Feb. 6, 1962 M. F. REIJNST 3,020,503

INDUCTANCE COIL COMPRISING AN ANNULAR PREMAGNETISABLE CORE

Filed April 12, 1957

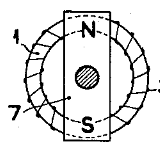

FIG.1

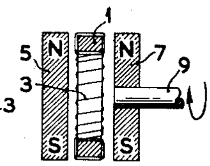

FIG.2

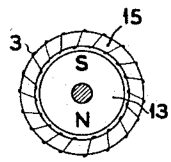

FIG.3

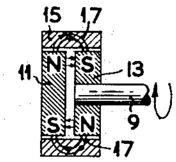

FIG.4

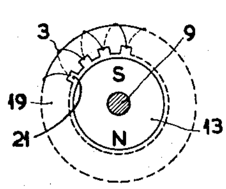

FIG.5

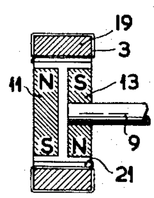

FIG.6

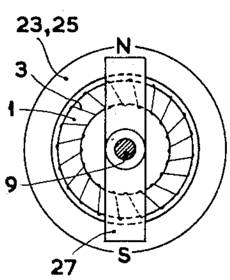

FIG.7

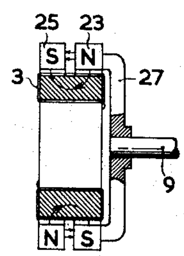

FIG.8

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INDUCTANCE COIL COMPRISING AN ANNULAR PREMAGNETISABLE CORE

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This invention relates to coils, more particularly inductance coils, having annular cores which may be premagnetized by means of two magnets which are magnetized at right angles to the axis of the ring and are arranged one behind the other in the axial direction, at least one magnet being rotatable relatively to the other about an axis coaxial with the ring. By turning one magnet with respect to the other, it is possible to vary the strength of the premagnetisation and hence the inductance of the coil.

In the known construction of such coils, the two magnets are arranged on each side of the coil. As will be explained more fully hereinafter, in this case a considerable residual magnetisation of the core still occurs even in the position of minimum premagnetisation (maximum inductance), so that it is not possible to attain the maximum inductance which is theoretically possible when the core was not premagnetised at all.

The object of the invention is to obviate said disadvantage at least in part. This is achieved in that the magnets are arranged at least for the greater part in the space inside or around the annular core, preferably with a small spacing between them. The pole surfaces of the magnets may have a cylindrical shape matched to the inner surface of the annular core.

In order that the invention may be readily carried into effect, it will now be described more fully, by way of example, with reference to the accompanying drawing, in which

FIGS. 1 and 2 show the known construction in axial elevation view and in axial cross-section, respectively, and

FIGS. 3, 4 and 5, 6 and 7, 8, respectively, show three embodiments of the invention in the same manner.

The known device shown in FIGS. 1 and 2 comprises an annular core 1 of ferromagnetic material, having a toroidal winding 3. On each side of the coil 1, 3 there are arranged two flat, rod-shaped permanent magnets 5 and 7, one of which (magnet 7) can rotate about an axis 9, which is coaxial with the ring 1. The two magnets are magnetized in the longitudinal direction in the manner shown.

In the position as shown, the magnetic circuit of the magnets 5 and 7 closes via the annular core 3, so that this is premagnetized fairly strongly. The inductance of the coil 1, 3 is in this case low. When the magnet 7 is turned about the axis 9 through an angle of, for example, 180°, the poles of the magnets 5, 7 having different polarities are opposite one another and their magnetic circuit closes via the portions of core 1 located directly between the extremities of the magnets. The remaining portion of the core is thus not premagnetized and the inductance of the coil is higher than in the position shown.

A portion of the core 1 thus always remains premagnetized, so that it is not possible to attain the maximum inductance theoretically possible as corresponds to a core which has not been magnetized at all.

Said disadvantage is substantially eliminated by means of the device shown in FIGS. 3 and 4, in which according to the invention, the magnets 11 and 13 are arranged in the space inside the annular core 15. The pole surfaces of the magnets have a cylindrical shape matched to the inner surface of the annular core 15 (that is to say the

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magnets are disc-shaped). The operation of this device is fundamentally similar to that of known devices, but the magnetic circuit of the magnets 11 and 13 closes in the position of maximum inductance as shown, partly through the narrow air-gap between the magnets 11 and 13 which are arranged preferably with a small axial spacing. The remainder of the magnetic flux (lines of force 17)—contrary to the situation in the device shown in FIGS. 1 and 2—does not traverse the whole cross-section of the core 15. The undesirable residual premagnetisation of the core is thus considerably less than in known devices especially if the spacing between the magnets is small with respect to the axial dimension thereof.

The matched cylindrical shape of the pole surfaces of the magnets 11 and 13, which pole surfaces may be formed on polepieces arranged on the extremities of the magnets, is essential to obtain an air-gap of large size and small uniform width between the magnets and the ring 15.

FIGS. 5 and 6 show that the inner side of the annular core (19) may be provided with grooves 21, in which the turns of the core winding 3 are accommodated. The air-gap between the magnets and the core may in this case be very narrow.

In the embodiments shown in FIGS. 7 and 8, the magnets (23 and 25) are annular in shape and arranged around the coil 1, 3. The rotary magnet 22 may be secured to the shaft 9 by means of a clasp 27 of non-magetisable material.

The annular magnets 23 and 25 and also the disc-shaped magnets 11 and 13 shown in FIGS. 3 and 4 may be provided with more than two poles, for example four poles. The maximum angle of rotation is then less than 180°, for example 90°.

What is claimed is:

1. A variable inductor comprising an annular ferromagnetic core, a toroidal winding disposed on said core, a pair of similar magnets magnetized transversely to the axis of the core and both mounted wholly inside of the annular core so as to lie substantially in the same plane as the annular core and facing one another across a small gap and serving to premagnetize the core by an amount dependent on the interrelationship of their poles, said magnets being relatively rotatable about the core axis so as to vary the said interrelationship and thereby change the degree of premagnetization of the core.

2. A variable inductor comprising an annular ferromagnetic core, a toroidal winding disposed on said core, a pair of similar disc-like magnets magnetized transversely to the axis of the core and both mounted wholly inside of the annular core so as to lie substantially in the same plane as the annular core and facing one another across a small gap and serving to premagnetize the core by an amount dependent on the interrelationship of their poles, said magnets being relatively rotatable about the core axis so as to vary the said interrelationship and thereby change the degree of premagnetization of the core.

3. A variable inductor as set forth in claim 2 wherein the inner surface of the annular core contains grooves with the turns of the winding located in said grooves.

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