Jan. 30, 1940. H. W. COX 2,188,651

INDUCTANCE COIL

Filed April 26, 1937

Fig. 1

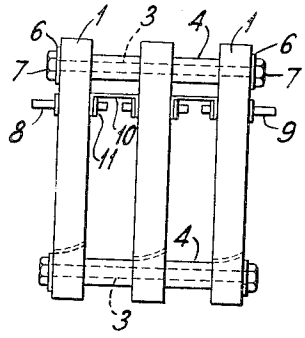


Fig. 5

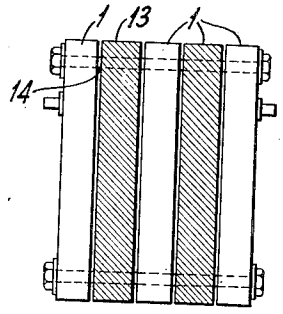


Fig. 2

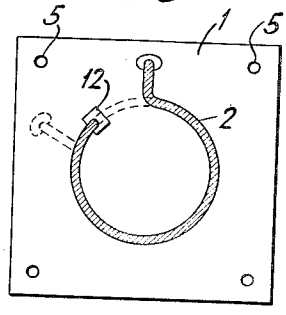
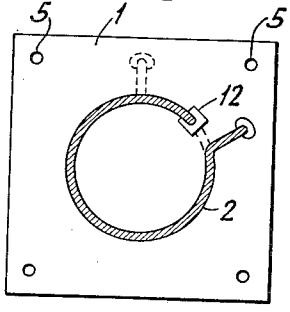


Fig. 3



Fig. 4



INVENTOR
HAROLD WALTER COX

BY H. S. Brown

ATTORNEY

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INDUCTANCE COIL

Harold Walter Cox, Mitcham, England, assignor to Electric & Musical Industries Limited, Hayes, Middlesex, England, a British company

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2 Claims. (Cl. 175—359)

This invention relates to inductance coils.

It is realized that the inductance of a coil is inter alia a function of the length and diameter of the coil and consequently the predetermined inductance of the coil varies on variation of temperature. It is known to construct an inductance coil in which the turns of the coil are wound around a series of supports of substantially segmental shape in cross-section, the ends of the supports being connected to end members in such a manner as to present a cylindrical formation, the materials of the supports and the end members having such coefficients of linear expansion that any variation of inductance due to the expansion of the turns on rise of temperature is counteracted by a variation in the overall length of the coil.

It is the chief object of the present invention to provide a generally improved construction of inductance coil in which provision is made for controlling the inductance on increase of temperature, and mainly an inductance coil constructed with a view to overcoming the possibility of residual strains occurring in the conductor as a result of variation in temperature, which residual strains tend to vary the constant of the coil.

According to the invention, an inductance coil comprises at least two supporting elements, each having at least one loop or turn of conducting material intimately associated with the surface thereof, and means for holding the supporting elements in spaced relationship permitting the electrical connection and for connecting the loops or turns, the arrangement being such that on increase of temperature, variation of the predetermined inductance of the coil due to the expansion of the loops or turns is counteracted or controlled by an increase in the distance between adjacent loops or turns. For the purpose of intimately connecting the loops or turns to the surfaces of the supporting elements, the loops or turns may, for example, be sprayed or metalized, or they may be formed of silver wire which is burnt on to the supporting element in known manner, so as to provide a thin flat metal loop on one or both surfaces of each element in intimate association therewith. Owing to the intimate connection between the loops or turns and the supporting elements, the expansion and contraction of the loops is dependent on the expansion and contraction of the supporting elements, and consequently, after expansion and subsequent contraction, the intimate connection will ensure that no permanent strain appears in the loops tending to prevent their return to the initial predetermined dimension. Thus, permanent distortion of the loops or turns due to the difference in the co-efficients of expansion of the material of the supporting element and of the loops or turns, will not arise, since the contraction of the loops or turns is controlled by the contraction of the supporting elements, as effectively as the expansion of the loops or turns is controlled by the expansion of the supporting elements. The supporting elements are held in spaced relationship in any convenient manner, as by a suitably disposed bolt or bolts, the supporting elements being held in spaced relationship by spacing elements, of such a size and made of a material having such a coefficient of expansion compared with the coefficient of expansion of the supporting elements, that on increase of temperature a variation of the inductance of the coil due to an increase in the diameter of the turns will be counteracted or controlled by the increased space in the distance apart of the turns due to the increased length of the spacers. This counteraction or control may be employed to neutralize the effect due to temperature changes, or to increase or reduce the inductance of the coil by predetermined amounts on increase of temperature.

The method of carrying the invention into practice will be readily understood from the following description with reference to the accompanying drawing, in which:

Fig. 1 is a side view of an inductance according to the invention;

Fig. 2 is a front plan view of a coil mounting element in the arrangement shown in Fig. 1;

Fig. 3 is a side view of the coil mounting element shown in Fig. 2;

Fig. 4 is a rear plan view of the coil mounting element shown in Fig. 2; and

Fig. 5 is a side view of an inductance constructed according to the invention generally similar to that shown in Fig. 1, but having coil spacers of a different form.

Referring to Fig. 1, it will be seen that the arrangement according to the invention therein shown, comprises a plurality of coil supporting elements 1, of which one is shown in detail in Figs. 2, 3 and 4. These supporting elements may be in the form of square plates as shown, or plates of circular or other suitable form, of insulating material such as ebonite, synthetic resin or similar materials, or plates made of ceramic material, the latter material being preferable owing to its low coefficient of expansion. To one

or both surfaces of the plates 1, as shown in Figs. 2 and 4, a loop or turn 2 of conducting material is applied, the plates being then assembled together on bolts 3 carrying spacers 4 and passing through holes 5 provided in the supporting elements 1, for example, in the four corners of the elements as shown in Figs. 2 and 4. These spacers 4 have such a length and a coefficient of expansion compared with the coefficient of expansion of the material of the supporting elements 1, that on increase of the temperature of the inductance as a whole, the variation of the inductance of the coil due to the increase in diameter of the turns will be counteracted or controlled by an increase in the distance apart of the turns. The supporting units 1 and spacers 4 are held in assembled relation on the bolts 3 between washers 6 by means of nuts 7. Terminals such as 8 and 9 are provided on the outermost of the supporting elements, and one end of each of the end turns of the inductance makes contact with these terminals. Adjacent turns on successive plates are electrically connected together by means of conducting straps 10 secured or soldered to terminals such as flat plates 11 with which the appropriate ends of turns 2 make contact. If desired, connection between adjacent turns on successive supporting units may be made through the spacers 4, which may be constructed of an electrically good conducting metal insulated from bolts 3, or of metallized insulating material, the metal or metallized washers being in electrical connecting engagement with the turns or loops for the purpose of electrically connecting adjacent turns or loops together by means of a flat strip, not shown.

The washers 6 are made resilient to permit the relative movement of the supporting units 1 as the spacers 4 expand or contract.

In cases of construction where the supporting elements carry a turn on each side, especially in the case where the supporting elements are made of ceramic material, the turns on opposite sides of each supporting element may be connected together by passing the conductor of which the turns are formed, through a hole in the supporting element, for example, as shown at 12 in Figs. 2 and 4. The loops or turns 2 may, for example, be made of silver wire or other suitable material which is burnt on to the ceramic material in known manner. However, instead of connecting the turns on each side of the supporting elements by passing the wire conductor through a hole, the turns may be connected by a flat strip (not shown) a screw passing through a hole (not shown) in the supporting element and in electrical contact with the opposite turns, or alternatively the supporting element may be made only slightly larger than the diameter of the loop or turn so that the conductor may conveniently be passed over the edge of the supporting element. The loops or turns 2 might also be formed, for example, by spraying or metallizing the supporting elements 1.

In some cases, the supporting elements may be connected together by a single bolt (not shown) passing through apertures in the centres of the several supporting elements, the supporting elements being spaced by means of spacers as above described. In this case, the central bolt may be formed of magnetic material so as to function as a core for the coil.

In the arrangement shown in Fig. 5, the spacers 4 of Fig. 1 are replaced by plates 13 shown shaded which may be similar to the supporting elements 1 except that they do not carry coil turns. These "dummy" elements are made of the correct thickness to function in the same way as spacers 4 to compensate for increase in temperature of the coil.

What is claimed is:

1. An inductance coil comprising a plurality of substantially thick plates of insulating material having a low temperature coefficient of expansion, a circular conductor turn on and intimately associated with each surface of said plates forming a portion of the turns of said coil, each plate having a plurality of apertures and metallic means in at least one aperture for joining the turns of opposite surfaces together, means for spacing said plates apart including a plurality of spacing members, the material and length of said spacing members being such that on an increase of temperature of the inductance coil as a whole the variation of inductance due to an increase in diameter of the turns will be counteracted, and means between adjacent plates for electrically connecting conductor turns on facing surfaces together.

2. An inductance coil comprising a plurality of substantially thick plates of insulating material having a low temperature coefficient of expansion, a circular conductor turn on and intimately associated with each surface of said plates forming a portion of the turns of said coil, each plate having a plurality of apertures, one of said apertures located at the same radial distance from the coil axis as the conductor turns and having metallic means located therein for joining the turns of opposite surfaces together, another aperture located outside the circumference of said conductor turns, means for spacing said plates apart including a plurality of spacing members, the material and length of said spacing members being such that on an increase of temperature of the inductance coil as a whole the variation of inductance due to an increase in diameter of the turns will be counteracted, and means between adjacent plates and located near the aperture which is located outside the circumference of said conductor turns for electrically connecting the conductor turns on facing surfaces together.

HAROLD WALTER COX.