Oct. 10, 1967 S. L. McNAIR 3,346,748

VIBRATOR MOTOR WITH SELF-CONTAINED COOLING MEANS

Filed June 7, 1965

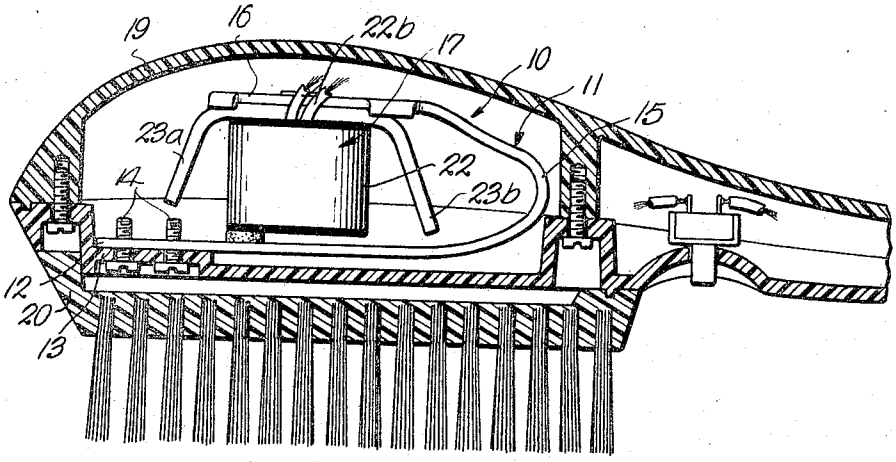

Fig. 1.

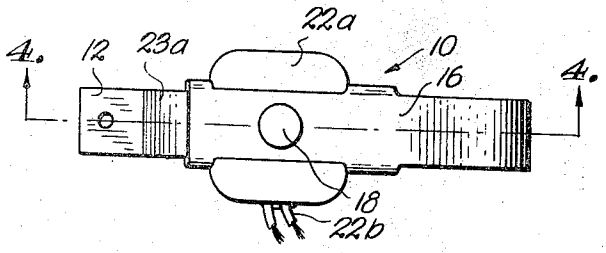

Fig. 2.

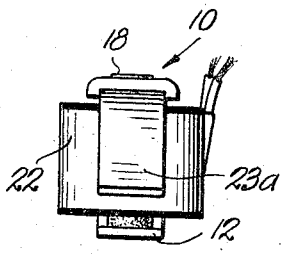

Fig. 3.

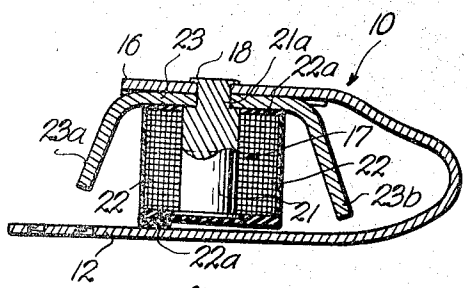

Fig. 4.

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VIBRATOR MOTOR WITH SELF-CONTAINED COOLING MEANS

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ABSTRACT OF THE DISCLOSURE

A vibrating device having an electromagnet affixed to a cooperating spring member. The electromagnet having a single leg, an excitation coil circumscribing the length of the core and a heat conducting vane secured to one end of said core.

The use of electromagnets in conjunction with U-shaped spring members which form an integral part of a vibrating device is a recognized expedient for initiating vibratory energy to some type of vibration applicator. These A-C operated electromagnets are invariably of the E-shaped laminated core construction and include an excitation coil either around the center leg of the E-shaped core or around each outside leg.

An important object of the instant invention is to provide an efficient yet inexpensive vibrator motor comprising a novel core having a single leg. The need for laminations as a means for reducing eddy current and hysteresis loss in A-C operated equipment is eliminated due to the novel construction of the entire electromagnet.

A further object of the invention is to provide an electromagnetic vibrating motor including a magnetic core having a single leg and with an excitation coil circumscribing the length of said core and including at one end of said core, a heat conducting vane. The proximity of the core to the vane being such that the vane will successfully convey the heat produced by the coil-core combination away from said combination. As a result the heat conducting vane successfully eliminates overheating of either coil or core.

Still another object of the invention is to provide a novel, simple and economical way to utilize an A-C operated vibrating motor comprising a non-laminated single leg shaped core by conducting the resulting heat away from the core with a metal contacting heat conducting vane mounted transverse to one end of said core. The invention further contemplates the angling of each end of the vane toward the sides of the core to effectively create a "fanning" of the air surrounding the vibrator motor when in an operating state.

Another object of my invention is to provide a novel electromagnet structure especially adaptable for hand operated massagers, brushes, and other relatively portable vibrating devices.

Other and further objects of the invention, together with features of novelty appurtenant thereto will appear in the course of the following description.

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals indicate like parts in the various views:

FIG. 1 is a side view of the electromagnetic vibrating motor mounted within a unitary housing forming a brush, said housing shown in cross-section;

FIG. 2 is an enlarged top view of the electromagnetic vibrator motor shown detached from the mounting of FIG. 1;

FIG. 3 is a front view of the electromagnetic vibrator motor shown in FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2 in the direction of the arrows.

Referring to the drawings, reference numeral **10** indicates generally the electromagnetic vibrator motor structure. The motor, for exemplary purposes, is used to transmit vibratory energy to a hair brush constructed in accordance with the disclosure of my application Ser. No. 402,416 for "Brush with Self-Locking Detachable Head Portion," filed Oct. 8, 1964, now Patent No. 3,277,509. The details of the brush do not form any part of my present invention and will not further be described here. Reference can be made to the foregoing application should any further information be desired.

The electromagnetic vibrator motor transmits vibratory energy to the housing in a manner similar to that disclosed in the Martin J. Stam Patent No. 3,155,854, for "Electromagnetic Vibrator Motor," issued Nov. 3, 1964.

Vibrator motor **10** includes a U-shaped spring **11** and has one leg **12** mounted in cantilever fashion on boss **13** by a set of screws **14**. Leg **12** extends from the boss to bend **15** with a second leg **16** extending back generally parallel to leg **12**. An electromagnet generally shown at **17** is mounted to the inside of leg **16** by a rivet type connection **18**, best seen in FIG. 4. Electromagnet **17** creates an alternating magnetic field which cooperates with each leg and bend **15** to transmit vibratory energy through boss **13** to the unitary housing. The housing comprises upper and lower members **19** and **20** respectively and is vibrated in a manner similar in operation to the Stam patent, supra.

Electromagnet **17** includes core **21** which at one end forms the rivet connection **18** to upper leg **16**. For exemplary purposes, I have shown core **21** as cylindrical in shape having a circular cross-section, however it is pointed out that core **21** can be given various sizes and shapes. Core **21** is constructed of a non-laminated magnetically permeable metal and has an exciting coil **22** circumscribing its length. The coil is wound within plastic bobbin **22***a* which extends to the core's necked down portion **21***a*. Coil **22**, energized by electric cord **22***b* from a conventional 60 cycle A-C source, creates an alternating magnetic field which is directed by the shape of cylindrical core **21** thus facilitating the establishment of vibratory energy.

A heat conducting vane **23** is rigidly attached to the necked down portion **21***a* and extends transversely thereto. Ends **23***a* and **23***b* of vane **23** are bent or angled toward the sides of core **21** circumscribed by coil **22**.

As the core is not laminated, it is not able to compensate for the eddy current loss accompanying the rapid flux change when energized from a conventional 60 cycle A-C voltage source. These losses are dissipated in the form of heat and as such is conducted away from the core by the metal heat conducting vane **23** in contact with core **21**. Vane **23** is constructed of any metal which is a good heat conductor and serves as a means to convey the heat away from the innermost portions of the coil-core combination. The bent ends **23***a* and *b* form a "fan" when the electromagnet **17** is vibrating and causes the ambient air within the housing to circulate and prevent a heat concentration at the coil-core combination. Thus vane **23** acts both as a means to convey the heat away from the coil-core combination and as a means to cause circulating air to act in a cooling manner further eliminating hot spots in and around the coil-core.

My invention allows an inexpensive and more compact vibrator motor to be utilized as the size of the core and the accompanying winding can be significantly reduced along with eliminating the substantially more expensive laminated ferrous metal heretofore needed for cores designed to be used with A-C vibrator motors.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a vibrating device having a freely vibrating core and an excitation coil which induces a directional field in said core, said directional field assisting in causing said core to vibrate and to transmit the vibratory energy to said device, the improvement comprising,

said core consisting of a single leg,

said inducing coil circumscribing said core, and

a means to conduct heat developed by the cooperating core and coil combination away from said combination.

2. In a vibrating device having a freely vibrating core and an excitation coil which induces a directional field in said core, said directional field assisting in causing said core to vibrate and to transmit the vibratory energy to said device, the improvement comprising,

said core consisting of a single leg of a non-laminated magnetically permeable metal,

said inducing coil circumscribing said core, and

a means to conduct heat developed by the cooperating core and coil combination away from said combination.

3. The combination as in claim 2 wherein said heat conducting means includes a heat conducting vane affixed to one end of said core.

4. The invention in claim 3 wherein said heat conducting vane is constructed of a heat conducting metal, said conducting vane connected transversely to said core and having each end of said heat conducting metal bent at an angle thereto, forming a means to cause air to circulate around said coil-core combination during the operation of said vibrating device.

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