Nov. 25, 1947. M. CAMRAS 2,431,541

MAGNETIC RECORDING HEAD

Filed May 31, 1945

Fig-1

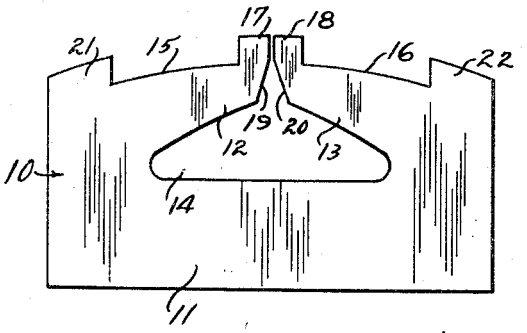


Fig-2

Fig-3

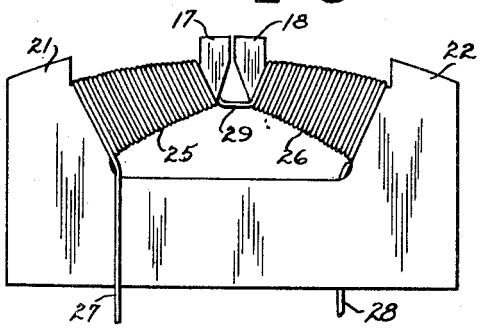
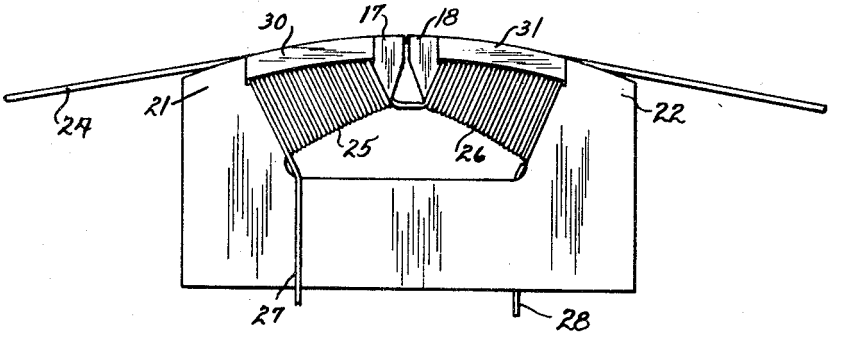


Fig-4



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2,431,541

MAGNETIC RECORDING HEAD

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7 Claims. (Cl. 179—100.2)

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This invention relates to a magnetic recording head and more particularly to a head which may be employed to magnetically record fluctuating electric energy on an elongated traveling record medium, and to reproduce electrical fluctuation from a previously magnetized record medium.

One of the principal features and objects of the present invention is to provide a novel magnetic recording head which will approximate the same high quality recording and reproduction which is obtained by using a head having a traveling record medium pass directly through the voice coil, but which employs, in this case, an arrangement in which the head may be placed into a position against the traveling record medium and moved away therefrom at any time.

More particularly, this is an improvement over my copending application entitled "Magnetic recording head," U. S. Serial No. 580,605, filed March 2, 1945, and assigned to the same assignee as the present invention.

It is one of the objects of the present invention to provide a novel recording and reproducing head of an improved open slot type.

It is a further object of the present invention to provide a core piece of novel construction for a magnetic recording and reproducing head.

Another and further object of the present invention is to provide a novel recording head in which the greater part of the recording head is at substantially zero M. M. F.

Another and still further object of the present invention is to provide a recording head having the electric recording or pickup coil wound thereon in a novel manner.

Still another and further object of the present invention is to provide a novel method and means for magnetizing a traveling elongated record medium and for reproducing electric energy from a previously magnetized record medium.

A still further object of the present invention is to provide a novel high fidelity recording and reproducing head including pole pieces constructed in a novel manner.

The novel features which I believe 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 by reference to the accompanying drawing, in which:

Figure 1 is a front elevational view of the core member of a recording head embodying the novel features of the present invention;

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Figure 2 is an end view of the core member shown in Figure 1;

Figure 3 shows the recording head, including the core piece, as shown in Figures 1 and 2, together with the core wound in place thereon prior to the insertion of certain non-magnetic wire guide blocks; and

Figure 4 is a view similar to Figure 3 but with the wire guide blocks in place and a traveling record medium in operative association therewith.

Referring first to Figures 1 and 2 of the drawing, I have illustrated thereby the paramagnetic core structure of one embodiment of the present invention. More particularly, I have shown in Figures 1 and 2 a core piece 10 which is preferably made from a stamping of some suitable paramagnetic material having a relatively high initial permeability. As the expression "initial permeability" is used herein, it refers to the permeability of the material at relatively low values of the exciting field. In other words, a material having relatively high initial permeability is a material having rapidly increasing values of magnetism for small incremental increases of field strength at relatively low values of field strength.

The stamping or core piece 10 includes a base portion 11 and two confronting polar portions 12 and 13. The confronting polar portions 12 and 13 are formed by stamping a generally triangular shape opening 14 in the core 10 and by cutting out upper notches 15 and 16 as shown. This leaves the confronting polar portions 12 and 13 with upstanding tongues 17 and 18. The edges of these upstanding tongues 17 and 18 are cut back as at 19 and 20 in the manner shown in Figure 1.

The upper corners 21 and 22 are grooved as at 23 (see Figure 2), as are also the pole tips 17 and 18. This groove 23 lying in the corner portions 21 and 22 and the pole tips 17 and 18 are arranged to receive and guide a traveling record medium such, for example, as a steel wire 24 (see Figure 4).

Referring now to Figure 3, it will be apparent that a number of turns of wire (such, for example, as insulated copper wire) are wound on the polar portion 12 as at 25 and on the polar portion 13 as at 26. The wire forming the coil 26 is a continuation of the wire forming the coil 25 and is wound in the same direction. In effect, the coils 25 and 26 are like a single solenoid or helically wound coil with adjacent turns of the coil near the center spread apart but still electrically connected to each other. The outer end of the coil 25 terminates in a lead conductor 27 and the outer

end of the coil 26 terminates in a lead conductor 28. The inner ends of the two coils 25 and 26, as explained above, are integrally connected by the portion of wire 29.

The magnetic head is completed by inserting non-magnetic blocks 30 and 31 in the notched out portions 15 and 16 after the coils 25 and 26 have been wound on the polar portions 12 and 13. It will therefore be seen that the non-magnetic blocks 30 and 31 overlie the top surface of the coils 25 and 26. These blocks may be secured to the upper corner portions 21 and 22 and the pole tip portions 17 and 18 in any suitable manner, such as soldering, cementing, pinning, or the like. The blocks 30 and 31 are also notched for the reception of the traveling record medium 24 in the same manner as were the upper edges of the corners 21 and 22 and the pole tips 17 and 18. The blocks 30 and 31 also are provided with an arcuate upper edge which forms a continuation of the upper edge of the corners 21 and 22 and the pole tips 17 and 22. This, in effect, will provide a crowned edge for the portion of the magnetic head which receives the traveling record medium.

While the blocks 30 and 31 may be formed of any suitable non-magnetic material, by way of example it may be said that they may be formed of brass or some other relatively hard non-magnetic material which will serve as the principal bearing surface for the traveling wire 24.

Considering now the effect of the operation of the recording and reproducing head when acting in its recording capacity, let it be assumed that at some given instant of time current is flowing up through lead conductor 27 and down through conductor 28. This will produce a north pole at the left-hand end of the coil 25 and a south pole at the right-hand end of the coil 25. It will also produce a north pole at the left-hand end of the coil 26 and a south pole at the right-hand end of the coil 26. This produces a very strong concentration of flux across the gap between the pole tips 17 and 18. The return path for the flux is through the relative large mass of the base portion 11. Due to the presence of the non-magnetic blocks 30 and 31 there is substantially no return path in the region above the coils 25 and 26. This, then, means that substantially the entire M. M. F. drop in the magnetic circuit is across the relatively narrow gap between the pole tips 17 and 18.

It will further be understood that the region of the core near the upper corners 21 and 22 where the wire enters and leaves the magnetic head is substantially at zero M. M. F. Upon careful consideration of this, it will be seen that substantially the same effect is obtained with this type of core structure and magnetic head as would be obtained by mounting an exciting coil on a core piece having a hole extending axially therethrough and running the record medium directly through this axially extending hole in the center of the exciting coil.

The impedance of the magnetic head may be varied by varying the number of turns of wire in the coils 25 and 26 and the winding may be in the form of a single layer or a plurality of layers, depending upon the impedance desired.

When the magnetic head is being used for reproducing, it will operate with equal efficiency, for the magnetized record medium traveling between the pole tips 17 and 18 will induce a fluctuating current in the coils 25 and 26 which is a function of the recorded fluctuation on the record medium.

Due to the simplicity of the core structure, it will further be observed that this magnetic head is extremely economical to manufacture and by its open slot construction is extremely practical and easy to use, for it is simply necessary to move any intermediate portion of the traveling record medium 24 into position in the wire guiding slot 23 of the head.

While I have shown a particular embodiment of my invention, 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 true spirit and scope of my invention.

I claim as my invention:

1. A magnetic head for recording and reproducing comprising a core member having a pair of polar portions extending toward each other, each polar portion having a toe portion extending generally laterally to the general direction of extension of the main body of said polar portion, said toes lying in close proximity to each other and having a non-magnetic region therebetween, magnetizing and reproducing coils wound over said main body portions of said polar portions, said head having means for guiding a traveling record medium alongside of one of said coils, over first one and then the other of said toes and then alongside of said other coil, the region between said traveling record medium and said coils being substantially nonmagnetic in character.

2. A magnetic head for recording and reproducing comprising a core member having a pair of polar portions extending toward each other, each polar portion having a toe portion extending generally laterally to the general direction of extension of the main body of said polar portion, said toes lying in close proximity to each other and having a non-magnetic region therebetween, said polar portions also having heel portions spaced from said toe portions and extending in the same direction as said toe portions, magnetizing and reproducing coils wound over said main body portions of said polar portions, said head having means for guiding a traveling record medium over one of said heels, then alongside of one of said coils, then over said toe portions successively, then alongside the other of said coils, and then over the other heel.

3. A magnetic head for recording and reproducing comprising a core member having a pair of polar portions extending toward each other, each polar portion having a toe portion extending generally laterally to the general direction of extension of the main body of said polar portion, said toes lying in close proximity to each other and having a non-magnetic region therebetween, magnetizing and reproducing coils wound over said main body portions of said polar portions, said head having means for guiding a traveling record medium alongside of one of said coils, over first one and then the other of said toes and then alongside of said other coil, said head having non-magnetic portions between said path of travel of said record medium and said coil, said non-magnetic portions including means for guiding the record medium over said head to and away from said toe portions.

4. A magnetic head for recording and reproducing comprising a core member having a pair of polar portions extending toward each other, each polar portion having a toe portion extending generally laterally to the general direction of extension of the main body of said polar por-

tion, said toes lying in close proximity to each other and having a non-magnetic region therebetween, said polar portions also having heel portions spaced from said toe portions and extending in the same direction as said toe portions, magnetizing and reproducing coils wound over said main body portions of said polar portions, said head having means for guiding a traveling record medium over one of said heels, then alongside of one of said coils, then over said toe portions successively, then alongside the other of said coils, then over the other heel, said head including non-magnetic members between the heel and toe of each of said polar portions, said means for guiding said traveling record medium including in part said non-magnetic members.

5. A magnetic head for recording and reproducing comprising a core member having a pair of polar portions extending toward each other, each polar portion having a toe portion extending generally laterally to the general direction of extension of the main body of said polar portion, said toes lying in close proximity to each other and having a non-magnetic region therebetween, said polar portions also having heel portions spaced from said toe portions and extending in the same direction as said toe portions, magnetizing and reproducing coils wound over said main body portions of said polar portions, said head having means for guiding a traveling record medium over one of said heels, then alongside one of said coils, then over said toe portions successively, then alongside the other of said coils, then over the other heel, said head including non-magnetic members between the heel and toe of each of said polar portions, said means for guiding said traveling record medium including in part said non-magnetic members, said non-magnetic members lying between the path of travel of said record medium and said coil.

6. A magnetic head for recording and reproducing comprising a plate of relatively high magnetic permeability and relatively low magnetic retentivity, a groove extending along one edge of said plate for receiving and guiding a traveling record medium, said plate having a non-magnetic gap therein extending inwardly from said one edge, said plate having a pair of slots in close proximity to said one edge on opposite sides of said gap, said plate having at least one additional opening therein, and a magnetizing coil wound through said slot from said additional opening, the coil being wound the same way on both sides of said gap, whereby the adjacent ends of the coil portions on opposite sides of said gap are of opposite magnetic polarity, said plate being formed of non-magnetic material in the region between said groove and said coil.

7. A magnetic head for recording or reproducing comprising a core member, means for guiding a traveling record medium over a predetermined path, at least three apertures in said core member, the first and second of said apertures being located in close proximity to said path of travel of said record medium, said core member having a non-magnetic gap between said first and second apertures, and a recording and reproducing coil wound partly through the first and partly through the second of said apertures and the additional apertures, the region lying immediately between the path of travel of said record medium and said coil part being non-magnetic, but all of the remaining portion of said plate being formed of a material of relatively high magnetic permeability and relatively low magnetic retentivity, including the portions immediately adjacent and on either side of said non-magnetic gaps.

MARVIN CAMRAS.

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The following references are of record in the file of this patent:

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