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E. SAKASEGAWA

3,518,646

TRANSDUCER WITH CONDUCTIVE GAF MATERIAL

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FIG. 1.

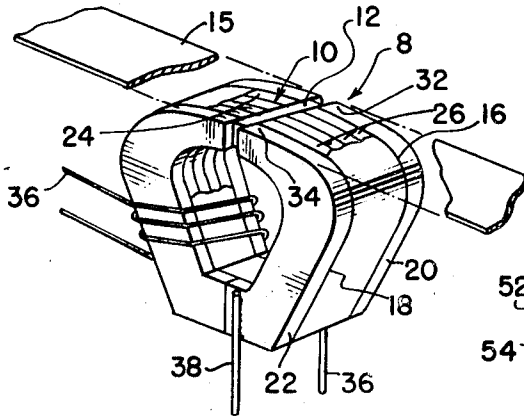


FIG. 2.

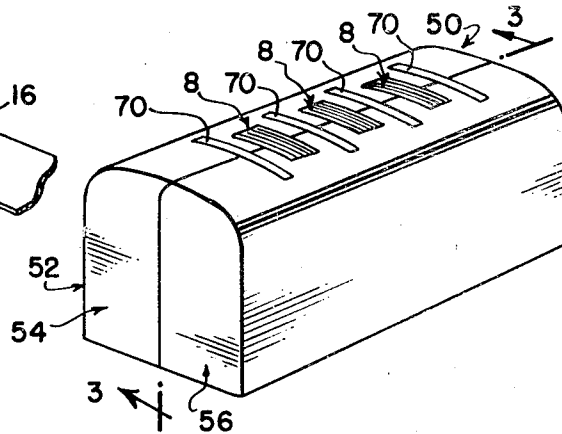
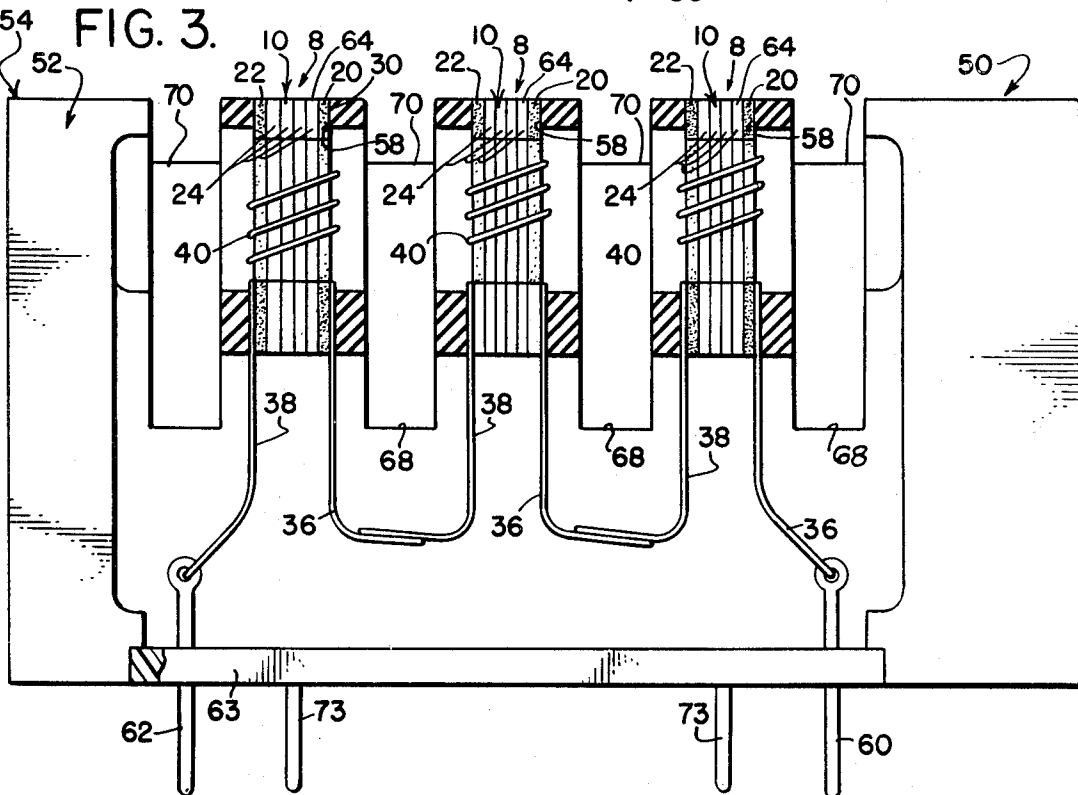


FIG. 3.



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3,518,646 TRANSDUCER WITH CONDUCTIVE GAP MATERIAL

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2 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure provides a method for constructing a transducer wherein the thin gap member utilized as a conductor for a bias signal may be readily coupled to the source of the bias signal. The method of construction allows a plurality of gap members to be readily connected into a single conductive path.

This invention relates to a magnetic transducer. In particular, this invention relates (1) to the mechanical construction of a magnetic transducer adapted to be employed with a plurality of tracks on a recording medium; and (2) to the individual core construction employed therein.

Recently, a magnetic transducer has been invented employing a conductor which passes through the gap in a plurality of cores (hereinafter referred to as a stack). The conductor is pumped with an unusually high frequency to provide a bias for all of the cores. While this transducer has exceptional operational characteristics, there are several problems regarding its fabrication. Specifically, to employ a unitary continuous conductor member which passes through a number of gaps requires either partial shields to be employed for isolation purposes or shields to be employed having a special geometric configuration. The former alternative disrupts the continuity of the surface over which the medium passes and compromises isolation to a certain extent, while the latter alternative requires that the shield construction be altered to enable the conductor to pass through, thereby adding to the complexity of the shield and causing additional manufacturing steps. The use of a continuous conductor made from a number of members involves connecting a plurality of very thin gap members (e.g., less than 1.0 mil) together at inconvenient locations which tends to result in structurally weak and less reliable connections. This invention provides a construction wherein the very thin gap material may readily be formed into a continuous conductor while complete shielding is maintained, without altering the shield configuration.

Briefly, the structure of the core employed in this invention comprises a core of magnetic material having a pair of ends; a conductive gap material positioned in the core adjacent the recording material and extending at least into close proximity to these ends; and at least two planar conductive members, one of which is located at each of the ends and adjacent the ends. The planar members form an electrical connection to the gap material. These cores are readily connected to form a stack by providing an elongated conductive member electrically contacting the planar conductive members to form a continuous path from core to core and through the gap of each core.

The advantages and specific details of this construction will now be described with reference to the drawings, wherein:

FIG. 1 is a perspective view of the invented individual core;

FIG. 2 is a perspective view of the invented stack; and,

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

Referring to FIG. 1, the cores 8 employed in the stack comprise a core of magnetic material 10, a conductive gap material 12 positioned in core 10 adjacent recording medium 15 and extending to the vicinity of ends 16 and 18 of core 10, and a pair of planar electrically conductive members 20 and 22. The planar members 20 and 22 may be copper laminations or laminations of other conductive material while gap material 12 may take the form of a shim or a vacuum deposited gap material or a combination of the two. The planar members 20 and 22 are located adjacent ends 16 and 18, respectively, and form the basis for an electrical connection with the gap material 12. The core 10 consists of a plurality of laminations 24 and 26 which are C-shaped members placed in abutting relationship with gap material 12 and made from such magnetic material as Mumetal, alphenol, sendust, or any other magnetic material that may be employed in a magnetic recorder transducer. The laminations 24 and 26 are separated by a layer of insulating material such as coated paper commonly employed in the capacitor art. The planar conductive members 20 and 22 have essentially the same configuration as laminations 26. The number of laminations 24 may be equal to the number of laminations 26 in which case planar members 20 and 22 will be placed on both sides of the cores. Alternatively, there may be an unequal number of laminations 24 and 26 in which case planar conductive members 20 and 22 would be placed only on one side of the core with an electrical connection to each side.

The tips 32 and 34 of planar members 20 and 22 are in the vicinity of gap material 12 and in direct contact with gap material 12 and making electrical contact therewith. This enables electrically conductive elongated members, such as ribbons or wires 36 and 38, to be attached to planar members 20 and 22 to form a conductive path through the individual transducers via planar member 20, gap material 12, and planar member 22. It is within the scope of the invention to employ a gap shim placed in direct contact with a planar member with a vacuum deposited conductive layer formed over and in the vicinity of the junction of these members to assure the electrical contact. Another embodiment utilizes only a conductive vacuum deposited gap which is in part deposited over the planar members to thereby simultaneously form both the gap and the connection between the gap and the planar member. In this respect it is intended that the term "abutting" as used herein includes: (1) the cooperative relationship between a vacuum-deposited gap and planar members 20 and 22, (2) the cooperative relationship between a gap shim and planar members 20 and 22, in actual contact, and (3) the cooperative relationship between a gap shim with a vacuum deposited portion and planar members 20 and 22.

In a particular application, the conductive ribbons 36 and 38 may be attached to a terminal board or to other individual transducers. This will be considered in further detail later in the specification. The core 8 is completed by winding a coil 40 thereabout and attaching the ends of coil 40 to terminals for supplying an information signal thereto. It is understood that coil 40 may be placed around both sides of core 8. A bias signal is supplied to the conductive ribbons 36 and 38.

In operation an information signal is supplied to the coil 40 and a bias signal is supplied to conductive ribbons 36 and 38. The bias signal results in a current passing through planar member 20, gap material 12 and planar member 22 with the magnetic field incident thereto radiating outwardly from the gap toward the recording medium 15. This is explained in detail in co-pending U.S.

patent application Ser. No. 490,337, assigned to the assignee of this application. The information signal applied to coil 40 operates in the usual manner causing a magnetic flux to pass through laminations 24 and then bridging the gap material 12 via recording medium 15 and passing through laminations 26 to complete the magnetic circuit.

From the above description, it can be seen that the construction of core 8 provides a means 12, 20, 22, 36 and 38 for passing a current through the gap of the transducer which can be readily and conveniently fabricated. The connection to the very thin gap material (e.g., less than 1 mil) is facilitated by planar members 20 and 22 which have a shape substantially identical with the laminations of core material 10. The abutting relationship of the gap material and the planar members coupled with the relative large area of the planar members facilitates the making of a connection to the gap material and the passing of the current through the core. The conductive path formed is reliable, simple and economically formed.

With the construction of the individual cores or transducers in mind, the structure of a transducer stack (FIGS. 2 and 3) may readily be understood. The stack 50 includes a housing means 52 for holding a plurality of individual cores 8 in alignment and in a predetermined relationship whereby they may readily be associated with a recording medium. The housing 52 includes a pair of side pieces 54 and 56 which are made from a material such as anodized aluminum and which are individually assembled with cores therein and then fastened together to form the completed housing 52 and transducer stack 50. FIG. 2 shows side piece 52 with halves of the individual cores 8 placed in receiving slots 58. Planar members 20 and 22 are placed in the slot 58 with the conductive ribbon 36 of core 8 at the right end (FIG. 3) of side piece 52 attached to a terminal 60. The conductive ribbon 38 of the core 8 at the left end (FIG. 2) of side piece 52 is attached to terminal 62 (FIG. 3). The other conductive ribbons 36 and 38 are connected in series so that once the conductive gap material is placed across the confronting pole tips 64 of each of the cores 8, a continuous conductive path is formed from terminal 60 to terminal 62 via planar members 28 and 30, conductive ribbons 36 and 38, and gap material 12. In this embodiment it is desirable to form the gap material by placing the side piece 52 with halves of cores 8 already positioned therein, into a vacuum deposition chamber. The portions of side piece 52 and cores 8 that are not to be vacuum deposited are masked or shielded during the deposition process.

The conductive ribbons 36 and 38 are shaped to pass beneath shield 70 (FIG. 2). This is accomplished by placing connecting ribbons 36 and 38 as shown and then inserting dummy Teflon shields into slots 68. The dummy shields extend to a position slightly above ribbons 36 and 38 so that they may be covered by an epoxy resin or other potting material. With the dummy shields in place, the assembly is in part potted. Following this the dummy shields are removed and the assembly is completed. The resulting arrangement of the conductive ribbons 36 and 38 covered by epoxy resin enables a shield to be inserted to extend from the surface of the trans-

ducer stack 50 to below the bottom of cores 8, thereby affording substantially complete isolation while enabling a conductive path to be formed through all of the individual transducers in series with relatively short leads (36 and 38). The transducer stack is completed by securing side piece 52 to side piece 56 having halves of cores 8 therein. This may be accomplished by filling the interior of side pieces 54 and 56 with an epoxy resin or the like, or by mechanical fastening, or a combination of such methods. In operation, all of cores 8 are provided with a bias signal by the connection of terminals 60 and 62 to a bias oscillator. The information signals are applied to other terminals 73 on terminal board 63 which are associated with coils 40.

Although this invention has been disclosed and illustrated with reference to a particular embodiment, the principles involved are susceptible of numerous other embodiments which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

What is claimed is:

1. A transducer stack that cooperates with a plurality of tracks on a magnetic recording medium comprising:
 - a plurality of individual transducers each including a magnetic core having ends; said core including a plurality of laminations of magnetic nonconductive material insulatedly separate and arranged in side-by-side relation;
 - bias terminals connected to conductive ribbons for supplying a bias signal thereto; and,
 - a housing means for holding the cores in alignment; at least two planar conductive members, said planar members being conductive laminations of substantially the same configurations as said core of magnetic material, one of which is located adjacent each of said ends;
 - a conductive gap material positioned in said core adjacent the recording medium and extending at least to the vicinity of said ends to make electrical contact with said conductive members; and,
 - conductive elongated members electrically contacting said planar conductive members to form a continuous conductive path through said transducers via said conductive members, said conductive gap material, and said conductive elongated members.
2. The structure recited in claim 1 wherein a plurality of shields separate and isolate each of said cores.

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