit of yet another modification of a circuit for use with a therapeutic pad in accordance with the present invention. In FIG. 10, the primary winding 35 of a transformer is connected through switch 27 and plug 26 to a source of alternating current, such as 120 volt, 60 Hertz current. The secondary winding 36 of the transformer is connected via leads 37 and 38 to a plurality of coils 39, 40, 41, 42, respectively. (FIG. 11). Preferably the transformer forming coils 35 and 36 is a step-down transformer so that the voltage appearing across winding 36 is substantially lower than that across the primary winding 35.

One advantage of the circuit illustrated in FIGS. 10 and 11 resides in the fact that the circuit operates at a lower voltage than ordinary 120 volt house voltage. The multi-filar winding of windings 39, 40, and 41 improves the current distribution on the surface of the therapeutic pad and does not significantly stiffen the pad so the pad remains flexible. Furthermore, with the step-down transformer, a higher current appears on leads 37 and 38 of the secondary winding of the transformer so that a given magnetic field strength may be generated with a lesser number of turns of coils 39, 40 and 41. This is due to the fact that the strength of the magnetic field is dependent upon the number of ampere turns, and since the current is higher in the secondary winding, fewer number of turns are required to maintain the same ampere turns. With fewer turns required in the coil for the therapeutic pad, winding impedance is significantly reduced, thereby increasing the efficiency of the pad.

The present invention thus provides a therapeutic pad capable of effectively using the magnetic field generated by an alternating or pulsating current source. Additionally, circuits are provided which enable use of the therapeutic pad in connection with both vibrating and heating modes for maximum therapeutic value. The therapeutic pad makes more effective use of available magnetic field than prior pads by concentrating the magnetic field into the armature with less flux leakage than prior therapeutic pads. Also, unlike prior therapeutic pads, the therapeutic pad in accordance with the present invention is capable of being warped or wrapped in the direction of the axis of the coil. Hence, the pad may be wrapped about a limb, such as an arm or leg, for most effective therapeutic value.

Although the present invention has been described with a use of a single coil, it is to be understood that a plurality of coils may be utilized in connection with the armature. Also, although the present invention has been described in connection with the use of armature strips having a substantially rectangular cross-section, it is to be understood that the cross-section of the armature strips may be oblong, or otherwise shaped. It is preferred only that the strips be of extended length and that they be capable of being warped or bent under the influence of magnetic field and return to their natural or relaxed shape when the magnetic field is removed.

This invention is not to be limited by the embodiments shown in the drawings and described in the description, which are given by way of example and not of limitation.

What is claimed is:

1. A therapeutic pad comprising: field producing means for producing an alternating magnetic field; and a metal armature assembly adjacent to said field producing means for providing vibrations when said field producing means produces an alternating magnetic field, said armature comprising a plurality of elongated metal strips having their lengths disposed substantially normal to the direction of said magnetic field and parallel to each other at least a portion of adjacent ones of said strips overlapping and overlaying each other in the direction lateral to their direction of length, and being spaced apart from one another said magnetic field tending to move an edge of each strip toward an edge of its adjacent strip, whereby to impart a rotary, twisting motion to the said strips.

2. Apparatus according to claim 1 wherein said field producing means comprises conductive coil means wrapped around said armature assembly, with its windings extending generally parallel to the direction of length of the strips.

3. Apparatus according to claim 2 wherein spacer means is bonded to an end of each of said strips to maintain each strip in said overlapping and spaced relation.

4. Apparatus according to claim 2 further including half-wave rectifier means in series with said coil means.

5. Apparatus according to claim 1 wherein said elongated strips are warped when in their relaxed position, the strips being so arranged and disposed that a portion of each strip contacts a portion of the edge of its next adjacent strip and a portion of each strip is thereby held spaced from a portion of the next adjacent strip.

6. Apparatus according to claim 1 wherein the strips are substantially flat and rectangular, and in which resilient frame means is provided which holds the end of each of said strips.

7. Apparatus according to claim 6 wherein spacer means is bonded to an end of each of said strips to maintain each strip in said overlapping and spaced relation.

8. Apparatus according to claim 2 wherein said coil means comprises a plurality of conductive coils, half-wave rectifier means in series with said plurality of conductive coils, and normally closed thermostat means short circuiting said rectifier means and at least one of said coils, said thermostat means opening in response to heat produced by another of said plurality of coils, whereby when alternating current is initially supplied to said coil means, full power is supplied to said other of said plurality of coils through said thermostat means to heat said other coil and said thermostat means opens in response to heat produced by said other coil so that said half-wave rectifier means reduces power to said plurality of coils.

9. Apparatus according to claim 2 wherein said elongated strips are warped when in their relaxed position, the strips being so arranged and disposed that a portion of each strip contacts a portion of the edge of its next adjacent strip and a portion of each strip is thereby held spaced from a portion of the next adjacent strip.

10. Apparatus according to claim 2 wherein the strips are substantially flat and rectangular, and in which resilient frame means is provided which holds the end of each of said strips.

11. Apparatus according to claim 2 wherein said coil means comprises a multi-filar coil, and in which a stepdown transformer has its primary winding adapted for connection to a source of alternating current and has its secondary winding connected to the ends of each filar of said coil.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,664,332 Dated May 23, 1972

Inventor(s) LUIGI VECCHIO

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4, line 70 Cl. 1, line 8	insert a comma before "a"
Col. 4, line 73 Cl. 1, line 11	insert a comma before "said"

Signed and sealed this 17th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents