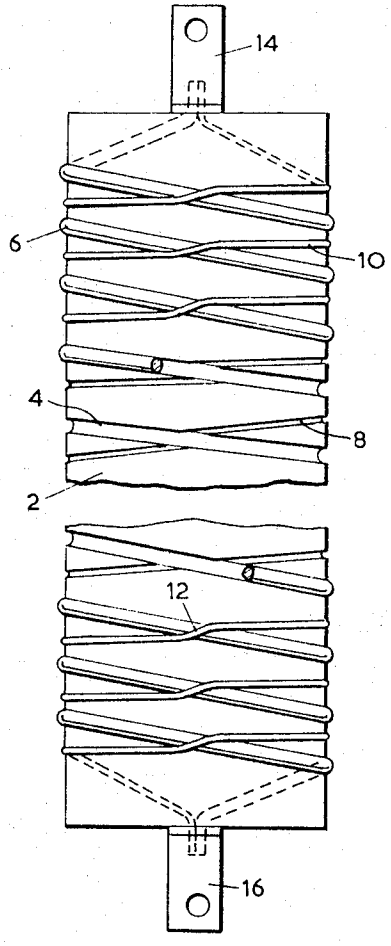
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CONCENTRIC HELICAL COILS WITH ELECTRICALLY CONNECTED CROSSOVER POINTS

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CONCENTRIC HELICAL COILS WITH ELECTRICALLY CONNECTED CROSSOVER POINTS

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The invention relates to inductors.

According to the invention, an inductor comprises two coaxial helical coils each connected between the two terminals of the inductor, one coil having a relatively high and the other a relatively low resistance, the coils being wound so as to cross over each other at various points and being electrically interconnected at selected ones of the cross-over points, the arrangement determining the relative voltages respectively applied across the turns of the low resistance coil when a transient voltage is applied between the terminals of the inductor.

Preferably, the coils are wound so as to extend along the common axis.

In an embodiment of the invention, the two coils are oppositely wound. Preferably, the two coils are wound uniformly and so interconnected that the relative voltages respectively applied to the turns of the low resistance coil when a transient voltage is applied between the terminals of the inductor are the same.

Advantageously, the coils are wound in grooves arranged in a former constructed of electrically insulating material.

One inductor according to the invention will now be described by way of example and with reference to the accompanying drawing which shows a side view of such an inductor, part of the inductor being omitted for clarity.

The inductor comprises a former **2** of electrically insulating material, such as a plastics material, ceramic, or glass, having grooves **4** in which is wound a helical coil **6** of high conductivity wire such as copper, and grooves **8** in which is wound a helical coil **10** of high resistance wire. The two coils have the same number of turns and are wound in opposite directions as viewed from either end of the former **2**, so that the magnetic fields generated are in opposition. Thus each turn of the coil **6** crosses twice over each turn of the coil **10**. At one crossover point **12** on each complete turn (only one of which is referenced in the drawing) an electrical connection is made between the two coils. One end of the coil **6** and one end of the coil **10** are connected to an electrically conducting terminal lug **14** fixed to one end of the former **2**, and the other ends of the coils are connected to a similar lug **16** at the other end of the former.

The arrangement provides a compact, inductor, an equal part of the resistance of the coil **10** being connected between each complete turn of the coil **6** so as to provide an equal voltage drop across each turn of the coil **6** when a transient voltage is applied across the inductor. Mutual inductance is set up between the two coils and it can be shown that, if each coil has the same inductance of L Henrys and the resistance of the high resistance coil **10** is R ohms, then the arrangement is equivalent to that of an inductor of value L Henrys in parallel with a noninductive voltage damping resistor of value $R/4$ ohms.

The arrangement can withstand high impulse voltages and fault currents because of the voltage proportioning effect of the high resistance coil **10** which prevents an undue proportion of the applied voltage appearing across a few of the end turns of coil **6** into which the current flows, as would otherwise be the case by reason of the

stray capacitive reactances which shunt the coil. The arrangement also has robust physical form. It can be used with advantage in, for example, the anode circuit of a mercury arc valve or for controlling the initial oscillatory discharge in protective spark gaps.

One of the two coils may have a non-uniform pitch on the former **2** so that the electrical interconnections at the crossover points provide nonequal voltage drops across the turns of the inductor.

What I claim as my invention and desire to secure by Letters Patent is:

1. An inductor comprising
two terminals,
first and second helical coils each connected between said two terminals and wound about a common axis so as to cross over one another at a plurality of points, said first coil having a relatively high resistance and said second coil having a relatively low resistance, and
conecting means interconnecting the first and second coils at selected ones of said points whereby selected lengths of said second coil are shunted by the resistance possessed by elected lengths of said first coil.

2. An inductor according to claim **1**, wherein the first and second coils are wound in opposite directions.

3. An inductor according to claim **2**, wherein the first and second coils have the same number of turns and are wound uniformly, and wherein the connecting means interconnect the coils at equidistantly spaced selected points so that the lengths of the first coil between the said points possess the same resistance as one another and the lengths of the second coil between the said points possess the same resistance as one another.

4. An inductor according to claim **1**, wherein one of the coils is wound uniformly and the other is wound non-uniformly, and wherein the connecting means interconnect the coils at spaced selected points so that the lengths of the said one coil between the said points exhibit different resistance values from one another.

5. An inductor according to claim **4**, comprising
a core of electrically insulating material, and
means defining grooves in the surface of said core, the first and second coils being wound in said grooves.

6. An inductor comprising
an electrically insulating core of circular cross-section,
means defining helical grooves in the circumferential surface of said core,
two terminals secured to opposite ends of the core,
first and second helical coils each connected between said two terminals and wound in opposite directions along said grooves, said first and second coils crossing over one another at a plurality of points along their length, and said first coil possessing a substantially higher ohmic resistance than said second coil, and
means interconnecting the first and second coils at selected ones of said points whereby selected lengths of said second coil are shunted by selected lengths of said first coil.

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