June 27, 1944. E. O. THOMPSON 2,352,458

TEMPERATURE COMPENSATOR FOR INDUCTANCE COILS

Filed Oct. 15, 1942

Fig. 1.

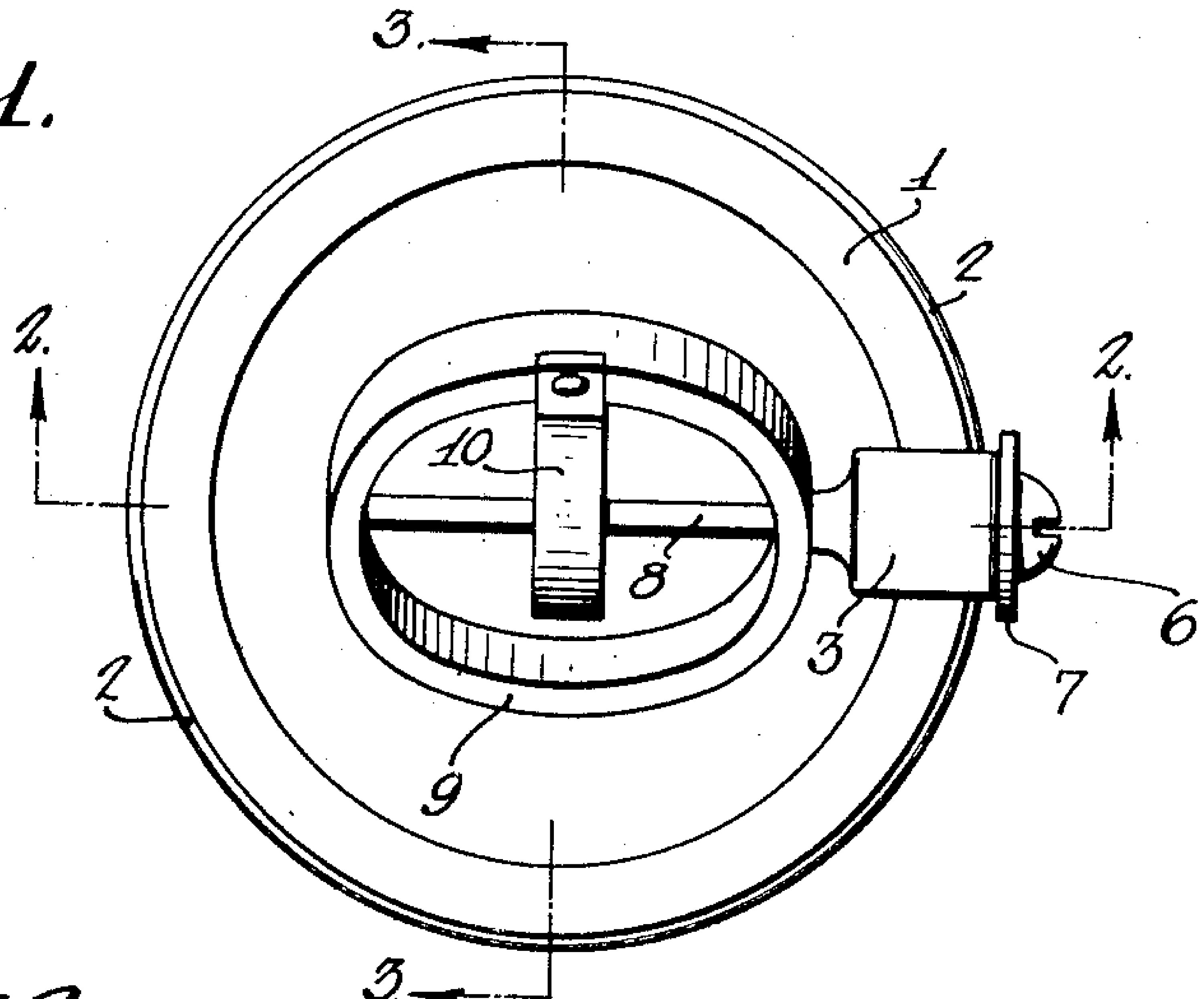


Fig. 2.

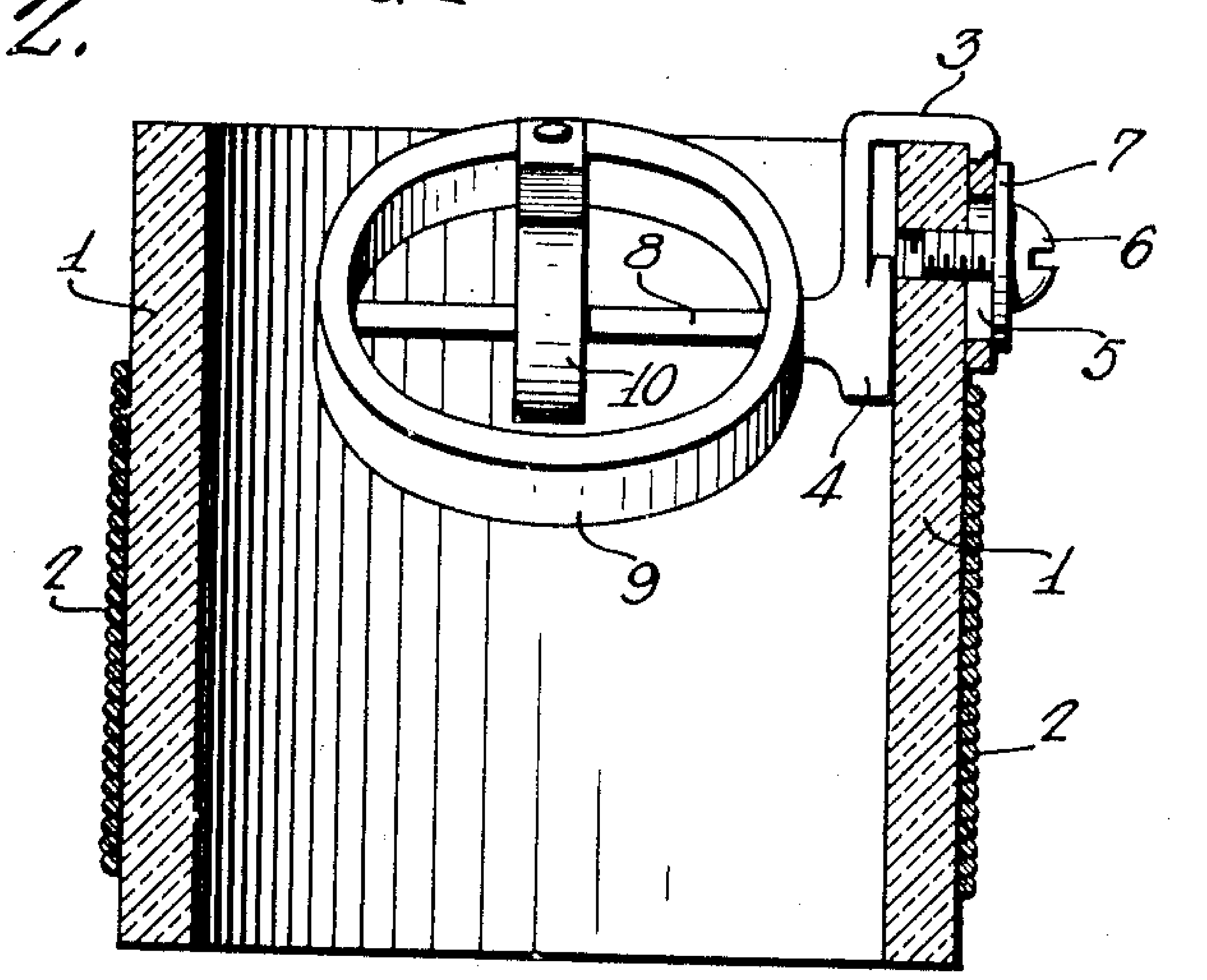
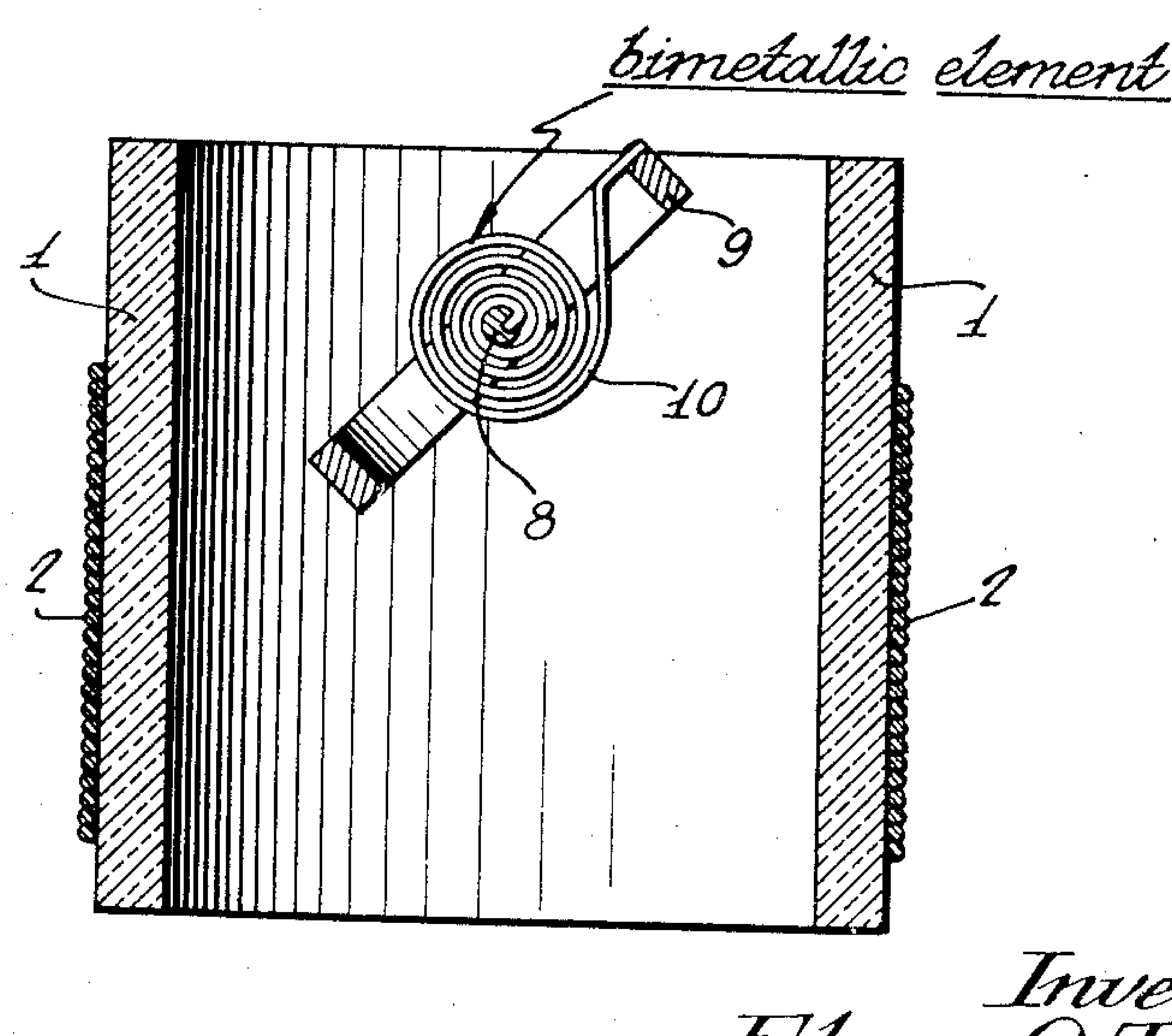


Fig. 3.



Inventor:-
Elmer O. Thompson,
by his Attorneys
Howson & Howson

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TEMPERATURE COMPENSATOR FOR INDUCTANCE COILS

Elmer O. Thompson, Grasmere, N. Y., assignor to Philco Radio and Television Corporation, Philadelphia, Pa., a corporation of Delaware

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2 Claims. (Cl. 171—242)

This invention relates to inductance devices, and more particularly to inductance coils employed in radio and allied arts.

The principal object of the invention is to provide a novel device for counteracting or compensating inductance variations of a coil, caused by ambient temperature changes, or heating due to losses in the coil itself.

Another object of the invention is to provide, in combination with an inductance coil, a novel temperature-responsive compensating means for maintaining the effective inductance of the coil substantially constant, despite temperature changes.

A further object of the invention is to provide a simple, inexpensive and highly efficient device for accomplishing the above-stated purpose.

Another object of the invention is to provide a compensating device which is free of conductive coupling with the coil and may be readily controlled.

A still further object of the invention is to provide a compensating device of the above-mentioned character which may be readily manufactured separately from an inductance coil and may be readily attached to the coil unit in cooperative relation therewith.

Other objects and features of the invention will be apparent hereinafter.

In the accompanying drawing:

Figure 1 is a plan view of a device embodying the invention;

Figure 2 is a sectional view taken along line 2—2 of Fig. 1; and

Figure 3 is a sectional view taken along line 3—3 of Fig. 1.

Referring more particularly to the drawing, there is shown an inductance coil unit comprising a cylindrical support 1 formed of suitable insulating material, such as a ceramic material, and a coil 2 wound about the peripheral surface of the support and carried thereby. For the purpose of the present invention, the details of construction of the coil and its support are relatively unimportant.

In accordance with the present invention, there is provided an inverted U-shaped bracket 3 which is adapted to embrace an edge portion of the coil support at one end thereof, as clearly shown in Fig. 2. This bracket may be formed of any suitable material. On the inner arm of the U-shaped bracket, there is provided a portion 4 which is adapted to engage the inner surface of the cylindrical support, as shown in Fig. 2. The outer arm of the bracket 3 is provided with a slot 5 through which a fastening screw 6 may extend. The screw engages a threaded opening in the support 1 and serves, in cooperation with a washer 7, to secure the bracket firmly to the coil support. The slot 5 permits vertical adjustment of the bracket for a purpose which will appear presently. In the illustration of Fig. 2, the bracket is shown in its lowermost position, in which it seats upon the upper end of the coil support.

A rod or shaft 8 is carried by the inner arm of bracket 3 and preferably is formed integrally therewith. This rod extends transversely of the axis of the coil unit near the upper portion thereof, as shown in Fig. 2. A closed conductor or loop 9 is rotatably carried by the rod 8. Preferably a single turn is used, although more than one turn could be used if desired. This loop or ring may be conveniently formed of copper, and it has substantial cross sectional dimensions, so that it is mechanically rigid and has very low electrical resistance. The rod 8 may be made of conducting material and connected to the loop 9; or it may be insulated therefrom, or made of insulating material. A thermal-responsive bimetallic element 10 in the form of a spiral (see Fig. 3) has its inner end fastened to the rod 8 and its outer end fastened to the loop 9. This element responds to temperature changes, and it expands or contracts accordingly, rotating the loop 9 about the fixed rod 8 as an axis. Since thermal-responsive elements of this type are well known, its action will be well understood.

The loop 9 is disposed in the magnetic field produced by the current flowing in the inductance coil. Consequently, the loop 9 is inductively coupled with coil 2 by virtue of the interlinkage of these elements by at least a portion of the magnetic flux associated with coil 2. Assuming that the loop 9 is normally disposed as illustrated in Fig. 3, if the loop is rotated clockwise, a greater amount of the magnetic flux will interlink it with the coil 2. On the other hand, if the loop 9 is rotated counterclockwise, a smaller flux interlinkage will result.

As will be well understood, the presence of loop 9 in mutually inductive relation with coil 2 will affect the inductance of the coil. The two elements may be considered as constituting an air core transformer, the loop 9 being effectively a short-circuited secondary winding. By varying the position of loop 9 in relation to coil 2, the effect of the loop upon the effective coil inductance may be varied due to the varying flux interlinkage above mentioned. The purpose of the thermal-responsive element 10 is to adjust the loop 9 according to temperature changes which tend to vary the coil inductance, so as to compensate for such variations and maintain the effective coil inductance substantially constant. As mentioned above the rod may be insulated from the ring or may be in conductive relation therewith. However, it will be understood that the use of a rod insulated from the ring would result in a different degree of compensation in response to a given angular movement of the ring than would result if the rod is in conductive relation with the ring. Preferably, the loop 9 is disposed at an angle of about 45° with the axis of the coil unit at normal temperature, as shown in Fig. 3.

By adjusting the loop 9 axially of the coil unit, the effect of the loop upon the coil inductance may be varied, as may be readily seen. This is accomplished by adjusting bracket 3 in the manner above described.

By adjusting the normal position of the loop in relation to the coil, the desired effective inductance of the coil may be obtained, and it may be caused to remain substantially constant over a wide variation of temperature. Or, if desired, the loop may be used to effect controlled variation of the coil inductance, in response to increments of temperature change. Since the resistance of the loop 9 is very low, it does not substantially affect the electrical properties of the coil. Moreover, the loop 9 is substantially unaffected by vibration, since it is rigid, of considerable mass, and is balanced about a fixed axis. Furthermore, the bimetallic element is preferably one having considerable inherent rigidity and therefore adds to the stability of the ring.

A structure of the type illustrated has other advantages, particularly from the standpoint of manufacture. The compensating device may be made and assembled as a unit separately from the coil and then attached to the coil unit in a simple operation, as will be readily apparent. This, as is illustrated in the preferred embodiment, may be accomplished by the provision of a threaded opening in the coil support to receive the fastening screw. The compensating device does not require a high degree of accuracy or precision in manufacture, since it may be readily adjusted after its assembly on the coil unit. Moreover, the device is of simple construction, and may be manufactured very inexpensively.

It will be understood, of course, that the invention is not limited to the specific structure illustrated, but is capable of modifications, particularly as to details, within the scope of the appended claims.

I claim:

1. In combination, a hollow coil support, a helical coil mounted thereon, a U-shaped bracket embracing an edge portion of said support at one end thereof, a rod carried by the inner arm of said bracket and extending transversely within said support, a conductive loop rotatably carried by said rod, and a thermal-responsive spiral element surrounding said rod and having its ends connected respectively to the rod and to said loop, said element serving to rotate said loop to vary its inductive relation with said coil according to temperature changes, thereby to maintain the effective inductance of said coil substantially constant.

2. In combination, a hollow coil support, a helical coil mounted thereon, a U-shaped bracket embracing an edge portion of said support at one end thereof, the outer arm of said bracket having a slot therein, a fastening screw extending through said slot and threadedly engaging an opening in said support, whereby said bracket may be adjusted to various positions, a rod carried by the inner arm of said bracket and extending transversely within said support, a conductive loop rotatably carried by said rod, and a thermal-responsive spiral element surrounding said rod and having its ends connected respectively to the rod and to said loop, said element serving to rotate said loop to vary its inductive relation with said coil according to temperature changes, thereby to maintain the effective inductance of said coil substantially constant.

ELMER O. THOMPSON.