Dec. 2, 1947. E. FRIEDLANDER 2,431,860

VARIABLE REACTOR

Filed Dec. 12, 1945

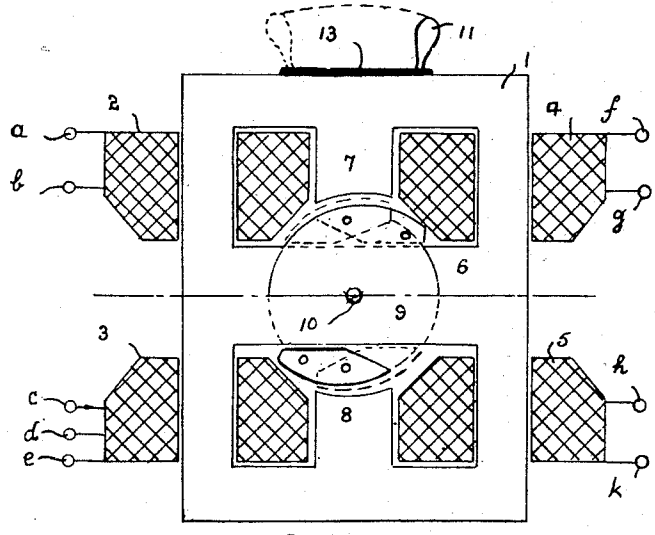


Fig. 1.

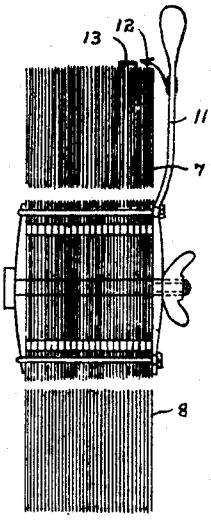


Fig. 2.

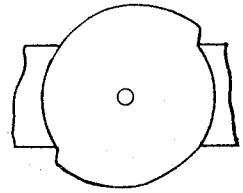


Fig. 3.

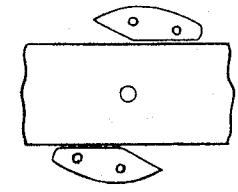


Fig. 4.

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VARIABLE REACTOR

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5 Claims. (Cl. 171—777)

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The present invention relates to variable reactors of the kind in which the reactance is varied by adjusting the length of an air gap in a magnetic core.

It is the object of the present invention to provide an improved variable reactor of this kind which is of simple and robust construction, in which the adjustment is easily made and which can be built for relatively heavy loads.

According to the present invention, there is provided a variable reactor comprising a winding having a core of magnetic material provided with an air gap of adjustable length, wherein the air gap is formed between a fixed pole surface and a surface of a rotatably mounted member of magnetic material, the opposing surfaces on the fixed pole and the rotatable member being of spiral shape, whereby when the rotatable member is rotated the length of the air gap is changed but remains uniform over the opposing surfaces.

A preferred construction according to the present invention applied to a double transformer suitable for use in a Scott-connected system for 3-phase-2-phase working where it is necessary to control the air gaps of two reactors simultaneously will be described by way of example with reference to the accompanying drawing in which

Fig. 1 is a part sectional view of the preferred construction,

Fig. 2 is a section in the medial plane of the arrangement of Fig. 1, and

Figs. 3 and 4 show details of the arrangement of Figs. 1 and 2.

Referring to the drawing, a laminated iron core 1 is provided with four coils 2, 3, 4 and 5 and has a bridge portion 6 whereby the structure is effectively divided into two distinct flux paths, one through the coils 2 and 4 and the other through the coils 3 and 5. It is required to provide each of these flux paths with a variable leakage path and for this purpose the core has inwardly projecting pole pieces 7 and 8 and a rotatable laminated iron member 9. The laminations of the rotatable member 9 are interleaved with those of the bridge portion 6 upon which the member 9 is rotatably mounted. Alternate laminations of the bridge portion 6 are interrupted to accommodate the member 9 and alternate laminations of the member 9 are of small size, as indicated in Fig. 4, to accommodate the bridge portion 6. Fig. 3 shows the shapes of the uppermost laminations of the parts 6 and 9 and Fig. 4 shows the shapes of the next laminations of these two parts. These two shapes alternate throughout the structure so that the laminations of the member 9 are interleaved with those of the bridge portion 6. In the upper half of Fig. 1 the laminations of Fig. 3 are shown uppermost and in the lower half of the figure the laminations of Fig. 4 are shown uppermost.

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The member 9 is rotatably mounted on a spindle 10 journalled in the bridge portion 6 and can be moved, when the core is de-energised, by means of a lever 11 having an indicator 12 cooperating with a graduated scale 13.

In order that the flux density should remain uniform over the opposing surfaces of the members 7 and 9 and 8 and 9, these surfaces are all made of spiral shape.

When designing the core, account is of course taken of the reduced effective cross section of the bridge portion 6 owing to the interruption of alternate laminations. To counteract this the portion is made of suitably increased cross-section.

In applying the structure shown in Figs. 1 and 2 to a Scott-connected circuit, the three phases of the input are connected to the terminals *a*, *c* and *e* respectively of the coils 2 and 3 and the terminal *b* of coil 2 is connected to the centre tap *d* of coil 3. Two-phase current is taken from terminals *f* and *k* of coils 4 and 5 the terminals *g* and *h* of these coils being connected together to form the neutral.

I claim:

1. A variable reactor comprising a winding having a laminated core of magnetic material including a first yoke portion, a second yoke portion in fixed relation to said winding and first yoke portion, a member rotatably mounted upon said second yoke portion with its laminations interleaved with the laminations of said second yoke portion, said first yoke portion and said rotatable member having juxtaposed spiral shaped surfaces constituting boundaries of an air gap whose length is varied by rotation of said rotatable member about said axis.

2. A variable reactor according to claim 1, wherein one set of alternate laminations of said member lie wholly outside the one set of alternate laminations of said second yoke portion which lie in the same planes, the other set of alternate laminations of said second yoke portion being interrupted to provide gaps and the other set of alternate laminations of said member lying in said gaps.

3. A variable reactor comprising a winding having a core of laminated magnetic material including a first yoke portion, a second yoke portion, a member mounted upon said second yoke portion with the alternate laminations of said

member and second yoke portion interleaved and shaped to permit limited relative rotation thereof about an axis perpendicular to the planes of the laminations, the laminations of said first yoke portion and said member having edges lying in juxtaposed surfaces of spiral shape, and said surfaces constituting the boundaries of an air gap whose length is variable by rotation of said member about said axis.

4. A transformer having two windings each provided with a core of laminated magnetic material, two yoke portions of laminated magnetic material linking the ends of said cores and constituting therewith a closed magnetic circuit, a laminated pole piece projecting inwardly from one of said yoke portions between said windings, a member of laminated magnetic material mounted upon the other of said yoke portions with its laminations interleaved with those of the said other yoke portion, the interleaving laminations being shaped to permit limited rotation of said member and said other yoke portion, the edges of the laminations of said pole piece and said member being shaped to lie in spiral surfaces which are juxtaposed and form the boundaries of an air gap.

5. A double transformer comprising two transformer portions each having two windings with cores linked by outer and inner yokes to form a closed magnetic circuit, said cores and yokes being of laminated magnetic material and said inner yokes being common to the two said portions, a member of laminated magnetic material mounted upon said common yoke and having its laminations interleaved with those of said common yoke, said interleaved laminations being shaped to permit limited rotational movement of said member relatively to said common yoke and a pole piece projecting from each of said outer yokes towards said member, said pole pieces and said member having juxtaposed surfaces of spiral shape constituting boundaries of air gaps.

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