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MAGNETIC RECORDING APPARATUS

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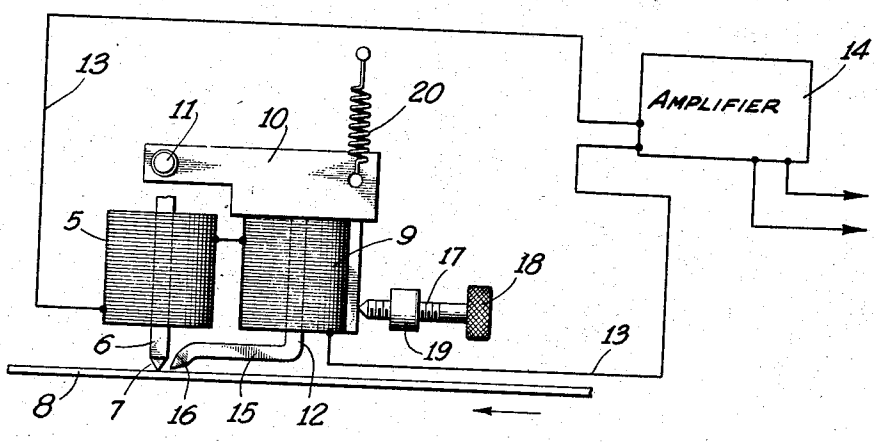


Fig. 1.

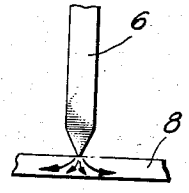


Fig. 2.

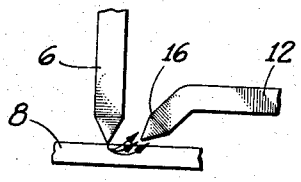


Fig. 3.

Inventor

Joseph B. Walker

By Joseph F. Westall

Attorney

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MAGNETIC RECORDING APPARATUS

Joseph B. Walker, Los Angeles, Calif.

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3 Claims. (Cl. 179—100.2)

This invention relates to magnetic recording apparatus and contemplates a recording magnet energized by a speech current to impress a magnetic pattern corresponding to the current upon steel tape, cylinders, disks, or other suitable recording media previously conditioned by a polarizing current.

Several methods of magnetic recording on steel wire or tape have been devised in the art prior to my invention. It has been common practice to use a pair of pole pieces placed on opposite sides of the recording medium and offset longitudinally of the tape or wire with respect to one another. This method of recording is known as longitudinal magnetism. The speed required of the tape or wire in order to record high frequencies greatly restricts the commercial possibilities of this system due to the tendency of the tape to rapidly wear away the pole pieces, and, of greater significance, makes it extremely difficult if not impossible to maintain uniformity of contact between the pole pieces and the recording medium. These variations of contact introduce excessive noise, and variably affect the magnetic reluctance of the flux path with a consequent variance in signal strength.

Steel tape has largely superseded wire as a recording medium as it is easier to control. Moreover the tendency of wire to rotate about its axis causes distortion of the signal which is difficult to overcome. The use of steel tape has another advantage in that it permits the use of the perpendicular method of magnetism in which the direction of the magnetism is substantially perpendicular to the surface of the tape. With the latter method high frequencies may be recorded with relatively low linear tape speed. In all such methods a certain amount of signal distortion will result from the spread of the signal flux in the medium. If the recording poles are disposed opposite one another in contact with the surfaces of the tape with only the thin dimension of the tape therebetween, the spread of the flux may be reduced.

However, in recording upon disks or cylinders the reduction in the spread of the flux cannot be obtained so readily with prior art methods and apparatus due to necessary thickness of the cylinder or disk separating the pole pieces.

It is the principal object of the present invention to provide apparatus comprising a single recording magnet having the pole piece thereof in contact with the recording medium, in combination with auxiliary means for confining the magnetic flux of the recording magnet to a relatively small area in the recording medium to enable high frequency recordation with relatively slow movement of the medium whereby more clearly defined signals may be recorded and reproduced.

More specifically, it is an object to provide a pole piece of polarity opposite to that of the recording pole juxtaposed adjacent and at the same side of the recording medium as the last named pole, but out of contact with the recording medium to deter by its counter-attraction the spread of the flux in the latter.

Another object is to provide a magnet comprising a coil and pole piece carried pivotally, and preferably at the side of the recording magnet from which the recording medium approaches, for movement toward and away from the point of contact of the recording pole piece with the recording medium, to vary the attraction of the first named pole to conform to variations in magnetic flux density.

Another object is to provide means for controlling the position of the auxiliary magnet for detering the spread of the flux produced in the medium by the recording magnet to facilitate adjustment and maintenance of the relationship between these elements most conducive to sharply defined recordation.

Other objects and salient features of my invention will be apparent from the following description read in the light of the accompanying drawing in which:

Fig. 1 is a diagrammatic view in plan of the apparatus adjusted as in use;

Fig. 2 is an enlarged elevation of the recording pole piece and tape, partially broken away, illustrating the spread of the flux in the latter, in the absence of the improvement of my invention;

Fig. 3 is a view in elevation, similar to Fig. 2, depicting the effect of the magnetic attraction of my auxiliary pole piece and magnet on the flux in the recording medium produced by the recording magnet.

Referring to the drawing more in detail the numerals of which indicate similar parts throughout the several views, 5 designates the recording magnet comprising a pole piece 6, rectangular in cross section and tapered to an edge 7. The pole piece 6 is arranged perpendicular to the recording medium, 8 e. g., steel tape, as in the embodiment illustrated. The magnet 5 is supported and tape 8 is moved and guided into contact with the edge 7 of pole piece 6 by any suitable means, which, forming no part of the present invention, is not illustrated or described.

A second magnet 9 is carried by a base member 10 pivoted at 11 to a suitable mounting (not shown) for a purpose later referred to. The coil of magnet 9 is wound in a direction opposite to the magnet 5 so that the pole piece 12 of magnet 9 is of opposite polarity to that of the pole piece 6.

The magnets 5 and 9 are arranged in the same circuit by wires 13, carrying the signal current, leading from amplifier 14.

The pole piece 12 of magnet 9 is laterally extended as at 15 and terminates in an oblique end 16 disposed in an arc having its center on the point of pivoting 11 of the magnet base 10 and passing through the point of contact between the recording pole piece 6 and the tape 8 whereby the auxiliary magnet 9 may be swung on its pivot 11 to move the end portion 16 of pole piece 12 toward or away from the tape-contacting end 7 of pole piece 6 of the recording magnet 5.

An adjusting screw 17 having a knurled head 18 is threaded through a suitably located lug 19 to contact the side of the casing of magnet 9 opposite to the side thereof at which the recording magnet 5 is disposed to move pole piece 12 toward the tapered end 7 of the pole 6. A helical spring 20 having one end thereof secured to a mounting (not shown) and its opposite end attached to the magnet 9 exerts tension on the latter tending to retain the auxiliary magnet against adjusting screw 17.

The operation of my invention is briefly described as follows:

It will be assumed that tape 8 or other recording medium is first conditioned by a polarizing current supplied by suitable means producing a biasing flux, forming no part of the present invention. It is preferable that the previous magnetization of the recording medium is in a direction perpendicular to the surface of the medium.

The magnetic impulses corresponding to the signal vibrations will be impressed in a magnetic pattern on tape 8 by the pole piece 6, suitable means being provided, as heretofore mentioned, for moving the tape at right angles to and in contact with the tapered end 7 of the recording pole piece so as to transmit different signal impulses to portions of the tape successively brought into contact with recording pole 6. It will be observed that the spread of the magnetic flux in the tape, which correspondingly disperses each signal impulse through a surrounding portion of the tape varying in size in proportion to the magnetomotive force and the permeance of the circuit, tends to preclude the impression of a clear magnetic representation of distinct signals. Confusion of the signal impressions may be largely avoided by either moving the tape across the recording pole piece with sufficient speed to prevent overlapping of the signal impressions or to confine the flux incident to each impulse to a smaller area on the tape. For high frequency recordation it is of course important to confine the flux as far as possible in order to avoid the mechanical disadvantages incident to excessive speed of the tape as heretofore described.

The pole 12 of opposite polarity to that of the recording pole 6, moved into close proximity to the point of contact of the recording pole 6 and tape 8 will attract the magnetic impulses received by the tape so as to restrict the spread of the flux through the tape. It will be observed from an examination of Fig. 3 and comparison thereof with Fig. 2 that the spread of the flux through the tape in the direction of the movement of the latter will be deterred while the flux tending to spread in the opposite direction will be similarly attracted and confined by the pole piece 12. Distinct magnetic impressions capable of reproduction which are impressed on the tape will thus be confined to relatively small areas of the tape and tendency of the magnetic impressions to blend as a result of the spread of the flux with consequent confusion of signals when reproduced, will be minimized.

By the threaded adjustment of screw 17, the pole piece 12 may be moved as close to the point of contact of the recording pole piece 6 and tape 8 as desired, or permit spring 20 to draw the pole piece 12 away from the point on the tape from which the magnetic flux emanates. Ordinarily the preferred position of pole piece 12 is with the end portion 16 thereof in as close proximity with the point of recordation as possible but out of contact with both pole 6 and tape 8. The auxiliary pole piece 12 may, if desired, be located at the opposite side of pole 6 with respect to the direction of movement of the recording medium.

It will be understood that while I have shown but one embodiment of my invention other structures commonly employed in the art may be combined herewith to enable more facile and effective use of the inventive features, and numerous changes in size, design, number and proportion of the various parts may be made, and further that any conventional adjusting means may be substituted for the screw and spring assembly for determining the position of the pole piece 12 with respect to the recording pole 6 if desired, and that the relation of the magnets 5 and 9 and the shape of the pole pieces 6 and 12 be varied to meet specific requirements—all without departing from the spirit of my invention.

In the following claims the term "recording medium" is intended to mean a steel tape or a disk or cylinder.

What I claim and desire to secure by Letters Patent is:

1. In a device of the character described, a recording medium, a magnet having a pole piece in contact with said recording medium, a second magnet having a second pole piece of opposite polarity from that of the first-named pole piece, means to pivotally support said second magnet with a protruding end of said second pole piece movable in an arc passing through the point of contact of said first-named pole piece and the recording medium.

2. In a device of the character described, a recording medium, a magnet having a pole piece in contact with said recording medium, a second magnet having a second pole piece of opposite polarity from that of the first-named pole piece, means to pivotally support said second magnet with a protruding end of said second pole piece movable in an arc passing through the point of contact of said first-named pole piece and the recording medium, and means to vary the proximity of the second pole piece to said point of contact.

3. In a device of the character described, a recording medium, a recording and reproducing magnet having a pole piece, means to supoprt said magnet with said pole piece adjacent one side of said recording medium, a second magnet having a pole piece of opposite polarity from that of said first-named pole piece disposed on the same side of said recording medium as said first-named magnet, means to move said recording medium relative to said pole pieces, and means to support said magnets with respect to one another to normally maintain said second pole piece adjacent to said first-named pole piece and spaced from the latter in the direction from which movement of said recording medium proceeds.

JOSEPH B. WALKER.