July 12, 1949. M. CAMRAS 2,475,694

NONTWISTING PARAMAGNETIC RECORD WIRE

Filed March 29, 1944

Fig-2

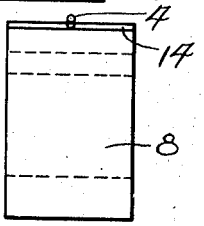


Fig-3

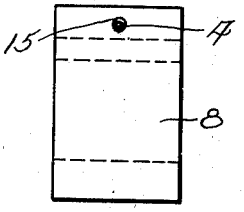


Fig-4

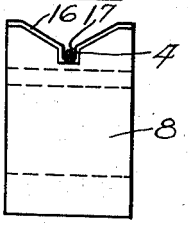


Fig-6

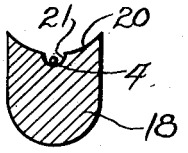


Fig-1

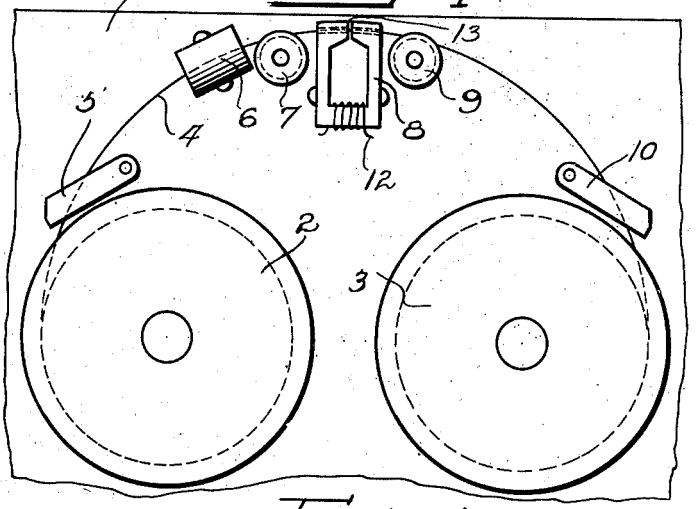


Fig-5

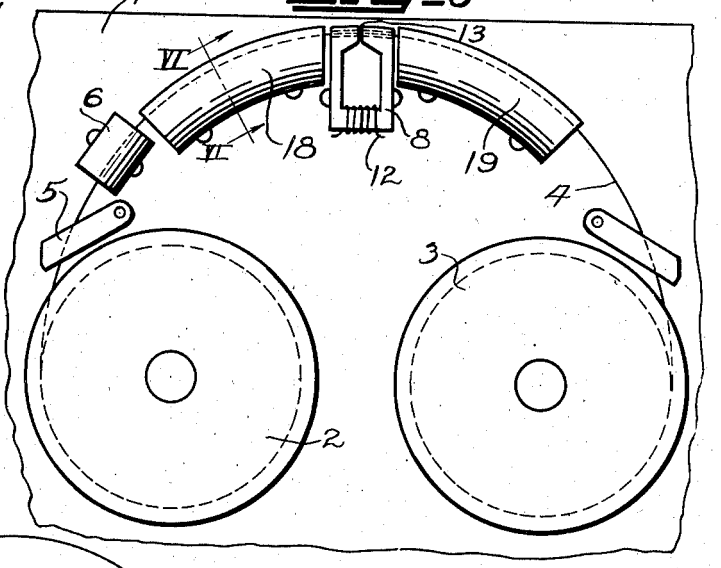
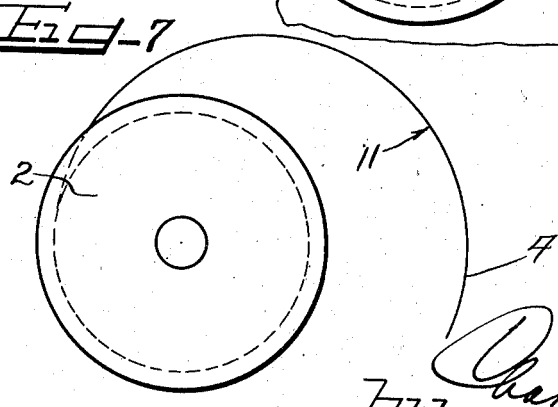


Fig-7



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Patented July 12, 1949 2,475,694

UNITED STATES PATENT OFFICE

2,475,694

NONTWISTING PARAMAGNETIC RECORD WIRE

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Application March 29, 1944, Serial No. 528,530

1 Claim. (Cl. 274—41.7)

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The present invention relates to improvements in recording mediums for magnetic recording or reproducing devices, and more particularly concerns an improved paramagnetic wire which effectually resists twisting in traveling across an electromagnetic transducer head of any such device.

In the past, difficulty has often times been experienced in connection with magnetic recording and reproducing devices by virtue of the fact that the recording wire would turn or rotate about its own axis during its travel over the recording or reproducing head. In most cases such rotation of the wire would lessen the fidelity of reproduction, and in many cases, it had such a deleterious effect that reproduction was unsatisfactory if not at times wholly obscured. Sometimes during the recording process, the wire did not become magnetized entirely therethrough, but only along one side thereof, and in the event the wire rotated about its own axis during reproducing so that the unmagnetized or lightly magnetized side of the wire would be disposed adjacent the reproducing head, reproduction would materially suffer. Further, such rotation of a recording wire frequently interfered with the proper travel of the wire through the instrumentalities of the device or intefered with the level winding of the wire upon the spools. Likewise, turning and twisting of the wire would naturally shorten its life.

With the foregoing in mind, it is an important object of the present invention to provide a wire for a magnetic recording or reproducing device which is in and of itself adapted to eliminate a tendency of the wire to rotate or turn about its own axis during use.

Still another object of the invention resides in the provision of a paramagnetic wire for use in a magnetic recording or reproducing device, which wire is provided with a set or permanent curvature therein.

Still a further object of the invention resides in the provision of a paramagnetic wire for use in connection with magnetic recording or reproducing devices, which wire may travel directly through an opening in a recording or reproducing head, through a groove in said head, or along the top of the head and still be effectively magnetized during a recording, and provide a satisfactory reproduction.

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,

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taken in conjunction with the accompanying drawing, in which:

Figure 1 is a fragmentary front elevational view of a magnetic recording or reproducing device including a paramagnetic recording wire embodying the principles of the instant invention.

Figure 2 is an end elevational view of one form of a recording or reproducing head usable with the device of Figure 1, illustrating the association of the recording wire with that head;

Figure 3 is a view of the same character as Figure 2, but illustrating a different form of head usable with the device of Figure 1;

Figure 4 is a similar view, but showing a still different form of the recording or reproducing head;

Figure 5 is a fragmentary front elevational view of a recording or reproducing device of somewhat different construction than that illustrated in Figure 1, but employing the same recording medium and embodying principles of the instant invention;

Figure 6 is a traverse vertical sectional view through the guide means in Figure 5, taken substantially as indicated by line VI—VI of Figure 5, looking in the direction of the arrows; and

Figure 7 is a somewhat diagrammatic elevational view of one of the reels or spools upon which the recording wire is wound, with a portion of the wire extending free of the spools to illustrate the set curvature in the wire.

As shown on the drawings:

In that illustrated embodiment of the invention seen in Figure 1, there is shown a magnetic recording or reproducing device including a panel or supporting structure 1 upon which a pair of spaced spools or reels 2 and 3 are mounted. These reels 2 and 3 carry a fine paramagnetic or magnetizable recording wire 4 of substantially round cross-section. The wire has its end portions engaged around the barrels of the spools and may be wound from one spool to the other. In most instances, the wire will be wound off spool 2 and onto spool 3 during the making of a recording, and also during reproduction of a previously made recording. The wire travels in the reverse direction, namely, from spool 3 to spool 2 during a rewinding operation.

As the recording wire travels in the forward direction, from spool 2 to spool 3, it first passes through a level winding arrangement 5, then through the field of an erasing head 6 which may be in the form of a coil or the equivalent through which high frequency current is passed to demagnetize or clean the recording wire. The

erasing head is, of course, disposed in advance of the recording head. Following the erasing head, the wire passes over a guide pulley 7, across a recording head 8, over another guide pulley 9, through another level winding arrangement 10, and onto the spool 3.

The recording wire 4 is arranged to inherently resist a tendency to rotate or turn about its own axis during its travel from one of the spools to the other. In the illustrated instance, the recording wire is so arranged by virtue of having a set or permanent curvature of proper constant radius in the wire, as indicated by numeral 11 in Figure 7. The curvature may be put in the wire in any suitable or desired manner, such, for example, as drawing the wire through a curve imparting die, or heating the wire around a curved surface and quenching the same, or in some other suitable manner. As indicated in Figure 7, whenever a portion of the wire is free from the spools or guide means, that portion of the wire will tend to assume a definite curvature, and that curvature will remain in the wire, regardless of the winding of the wire back and forth from one spool onto the other. In fact, the preset curvature runs continuously in one direction throughout the effective length of the wire. With such a curvature present, the wire will not tend to rotate or turn about its own axis during its travel, but the material of the wire will always resist deviation from a longitudinal plane and tend to follow a path in keeping with its own inherent curvature.

With reference to Figure 1, it will be noted that the wire travels a curvate path between the reels 2 and 3 in keeping with the set curvature in the wire itself. The guide pulleys 7 and 9 are so disposed relatively to the recording or reproducing head 8 so as to maintain that path of travel. Consequently, in each longitudinal section of the wire throughout its effective length as the wire passes the transducer head 8 the wire will always present the same side or always assume the same position relatively to the head 8. This is true whether the wire 4 travels over the head during a recording, or travels over the head during a reproduction.

The transducer head itself comprises a core of paramagnetic material, laminated or otherwise, as may be most desired. Around a leg of this core a coil 12 is disposed to energize the head 8 during a recording operation, or to enable the head to act as a pick-up member during a reproduction operation. The core is divided in that portion of the head associated intimately with the recording medium to provide a non-magnetic gap 13 defining confronting pole pieces. It is in the vicinity of that non-magnetic gap that magnetization of the medium occurs or that impulses are picked up by the head from the magnetization in the medium during a reproduction operation. The same head 8 is used both for recording and reproducing. In the first instance, the head magnetizes the medium in accordance with fluctuating electrical energy to be recorded. In the second instance, the head acts as a pick-up member and functions in response to impulses set up in the head by the magnetization on the recording medium. Hereinafter, therefore, and in the appended claim wherever the head 8 is referred to as a transducer or recording head, it will be understood that the head may equally as well be a reproducing head.

The head 8 is preferably formed arcuately in the upper portion thereof, if feasible, in keeping with the curvature of the recording medium. Where the recording head has an aperture through the pole pieces, it may not always be feasible to curve that aperture in keeping with the recording medium, and in such event, a straight aperture will function satisfactorily. Where the head has no top formation, other than perhaps a shallow guiding groove, and where the head is definitely grooved in its upper face, the portions of the head contacted by the recording medium may be curved in keeping with the medium.

In Figure 2, I have illustrated the use of the recording medium with a recording head 8 having a relatively smooth upper surface 14. Here, the medium 4 will travel over the upper face of the recording head, or in a shallow guiding groove in that head, but still it may be sufficiently magnetized to make a recording. Likewise, by virtue of the fact that it will not change the position it had relatively to the recording head during the recording process when traveling over that head for reproduction purposes, a satisfactory reproduction will be had from the medium. On the contrary, in the event the medium were permitted to rotate about its own axis, there would be points in the reproduction of less fidelity than other points, and possibly even points where the reproduction would be utterly obscure.

In Figure 3 I have shown the use of the recording medium with a set curvature in connection with a recording head of a high fidelity type. In this instance, the head has an aperture directly through the pole pieces, this aperture being preferably of just sufficient size to permit free passage of the recording medium therethrough. With a head of this type, all portions of the medium are effectively magnetized during a recording operation, and likewise all portions of the medium will set up a corresponding response in the head during a reproducing operation. With a head of this character, the set curvature in the recording medium is not as necessary as with a head of the character shown in Figure 2, but nevertheless, if the medium maintains the same position relatively to the head at all times, the reproduction will be better to some degree than if the recording medium is permitted to rotate about its own axis. It is preferable, if possible, to have the aperture 15 curved in keeping with the curvature of the recording medium.

In Figure 4, I have illustrated a recording head having a groove in the pole pieces through which the recording medium may travel. In this instance, the groove is preferably wider at the top as indicated at 16, and deeper and narrower in the central portion as indicated at 17. It is through this deeper portion that the recording medium travels. This arrangement insofar as fidelity is concerned, is between the arrangement of Figures 2 and 3. With the head of Figure 4, the maintenance of the medium in the same position at all times relatively to the recording head results in reproduction of higher comparative fidelity than is the case with the head of Figure 3. That is, with the showing in Figure 4, there will be a more noticeable difference in results between a recording medium having a constant position relatively to the head and a medium which is permitted to rotate about its axis, than is the case with the head of Figure 3.

In operation, the recording medium travels from the spool 2 to the spool 3 during a recording operation and by virtue of the coil 12, energized by other suitable equipment not forming a par

of the instant invention, the medium is magnetized in accordance with fluctuating electrical energy desired to be recorded.

During this operation, the medium 4 does not rotate about its own axis. After the recording, the medium may be rewound in the reverse direction back upon the spool 2. Then, with the erasing head 6 cut out, the medium may again travel in a forward direction, and this time the head 8 acts as a pick-up element rather than a magnetizing element. Again, during the reproducing operation, the recording medium maintains the same position relatively to the recording head that it maintained during the recording operation. Reproduction, therefore, is of higher fidelity than would otherwise be the case.

In Figures 5 and 6, I have illustrated a different arrangement of guiding means for the recording medium. In this instance, the apparatus is the same as above described, including the medium itself, with the exception that the guide rolls 7 and 9 are dispensed with, and guiding means in the form of curvate channel members 18 and 19 are employed. These members are identical in construction but disposed on opposite sides of the recording head 8. Each of the guide members 18 and 19 is preferably formed of non-magnetic material, a suitable plastic substance being satisfactory for this purpose. The guide members are curved preferably in accordance with the set curvature in the recording medium.

With reference more particularly to Figure 6, it will be seen that each guide member is provided with a channel formation in its upper surface including a relatively wide and gently sloping outer portion 20, with a deeper central portion 21 having abruptly sloping walls. It is in the deeper central portion that the recording medium travels. The shape of the upper part of the guide member enables the recording medium to be very easily threaded into operative association with the guide member. The guide members 18 and 19 materially aid in preventing rotation of the recording medium about its own axis, even though that medium did not have any set curvature in it, by defining a curvate path for the medium to travel. Thus, there is not only a set curvature in the recording medium itself whereby it inherently resists rotation or turning about its own axis, but the guiding arrangement upon the recording or reproducing device also tends to prevent turning of the recording medium about its own axis during travel, and

with the combined effect the medium is substantially positively maintained at all times in the same relative position with respect to the recording or reproducing head.

It will be further appreciated that the instant invention is extremely economical to acquire, it being of relatively negligible expense to provide either the guiding arrangement or to provide the set curvature in the medium itself. Further, the invention is highly durable, the guiding means being subject to nothing but wear by virtue of the medium traveling thereover, and the set curvature in the medium remaining throughout its life. Consequently, the invention is simple and economical both in manufacture and use.

I claim as my invention:

A lengthy thin paramagnetic record wire for use in a device of the type wherein a paramagnetic record wire travels from one spool to another across an electromagnetic transducer head having confronting pole portions to receive said wire and defining a nonmagnetic gap, said wire being of substantially round cross-section, and having a permanent preset curvature of substantially constant radius and running continuously in one direction throughout the effective length of the wire, the preset curvature being such that in each longitudinal section of the wire throughout said effective length as the wire passes across the transducer head the material of the wire resists twisting deviation from a longitudinal plane, whereby throughout travel across the transducer head the same side of the wire is presented substantially uniformly to the transducer head.

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