Aug. 16, 1949. M. CAMRAS 2,479,308

MAGNETIC RECORDER HEAD

Filed March 17, 1945

Fig. 1.

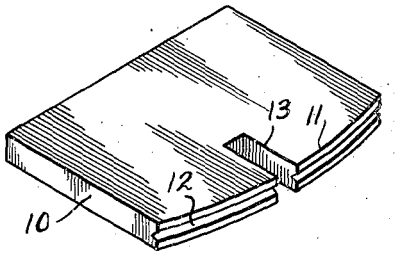


Fig. 3.

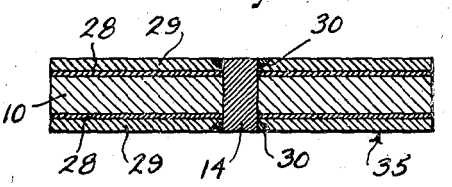


Fig. 2.

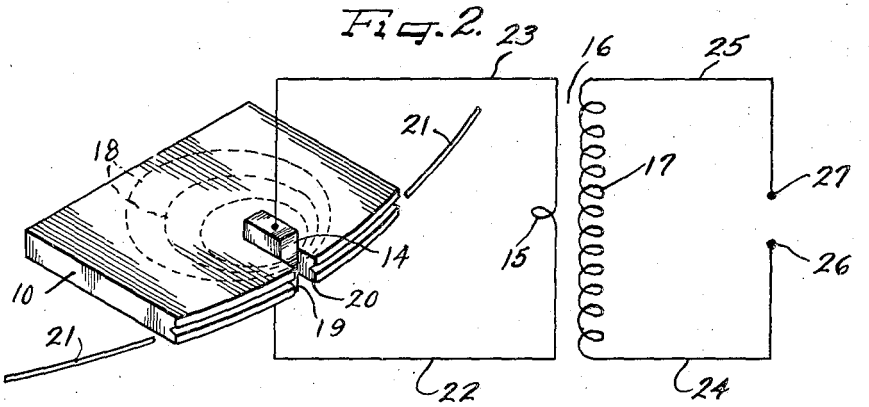


Fig. 5.

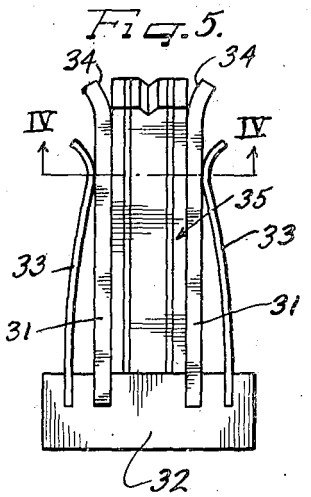
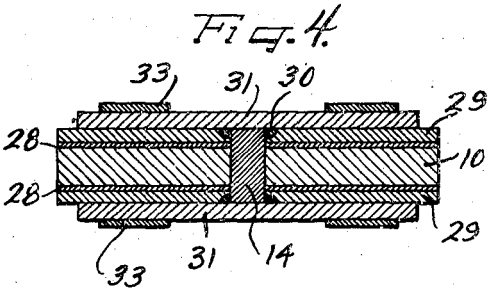


Fig. 4.



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MAGNETIC RECORDER HEAD

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7 Claims. (Cl. 179—100.2)

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This invention relates to a magnetic head which may be used for recording or reproducing or both, and more particularly to a magnetic head of low impedance for recording longitudinally on a traveling record medium and reproducing previously longitudinally recorded records.

One of the principal features and objects of the present invention is to provide the recording and reproducing head of low impedance which is extremely low in cost but which will nevertheless efficiently magnetize a traveling record medium longitudinally thereof and reproduce longitudinal recordings on traveling record medium which have previously been magnetized.

A further object of the present invention is to provide a novel recording and reproducing head which may be quickly and easily mounted in place, removed and replaced without necessitating any soldering or complicated connections of lead wires and so forth.

Another object of the present invention is to provide a novel recording and reproducing head in which the magnetizing and energy receiving element thereof is in the form of a single turret or a part of a single turret.

Another and further object of the present invention is to provide a novel recording head in which the circular field about a straight current-conducting element is employed to effect longitudinal magnetization of a traveling record medium.

Another and still further object of the present invention is to provide a novel recording and reproducing head in which the energizing coil is in the form of a substantially straight current-conducting element mounted in a core member formed of a substantially flat sheet of material of relatively high magnetic permeability and relatively low magnetic retentivity and which current-conducting element is disposed substantially at right angles to the sheet.

Still another and further object of the present invention is to provide a novel mounting for receiving and electrically connecting a magnetic recording or reproducing head.

Still a further object of the present invention is to provide a novel method of magnetic recording and reproducing.

The novel features which are believed to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization, manner of construction, and method of operation, together with further objects and advantages thereof, may best be understood with reference

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to the following description, taken in connection with the accompanying drawing, in which:

Figure 1 is an isometric view of the core member of a recording and reproducing head embodying the novel features of the present invention;

Figure 2 is a diagrammatic view showing the core member of Figure 1 with an energizing member mounted therein and electrically connected to the force of fluctuating energy when the head is being used as a recorder and to the reproducing circuit when the head is being used as a reproducer;

Figure 3 is a sectional view through the recorder head in proximity to the wire guiding groove but through the current-conducting member;

Figure 4 is a view similar to Figure 3 showing the recorder head in mounted position, the sectional view being taken substantially along the line IV–IV of Figure 5; and

Figure 5 is an end elevational view of the recording head in mounted position.

Referring first to Figures 1 and 2 of the drawing, the recording and reproducing head of the illustrated embodiment comprises a core member 10 which may be in the form of a stamping of any suitable material having relatively high permeability and relatively low magnetic retentivity. This member 10 is in the form of a small flat plate one edge of which is crowned as at 11 to facilitate the entry of a traveling record medium such as wire in the wire guiding groove 12 which is formed along the crowned edge 11. A slot 13 is cut in the plate 10 approximately mid-way along the crowned edge 11. This slot 13 is arranged to receive a current-conducting element 14 which may conveniently be of copper or silver in the form of a thin shim or strip of such material. It is to be understood that the drawing is very greatly enlarged from the actual size of the recording head and is not made to scale in order to emphasize the various novel features of the present invention. In practice it has been found that a core member may conveniently be approximately three-eighths of an inch long and a quarter of an inch high (that is, from its bottom edge to its crowned edge). It has further been found that the slot 13 may conveniently be approximately .002 inch in width. It will, of course, be understood that these dimensions are merely given by way of example to show one particular embodiment of the invention and to give some idea of the relative order of magnitude of the recorder head.

Referring now specifically to Figure 2 the func-

tional operation of the recording head will now be described and thereafter a specific physical embodiment of the recorder head will be described. If the current-conducting element 14 is electrically connected at its opposite ends to the low impedance winding 15 of a transformer 16, and fluctuating electric energy is supplied to the high impedance winding 17 of the transformer 16, the current flowing through the current-conducting element 14 will set up a magnetic field at right angles thereto as indicated by the flux lines 18. This is merely the usual system of magnetic fields which surround a current-conducting element when current is flowing therethrough. The circular magnetic field is at right angles to the current-conducting element. Due to the positioning of the current-conducting element 14 with respect to the core 10, it will be observed that the field will be greatly concentrated in the region of the gap formed by the slot 13 which lies between the current-conducting element 14 and the crowned edge 11. The flux lines in the other region around the current-conducting element 14 are spread out, however, due to the fact that the core member 10 provides a low reluctance path for the flux. The bunching of the flux lines or, in other words, the concentration of the magnetic field at the open portion of the slot 13 in effect causes the confronting portions 19 and 20 of the slot 13 to be confronting polar portion or pole pieces. It will be noted that all of the flux lines across the gap between the polar portions 19 and 20 lie in substantially the same direction and more particularly substantially longitudinally of the wire 21 which is traveling through the groove 12 in the crowned edge 11 of the core piece 10. This causes longitudinal magnetization of the wire or record medium 21 notwithstanding the fact that no poles in the usual sense are provided and notwithstanding the fact that no solenoid type energizing coil is provided.

In practice the winding 15 of the transformer 16 should preferably match the impedance of the current-conducting element 14 and where the current-conducting element 14 is of extremely good electrical conductivity, the winding 15 will usually be a single turn winding on the transformer 16.

It has been found in practice that very much better results are obtained when the conductors 22 and 23 which connect the current-conducting element 14 to the winding 15 of the transformer 16 are in the form of a loop which completely surrounds the wire 21. In other words, it has been found much more satisfactory to connect the winding 15, the conductors 22 and 23 and the conductor 14 in a closed loop around the wire 21 than it has been to connect these same elements in a closed loop with the wire 21 completely outside of the loop.

It is believed that the explanation of this phenomenon is that when the closed loop surrounds the wire only a small percentage of the flux due to stray fields threads the pick-up loop on reproduction. When the closed loop does not surround the wire but rather surrounds the bulk of the core member 10, a large percentage of the stray flux threads the loop and greater distortion results. This applies not only to the hum fields but to the fields of the wire itself which are just outside of the recording head.

The above functional operation of the device has been a description of the device when it is operating as a recording head. It will also operate in an extremely satisfactory manner as a reproducing head. When operating as a reproducing head, the energy in the record medium 21 induces an electric current in the current-conducting element 14 which reproduces a signal in the conductors 24 and 25 connected to the winding 17 of the transformer 16. These conductors may be connected to a suitable amplifier speaker system through the terminal member 26 and 27.

Having now described the novel functional operation of my invention and the novel method thereof, reference will now be made to a specific physical embodiment of the device. Opposite sides of the core member 10, which has been described in connection with Figures 1 and 2, are provided with a layer of insulating paper 28 and on top of the papers 28 are secured copper plates 29. The copper plates 29 are recessed or cut back as at 30 adjacent the current-conducting element 14 and solder is then poured into this cut-back portion 30. The result is that the current-conducting plates 29 are electrically connected to the current-conducting element 14. This has been found to form a very satisfactory way to electrically connect terminal members to the current-conducting member 14. In this instance, the terminal members are, of course, the conducting plates 29. This assembly forms a unit which can be conveniently and easily slipped into a head supporting structure as shown in Figures 4 and 5 which include a pair of conducting plates 31 mounted on an insulating support 32 and spring pressed as at 33. The current-conducting plates 31 which may conveninetly be formed of copper or the like form a good electrical contact with the plates 29 and provide, due to their area, relatively low contact resistance. The leaf springs 33 urge the plates 31 toward each other and thereby tightly grip the head structure. The conductors which lead to the amplifying apparatus are permanently connected (not shown) to the conducting plates 31. As may be seen best in Figure 5, the upper edge of the plates 31 are rolled back slightly as at 34 in order that the head may be quickly and easily inserted between the plates 31. When it is desired to replace the head structure generally designated by the reference numeral 35 in Figure 3, it is gripped at its opposite ends and quickly removed from between the plates 31. In this connection, it will be noted that the plates 31 are slightly shorter than the length of the head structure 35 in order to facilitate gripping of the same. A new head may be then easily inserted between the plates 31. No soldering or other electrical connection of a permanent nature may be made since the new head makes its electrical contact by virtue of the fact that the conducting plates 29 of the head structure 35 lie against the plates 31 of the head supporting structure.

While I have shown a particular embodiment of my invention and described a particular method of operation, it will, of course, be understood that I do not wish to be limited thereto, since many modifications may be made and I, therefore, contemplate by the appended claims to cover all such modifications as fall within the spirit and scope of my invention.

I claim as my invention:

1. A magnetic recording and reproducing head comprising a paramagnetic member, a second member of relatively good electrical conductivity extending to said first member in proximity to one edge thereof, said one edge of said first member being arranged to have a magnetic record medium pass therealong, said second member being

arranged to conduct a fluctuating magnetizing current to be recorded and to have induced therein a fluctuating current from a magnetized record medium, a sheet of electrical insulating material on both sides of said first member, and a pair of electrical conducting plates on the outer sides of each insulating sheet, said electrical conducting plate being electrically connected to the opposite ends of said second member.

2. A magnetic head assembly comprising a paramagnetic core member, an electromagnetic circuit associated with said core member, and a pair of electrical conducting plates on opposite sides of said core member and connected respectively to the opposite ends of said electromagnetic circuit, thereby providing terminal members therefor, said core, said circuit and said plate forming an integral unit, and a second pair of electrical conducting plates between which said unit is tightly nestled, whereby permanent circuit connections may be made to said second pair of electrical conducting plates and whereby said integral units may be readily and quickly inserted and removed.

3. A magnetic head assembly comprising a paramagnetic core member, an electromagnetic circuit associated with said core member, and a pair of electrical conducting plates on opposite sides of said core member and connected respectively to the opposite ends of said electromagnetic circuit extending through said core member, thereby providing terminal members therefor, said core, said circuit and said plate forming an integral unit, a second pair of electrical conducting plates, a base upon which said second pair of electrical conducting plates is mounted, and resilient means urging said second pair of electrical conducting plates toward each other, whereby said integral units may be inserted between said second pair of plates with said first pair of plates in good electrical conducting relation with said second pair of plates.

4. A magnetic recording and reproducing head comprising a member of relatively high magnetic permeability and relatively low magnetic retentivity, a sheet of insulating material on opposite sides of said member, electrical conducting plates on opposite sides of said member and separated therefrom by said sheets of insulating material, and a member of good electrical conductivity extending through said member, said sheet and said plate, said second member of good electrical conductivity terminating adjacent the outer surface of each of said plates and electrical bonding material securing said opposite ends of said second member to said plate.

5. A magnetic transducer head comprising a core of relatively high magnetic permeability and relatively low magnetic retentivity, said core having a gap therein extending inwardly from one edge to define a pair of confronting magnetic poles, and a single current-carrying conductor disposed in said gap itself between said confronting poles, said one edge of said core being arranged to have a magnetic record medium passed therealong across said gap.

6. A magnetic transducer head comprising a core of relatively high magnetic permeability and relatively low magnetic retentivity, said core having a gap therein extending inwardly from one edge to define a pair of confronting magnetic poles, and a single current-carrying conductor disposed in said gap itself between said confronting poles, said one edge of said core being arranged to have a magnetic record medium passed therealong across said gap, and an energizing circuit for said conductor forming a closed loop around the path of travel of said record medium.

7. A magnetic transducer head comprising a core of relatively high magnetic permeability and relatively low magnetic retentivity, said core having a gap therein extending inwardly from one edge to define a pair of confronting magnetic poles, and a single current-carrying conductor disposed in said gap itself between said confronting poles, said one edge of said core being arranged to have a magnetic record medium passed therealong across said gap, said conductor being spaced inwardly from the path of travel of said record medium and substantially filling the remaining portion of said slot.

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