Nov. 3, 1953 F. G. BUHRENDORF 2,658,114

MAGNETIC RECORDING-REPRODUCING DEVICE

Filed Aug. 26, 1952

FIG. 1

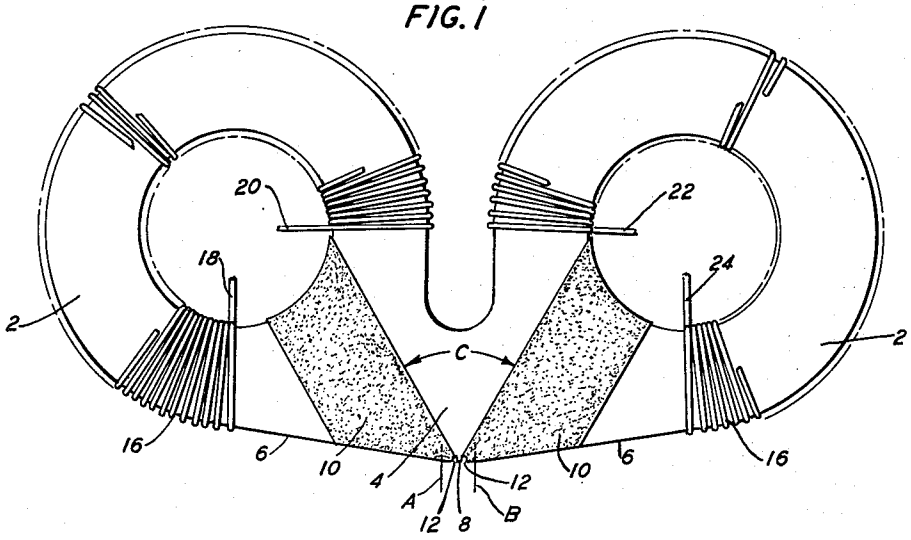


FIG. 2

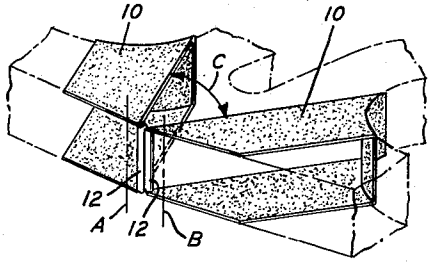


FIG. 4

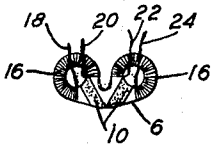
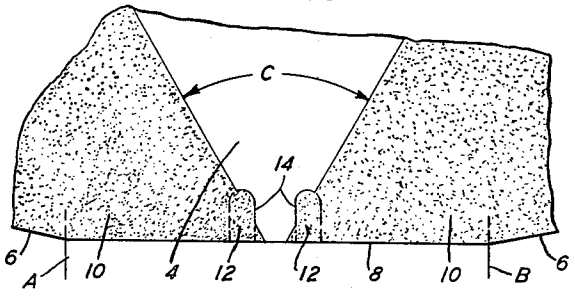


FIG. 3



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MAGNETIC RECORDING-REPRODUCING DEVICE

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11 Claims. (Cl. 179—100.2)

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This invention relates to electromagnetic transducers, and particularly to an electromagnetic transducer with a transformer built therein to form a single unitary structure.

An object of this invention is to provide an economical, high frequency magnetic recording-reproducing device comprising a plurality of independently operative, accurately spaced recording-reproducing elements disposed in close proximity.

Another object of this invention is to provide a high frequency magnetic recording-reproducing device comprising two independently operative recording-reproducing elements disposed in such close proximity as to be capable of successively scanning each of a plurality of spots recorded on a track of a magnetic record medium one spot at a time, the space between said elements being substantially less than the distance, center to center, between adjacent recorded spots.

In accordance with this invention the above-noted requirements are satisfactorily met by a novel electromagnetic transducer which comprises two transformer cores joined together by a bridge member to form a unitary structure. A surface of the bridge member faces the magnetizable surface of the record medium and the independently operative recording-reproducing elements are disposed in a portion of said bridge member surface which is substantially flat and parallel to the magnetizable surface of the record medium. Each core carries two windings. The primary winding, which is to be connected to the associated equipment, consists of a convenient number of turns of insulated wire, such as enamel covered copper wire, the number of turns being defined by the associated equipment and the structural limitations of the core. The secondary winding is endless and consists of one or several turns terminated in a slender filament of conducting material disposed in a slot or groove in the substantially flat portion of the surface of the bridge member which faces the magnetizable surface of the record medium. Flux surrounding this filament, when current is induced in it, is used to record on the magnetic medium in much the same manner as in conventional air-gap type heads. In reproduction, current induced in this filament generates a flux in the core and, by virtue of the transformer action, a voltage is delivered to the associated equipment by the larger primary winding. Each of the secondary windings is applied directly to the surface of its related core and the recording-reproducing elements, or operating filaments are spaced, center to center, as little as 0.005 inch apart, a spacing which is impracticable, if not impossible, with a conventional gap type structure.

The nature of the invention and its distinguishing features and advantages will be more

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clearly understood from the following detailed description and the accompanying drawings in which:

Fig. 1 is a plan view of an embodiment of the present invention in which each of the secondary windings is a single turn;

Fig. 2 is a view in perspective of the secondary windings shown in Fig. 1;

Fig. 3 is a partial enlarged plan view of the embodiment of Fig. 1 in the region of the confronting secondary windings and the closely spaced grooves in which are disposed the filamentary portions of said windings; and

Fig. 4 is a plan view showing the actual dimensions of an electromagnetic transducer in accordance with the present invention.

Referring now to the accompanying drawings, 2 is a core of the electromagnetic transducer and is preferably made of a high permeability, low loss, magnetic material, such as, ferrite. The bridge member 4 joins the cores 2 and, in order to facilitate the manufacture of a unitary structure, may be of the same magnetic material as cores 2. In the particular embodiment of this invention shown in Figs. 1 to 4 the outer surface 6 of the bridge member is tangential to the peripheral surfaces of the cores, and the portion 8 of surface 6 between the lines A and B is substantially flat and parallel to the magnetizable surface of the record medium which it faces. Each of the endless secondary windings 10 consists of one turn of a low resistance material, such as, copper or silver, and is terminated in a slender filament of low resistance, conducting material 12 which is disposed in one of the parallel slots or grooves 14 in the substantially flat portion 8 of the bridge member surface 6. For optimum results, the filament 12 should be flush with the flat surface 8. It is to be understood that the endless secondary winding may consist of a plurality of turns terminated in a filament, such as, the filament 12 shown in Figs. 1 to 4. Each of the primary windings 16 comprises a plurality of turns of insulated low resistance wire, such as, enamel covered wire, wound in such manner as to be coupled closely to the core and its related secondary winding, and to terminate in the wires 18, 20 and 22, 24, respectively. The number of turns in each of these windings is defined by the associated equipment to which they are to be connected and the structural limitations of the core.

While satisfactory results may be obtained with transducers in accordance with the present invention in which the filaments lie at an angle with respect to the axes of the cores, it has been found that for convenience in manufacture and simplicity in mounting, the filaments should be disposed in such manner as to be parallel to each other and to the axes of the cores shown in Fig. 2.

For optimum results the filaments should lie

in a plane substantially parallel to the magnetizable surface of the record medium, and should be disposed normal to the direction of the relative motion of the transducer with respect to the record medium.

The particular embodiment of this invention as shown in Figs. 1 to 4 is intended for use with a right circular cylindrical record medium revolving about its axis. The transducer is disposed so that each filament clears the magnetizable surface of the record medium by substantially 0.002 inch and is parallel to the axis of the cylindrical record medium. The filaments 12 are substantially 0.002 inch in width; the flat surface 8 as shown between the lines A and B in Figs. 1 to 3 is substantially 0.031 inch in length; and the secondary windings 10 are disposed with respect to each other at an angle C of substantially 60 degrees.

The conductor of the secondary winding should have as large a cross-section as possible, the area of said cross-section being limited only by the distributed capacity in a turn of the winding. The optimum average width of the conductor of the secondary winding is equal to substantially one tenth the average length of the magnetic path in its related core.

In the preparation of the transducer, the secondary windings may be applied directly to the surfaces of the cores 2 in the manner described in applicant's patent application, Serial No. 262,950, filed December 22, 1951.

By using one of the two filaments for reading and the other for writing it is possible to read in advance of recording by as little as ¼ of a cell time (a cell is equal to the distance, center to center, between adjacent recorded spots).

By spacing the filaments the exact multiple of cell size (as little as one or two or perhaps as much as 15 or 20 times) required to span an entry to be recorded, and again using one filament for recording and the other for reading, it is possible to repeat continuously the operations of recording and reading the entry so as to make the recorded entry available for reading in a small fraction of the time required to rotate the drum a full revolution.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Other arrangements may be devised by those skilled in the art, without departing from the spirit and scope of the invention.

What is claimed is:

1. An electromagnetic transducer comprising a pair of transformer cores, a bridge member joining said cores to form a unitary structure, a pair of grooves in said bridge member, a first winding on each of said cores, said windings being endless, a second winding on each of said cores, each of said endless windings including a segment individually disposed in one of said grooves.

2. An electromagnetic transducer comprising a pair of transformer cores, a bridge member joining said cores to form a unitary structure, said bridge member having an outer surface, a pair of grooves in said outer surface of said bridge member, a first winding on each of said cores, said windings being endless, a second winding on each of said cores, each of said first windings including a segment individually disposed in one of said grooves.

3. An electromagnetic transducer in accordance with claim 2 wherein each of said segments of said endless windings is filamentary.

4. An electromagnetic transducer in accordance with claim 2 wherein said segments of said endless windings are disposed in said grooves in such manner as to be flush with the outer surface of said bridge member.

5. An electromagnetic transducer in accordance with claim 2 wherein each of said endless windings consists of a single turn.

6. An electromagnetic transducer in accordance with claim 2 wherein each of said endless windings consists of a plurality of turns.

7. An electromagnetic transducer in accordance with claim 2 wherein said segments of said endless windings are parallel.

8. A magnetic recording or reproducing system including a record medium having a magnetizable surface, an electromagnetic transducer and means for providing relative motion between said record medium and said transducer, wherein said transducer comprises a pair of transformer cores, a bridge member joining said cores to form a unitary structure, said bridge member having a surface which faces the magnetizable surface of said record medium, a portion of said surface of said bridge member being substantially parallel to the magnetizable surface of said record medium, a pair of grooves in said portion of said surface of said bridge member, a first winding on each of said cores, said windings being endless, a second winding on each of said cores, each of said first windings including a segment individually disposed in one of said grooves.

9. A magnetic recording or reproducing system in accordance with claim 8 wherein said segments of the endless windings of said electromagnetic transducer are disposed normal to the direction of the relative motion between said transducer and said record medium.

10. An electromagnetic transducer comprising a pair of toroidal transformer cores, a tangential bridge member joining said cores to form a unitary structure, said bridge member having an outer surface which is tangential to the peripheral faces of said cores, a pair of grooves in said outer surface of said bridge member, a first winding on each of said cores, said windings being endless, a second winding on each of said cores, each of said first windings including a segment individually disposed in one of said grooves.

11. A magnetic recording or reproducing system including a record medium having a magnetizable surface, an electromagnetic transducer and means for providing relative motion between said record medium and said transducer, wherein said transducer comprises a pair of toroidal transformer cores, a tangential bridge member joining said cores to form a unitary structure, said bridge member having an outer surface which is tangential to the peripheral surfaces of said cores and which faces the magnetizable surface of said record medium, a portion of said outer surface of said bridge member being substantially flat and parallel to the magnetizable surfaces of said record medium, a pair of grooves in said substantially flat portion of said outer surface of said bridge member, a first winding on each of said cores, said windings being endless, a second winding on each of said cores, each of said first windings including a segment individually disposed in one of said grooves.

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No references cited.