April 8, 1947. M. CAMRAS 2,418,542

MAGNETIZING AND ERASING HEAD ARRANGEMENT FOR MAGNETIC RECORDERS

Filed Jan. 20, 1944 2 Sheets-Sheet 1

Fig- 1

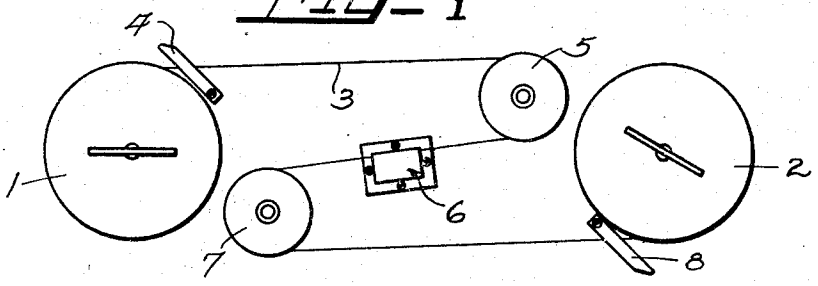


Fig- 2

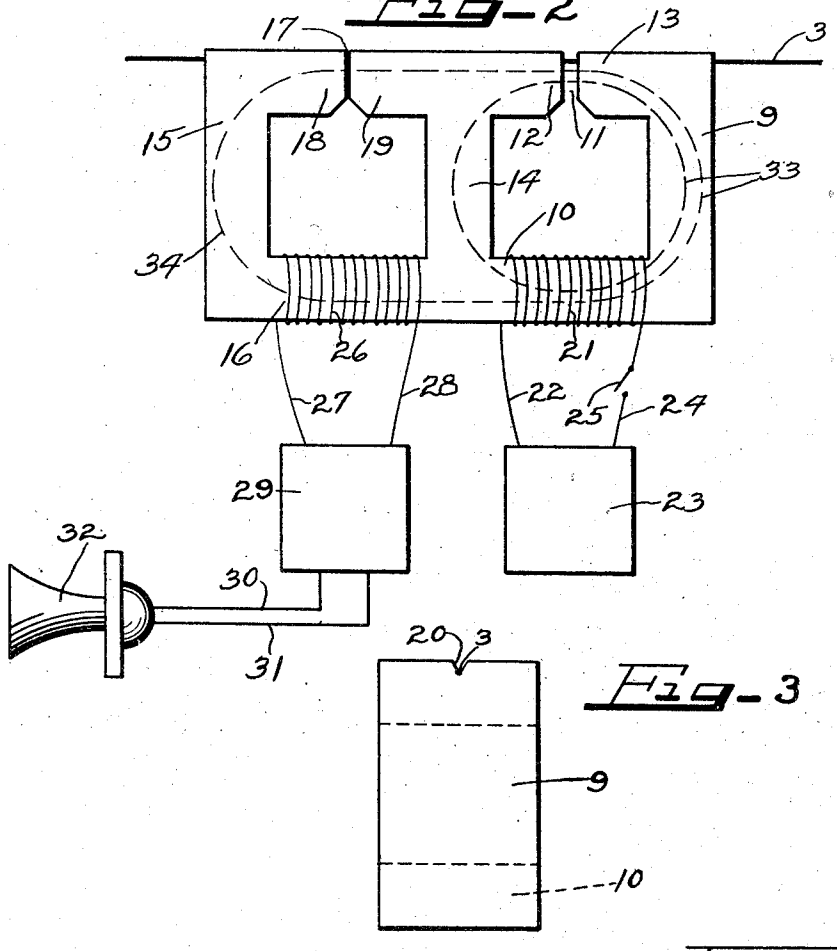


Fig- 3

INVENTOR
Marvin Camras

By Charles R. Hill Attys

April 8, 1947. M. CAMRAS 2,418,542

MAGNETIZING AND ERASING HEAD ARRANGEMENT FOR MAGNETIC RECORDERS

Filed Jan. 20, 1944 2 Sheets-Sheet 2

Fig- 4

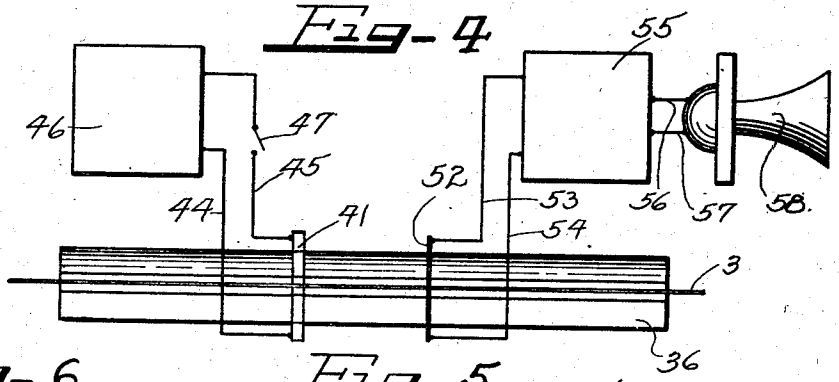


Fig- 6

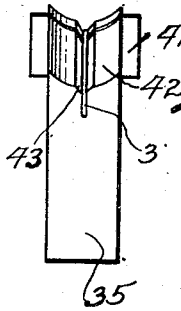


Fig- 5

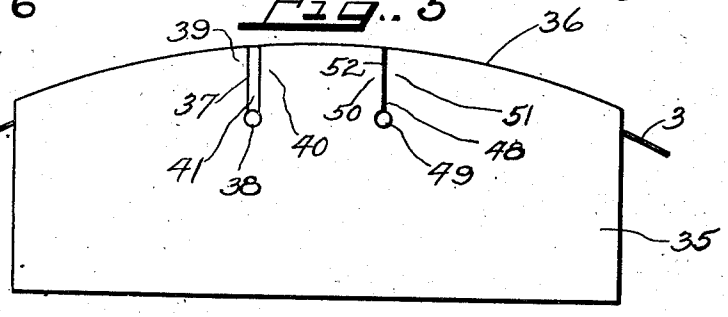


Fig- 7

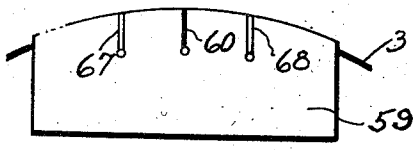
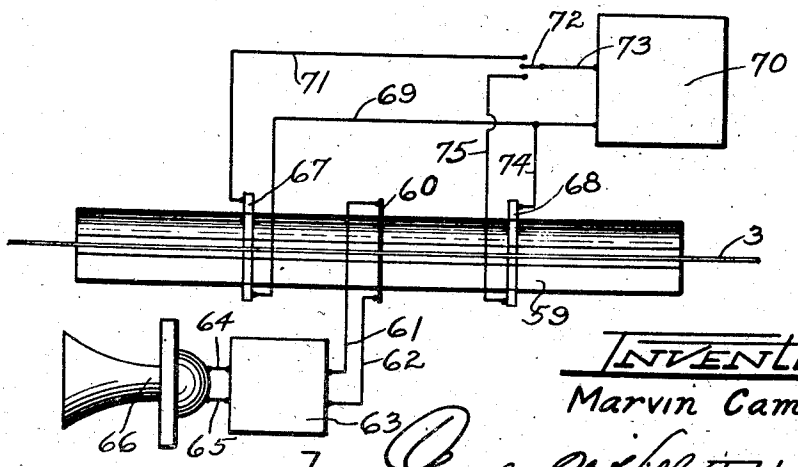


Fig- 8



INVENTOR
Marvin Camras

by Cameron & Kilbourn Attys

Patented Apr. 8, 1947

2,418,542

UNITED STATES PATENT OFFICE

2,418,542

MAGNETIZING AND ERASING HEAD ARRANGEMENT FOR MAGNETIC RECORDERS

Marvin Camras, Chicago, Ill., assignor to Armour Research Foundation, Chicago, Ill., a corporation of Illinois

Application January 20, 1944, Serial No. 518,922

12 Claims. (Cl. 179—100.2)

1

This invention relates to improvements in a magnetic recording and reproducing device, and more particularly to a magnetizing and erasing head arrangement for magnetic recorders, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

In many instances in connection with magnetic recording devices, it is desirable to employ an erasing head in addition to the recording head so as to insure what may be termed a clean wire before the recording head acts upon that wire. Such arrangement also eliminates the necessity of demagnetizing the recording medium, which may be in the form of a paramagnetic wire, tape, or other elongated element, at some location remote from the recording device. When an erasing head is employed, a medium magnetized in accordance with a previous recording may be used, and the erasing head will remove that previous recording prior to the medium reaching the recording head. In compact recording devices, however, it has been found difficult to provide both the erasing head and recording head because of insufficient room to accommodate them. In many arrangements, it is necessary to place the recording head and erasing head very close together, and yet it is desirable to provide a source of high frequency current for both the erasing head and recording head.

With the foregoing in mind, it is an important object of the instant invention to provide a magnetic recording and reproducing device wherein no high frequency current is applied to the recording head, and yet the benefits of such an application of high frequency are obtained in the recording head.

Another object of the invention resides in the provision of an erasing head and recording head arrangement for a magnetic recording device such that the high frequency component desired in the recording head is supplied by stray high frequency flux from the erasing head.

A further object of the instant invention resides in the provision of an erasing head and magnetizing head for a magnetic recorder in the form of a unitary assembly, both heads utilizing the same core, and the high frequency component in the recording head being obtained by virtue of stray flux from the erasing head.

Still another object of the instant invention is the provision of a recording and reproducing head for a magnetic recording device to which only audio-frequency current is supplied, but the arrangement being such that the recording possesses all benefits of the added application of high frequency current.

2

Also an object of the invention is the provision of a recording head arrangement for a magnetic recording device especially designed to lessen wear on the head by the recording medium travelling thereby.

Still a further object of the instant invention resides in the provision of an erasing and recording head assembly for a magnetic recording device so arranged as to permit the wire to travel in either direction by the assembly and be cleaned of a previous recording and magnetized in accordance with a new recording.

A still further object of the instant invention is the provision of an economical erasing and recording head assembly for a magnetic recording device, and which assembly occupies a minimum space.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a schematic elevational view of a portion of a magnetic recording device including an erasing head and a recording head embodying principles of the instant invention;

Figure 2 is an enlarged elevational view of the erasing head and recording head of Figure 1, with the casing removed, and indicating diagrammatically the electrical connections for the respective heads;

Figure 3 is an end elevational view of the core included in the structure of Figure 2;

Figure 4 is a fragmentary top plan view of an erasing and magnetizing head assembly of somewhat different construction, illustrating diagrammatically salient electrical circuits associated with the assembly;

Figure 5 is a side elevational view of the assembly of Figure 4;

Figure 6 is an end elevational view of the structure of Figure 5;

Figure 7 is a side elevational view of an erasing and magnetizing head assembly of the character permitting the recording medium to travel in either direction; and

Figure 8 is a top plan view of the structure of Figure 7 with salient associated electrical circuits indicated diagrammatically.

As shown on the drawings:

In Figure 1 I have shown an illustrated embodiment of the instant invention operatively

associated with a magnetic recording device. The recording device includes a pair of reels or spools 1 and 2 between which a recording medium 3 travels, the medium being wound around the barrel of each spool. In the illustrated instance, the medium is in the form of a paramagnetic wire, a very convenient form of medium because of a high recording capacity with little bulk in comparison with paramagnetic tape or some other form of elongated member. In travelling from spool 1 to spool 2, the recording and reproducing direction, the medium first passes through a level wind arrangement 4 associated with a spool 1, then over a guide pulley 5, and then through a unitary erasing and reproducing arrangement, generally indicated by numeral 6. As the medium passes through the arrangement 6, the medium is cleansed of any prior recording and magnetized in accordance with a new recording. The medium then passes over another guide pulley 7, through another level wind arrangement 8 and onto the reel 2. When it is desired to reproduce the recording from the medium, if the device is capable of both recording and reproduction, the medium is rewound onto the spool 1, and in the rewinding operation it is necessary that the erasing head be cut out so as not to remove the last recording from the medium. The medium then travels in the original direction from the spool 1 to the spool 2, and the recording head acts as a pick up to reproduce the recording from the medium through a suitable amplification and speaker system not illustrated in the drawings, the erasing head remaining out of circuit.

With reference more particularly to Figure 2, it will be seen that the arrangement of assembly 6 comprises both an erasing head and a magnetizing head. These two heads may, of course, be separate one from the other, but are preferably disposed relatively closely adjacent each other. In the illustrated instance, the two heads are combined in a unitary assembly in that the same paramagnetic core functions for both units. The core may be of any suitable shape, and a convenient shape is the overall substantially rectangular form as illustrated more clearly in Figure 2.

The portion of the core functioning for the erasing head includes an outside vertical leg 9, a lower horizontal leg 10, and a top leg split as indicated at 11 to provide a relatively wide non-magnetic gap and thus define confronting pole pieces 12 and 13 on either side of the gap. The core is completed by a middle vertical leg 14 which is common to both the erasing head and the recording head.

The portion of the core functioning for the recording head includes an outside vertical leg 15, a lower horizontal leg 16, and an upper leg split to provide a relatively narrow non-magnetic gap 17 defining confronting pole pieces 18 and 19 on either side thereof. The magnetic circuit is completed through the common middle leg 14.

With reference to Figure 3 it will be seen that a substantially V-shaped groove 20 extends entirely across the upper face of the core to form a path of travel for the recording medium 3, thus bringing the medium well within the concentrated flux areas between the pole pieces in the region of both non-magnetic gaps 11 and 17. As seen in Figure 2, the pole pieces may be beveled or cut off obliquely at their lower ends to more effectively concentrate the flux in the vicinity of the non-magnetic gaps.

Around the leg 10 of the erasing head portion

is a coil 21, one end of which may be connected through a conductor 22 to a suitable high frequency oscillator, diagrammatically illustrated at 23. The other end of the coil 21 may be connected through a conductor 24 embodying a suitable switch 25 to the oscillator 23. The switch 25 is for the purpose of disconnecting the erasing head when the recording medium is being rewound after a recording has been made, to prevent the removal of that recording. The high frequency oscillator 23 may embody its own source of power, or may be connected in the usual manner to any suitable or available source or supply.

Around the leg 16 of the recording head portion is a coil 26, the opposite ends of which may be connected by way of conductors 27 and 28 to an audio-amplifier and equalizer 29 which is in turn connected through conductors 30 and 31 to a microphone or equivalent pick-up device 32.

In operation, assuming that the recording medium is travelling from the spool 1 to the spool 2 and a recording is being made, the switch 25 is closed, and as the wire crosses the non-magnetic gap 11, the high frequency flux set up by the coil 21 in the vicinity of this gap will effectively demagnetize or clean the recording medium. The course of travel of the high frequency flux set up by the coil 21 in the core is indicated very diagrammatically by dotted lines 33. Some of this flux will stray and pass through the recording head portion of the core as indicated by dotted line 34. This stray high frequency flux is sufficient to provide the desired high frequency component in the recording head. Such component will, of course, be substantially constant. Whatever sound or impulse is to be recorded upon the medium 3 will be picked up by the microphone 32, passed through the audio-amplifier 29, and thence through the coil 26 thus imposing a variable audio component on the recording head in addition to the substantially constant high frequency component, and the recording medium is very effectively magnetized to record thereon the sound or impulses desired.

As stated above, it is not essential that the recording head and erasing head be associated with the same integral core, but each may have its own individual core and be entirely separate, one from the other. It is only necessary that they are placed in sufficiently close proximity that stray high frequency flux from the erasing head will enter the recording head and provide the desired high frequency component therein.

After a recording has been made, in the event the recording device is also capable of reproducing, it is simply necessary to rewind the medium from the spool 2 onto the spool 1. During this rewinding process the switch 25 is open, and the electrical switch associated wtih the recording head may also be open if desired, so that there will be no interference whatever with the recording on the medium. After the rewinding operation, the medium then may travel in its original direction from the spool 1 to the spool 2, and during this course of travel the switch 25 also remains open so as not to interfere with the recording on the wire, and the recording head functions as a pick up means for the reproduction of the previously made recording. Such reproduction will of course be through any suitable amplifying circuit to a loud speaker or other device to audibly or visibly indicate the impulses recorded upon the medium 3.

In Figures 4, 5 and 6, I have illustrated a re-

cording head and erasing head arrangement of somewhat different construction. Again, for purposes of convenience, an integral core for both the recording head and erasing head is shown. The structure of Figures 4, 5 and 6 provides certain advantages over the structure illustrated more clearly in Figure 2. The energizing coils or the equivalent are brought into closer proximity with the non-magnetic gaps so that the erasing or cleaning of the wire is a trifle more effective, and the recording is accomplished with added fidelity. Further, the construction of the arrangement is such as to resist wear due to the travel of the recording medium thereover. In the illustration for this arrangement, the recording and erasing head arrangement is shown in opposite position to that of Figure 2, namely, with the erasing head to the left and the recording head to the right. In recording or in reproducing, the recording medium 3 travels from left to right as seen in Figures 4 and 5.

In this arrangement, the core is a paramagnetic block 35 having an arcuate upper edge portion as indicated at 36. The core may be laminated or solid, as may be deemed most desirable. To provide the erasing head, the core is provided with a relatively deep and comparatively wide slot 37 establishing a non-magnetic gap. At the inner end of this slot an aperture 38 is provided transversely through the core and of sufficient size to establish confronting pole pieces 39 and 40 on either side of the slot. Disposed within the slot is a strip 41 of conductive material insulated in any suitable manner from the pole pieces 39 and 40. The upper face of the core or block 35 is channeled as indicated at 42 in Figure 6 and also centrally grooved as indicated at 43 to establish a path of travel for the recording medium 3. As also shown in Figure 6, the channeling of the upper edge of the core follows the arc 36. It will likewise be noted that the conductive insert 41 is channeled or cut in keeping with the upper face or edge of the core 35. The strip 41 functions substantially the same as the above described coil 21 in establishing a high frequency magnetic field through the erasing head portion of the core, but the strip 41 is much more economical to provide than is the coil 21. The use of the strip 41 disposed within the non-magnetic gap in a core is more fully set forth and claimed in a copending application.

Opposed ends of the strip 41 may be connected by way of conductors 44 and 45 to a high frequency oscillator 46. One of these conductors may have a switch 47 therein to open the circuit through the erasing head during a rewinding and reproducing operation.

For the recording head, the block 35 is provided with another slot 48, comparatively narrow with reference to the erasing head slot 37. At the inward termination of the slot 48 an aperture 49 is provided to establish pole pieces 50 and 51 on either side of the slot. This slot, of course, provides a non-magnetic gap. In this non-magnetic gap a conductive insert 52 is placed, of the same general character as the previously described insert 41. Opposite ends of the insert 52 may be connected through conductors 53 and 54 to an audio-amplifier and equalizer 55 which is in turn connected through conductors 56 and 57 to a microphone or equivalent pick up device 58.

The operation of the structure shown in Figures 4, 5 and 6 is substantially similar to the operation of the structure described in connection with the showing in Figures 2 and 3. The high

frequency flux developed in the erasing head portion by virtue of the insert 41 will effectively demagnetize or cleanse the recording medium. Some of this flux will stray and provide a high frequency component in the recording head portion, as above described. Having both the erasing head and recording head energized in the immediate vicinity of the non-magnetic gaps and in the immediate vicinity of the recording medium results in somewhat better operation in that the erasing is more effective, and the recording may be accomplished with higher fidelity. The arcuate shape of the upper portion of the core 35 provides a greater surface of travel for the recording medium 3, which in most instances is of harder material than the core. Thus, there is less likelihood of objectionable wear on the core caused by the travel of the recording medium thereover.

In Figures 7 and 8 I have illustrated still another magnetizing head and erasing head arrangement, and in this instance the arrangement is such as to permit travel of the wire in either direction for the purpose of recording or reproducing.

In this instance, a core 59 is provided of the same general shape as the above described core 35. In the central region of this core a relatively narrow non-magnetic gap is provided and in this gap a conductive strip 60 is inserted to provide a recording head. Opposite ends of this insert 60 may be connected by way of conductors 61 and 62 to an audio-amplifier and equalizer 63 which is in turn connected through conductors 64 and 65 to a microphone or equivalent pick up device 66.

On opposite sides of the non-magnetic gap in which the strip 60 is inserted similar but comparatively wider gaps are provided, these gaps having inserts 67 and 68 therein. Thus, an erasing head is provided on each side of the centrally disposed recording head. One end of the insert 67 may be connected through conductor 69 to a high frequency oscillator 70. The other end of the insert 60 may be connected through conductor 71 to a double throw switch 72 in turn connected by conductor 73 to the high frequency oscillator. The other insert 68 may have one end connected to conductor 69 by conductor 74, and its opposite end connected by conductor 75 to the opposite terminal of the switch 72.

During a rewinding or reproducing operation, the switch 72 is left in neutral position as illustrated in Figure 8, so that both erasing heads are de-energized. During a recording operation, assuming that the medium 3 is traveling from left to right as seen in Figure 8, the switch 72 may be closed with the conductor 71 so as to energize the left-hand erasing head, leaving the right-hand erasing head de-energized. When the wire travels in the opposite direction, from right to left, and a recording is desired to be made, the switch 72 is thrown in the opposite direction to close with conductor 75 and energize the right-hand erasing head, leaving the left-hand erasing head de-energized.

From the foregoing, it is apparent that I have provided a novel erasing head and recorder head arrangement for a magnetic recording and reproducing device, the arrangement being such that only audio current be fed to the recording head, and yet the recording head is provided with a desired high frequency component resulting from stray flux from the erasing head. It will be noted that with the arrangement so provided, the re-

cording medium may travel in either direction for recording purposes. It will be appreciated that the present invention is highly economical to use, and may be installed in extremely small space.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a magnetic recording device, a recording head to magnetize a recording medium in accordance with impulses to be recorded, an erasing head on each side of said recording head each capable of demagnetizing the medium, and means to selectively de-energize said erasing heads, an integral magnetizable core serving all three heads.

2. In a magnetic recording device, a recording head to magnetize a recording medium in accordance with impulses to be recorded, an erasing head on each side of said recording head each capable of demagnetizing the medium, means to selectively de-energize said erasing heads, means to energize each erasing head with high frequency current, means to energize said recording head with audio current, and said recording and erasing heads being disposed sufficiently closely together that stray high frequency magnetic flux from either erasing head will provide a useful high frequency component in the recording head.

3. In a magnetic recording device, a recording head to magnetize a recording medium in accordance with impulses to be recorded, an erasing head on each side of said recording head each capable of demagnetizing the medium, and means to selectively de-energize said erasing heads, means to energize each erasing head with high frequency current, means to energize said recording head with audio current, and an integral magnetizable core serving all said heads.

4. In a magnetic recording device, an erasing head, a recording head, means to supply high frequency current to said erasing head, means to supply audio current to said recording head, and an integral magnetizable core serving both said heads.

5. A combination unit for a magnetic recording device, including an integral core shaped to define both a magnetizing head portion and an erasing head portion, and means for separately energizing said core portions.

6. A combination unit for a magnetic recording device, including an integral core shaped to define both a magnetizing head and an erasing head, means to impart high frequency energization to the erasing head, and means to impart only audio current to the recording head, stray flux from the erasing head providing a high frequency component in the recording head.

7. A combination unit for a magnetic recording device, including an integral core having spaced non-magnetic gaps therein one of which is wider than the other, means to energize the core around the wider gap with high frequency current, and means to energize the core around the other gap with audio current only, stray flux providing a high frequency component around said other gap.

8. A combination unit for a magnetic recording device, including an integral core having spaced non-magnetic gaps therein, means to energize the core around the wider gap with high frequency current, and means to energize the core around the other gap with audio current only.

9. In a magnetic recording device, a recording head including a magnetizable core, means for energizing said core by audio current, means in said device energizable with high frequency current, and said core being disposed in such proximity to the second said means that stray magnetic flux will provide a useful high frequency component in said core.

10. In a head for a magnetic recording device, a core of magnetizable material having a bounding arcuate edge, said core having a plurality of spaced transverse slots extending inwardly from said arcuate edge to define non-magnetic gaps, said arcuate edge having a groove therein to provide a track for a travelling recording medium passing over said gaps, and means to separately magnetize said core in the vicinity of each gap.

11. In a head for a magnetic recording device, a core of magnetizable material having a bounding arcuate edge, said core having a plurality of spaced transverse slots extending inwardly from said arcuate edge to define non-magnetic gaps, said arcuate edge having a groove therein to provide a track for a travelling recording medium passing over said gaps, and means to separately magnetize said core in the vicinity of each gap, said gaps being disposed on either side of the high point of said arcuate edge.

12. In a head for a magnetic recording device, a magnetizable core having a bounding arcuate edge of a length greatly exceeding the thickness of the core transversely of said edge, said arcuate edge having a groove extending lengthwise thereof to define a track for a recording medium, said core having a transverse slot leading inwardly from said edge to provide a non-magnetic gap through which a medium following said track must pass, and means for magnetically energizing said core to cause the formation of magnetic poles of opposite polarity separated by said gap.

MARVIN CAMRAS.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
789,336	Poulsen	May 9, 1905
2,263,485	Clopton	Nov. 18, 1941
2,277,305	Clopton	Mar. 24, 1942
1,883,561	Chipman	Oct. 18, 1932
2,351,007	Camras	June 13, 1944
2,265,831	Woolridge	Dec. 9, 1941

FOREIGN PATENTS

Number	Country	Date
584,276	German	1929
779,642	French	1935
457,282	German	1928