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C. N. HICKMAN

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TELEGRAPHONE

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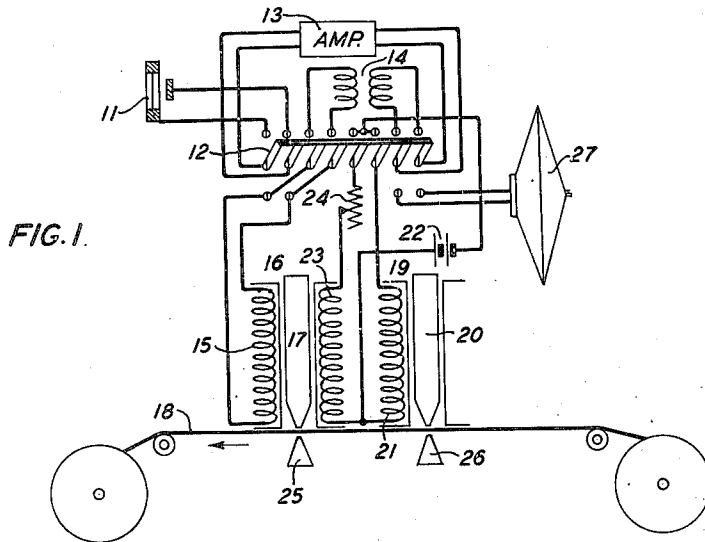
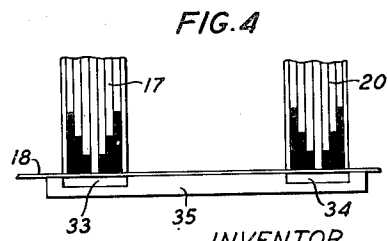
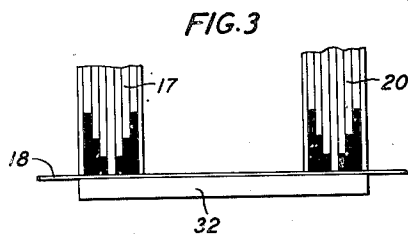
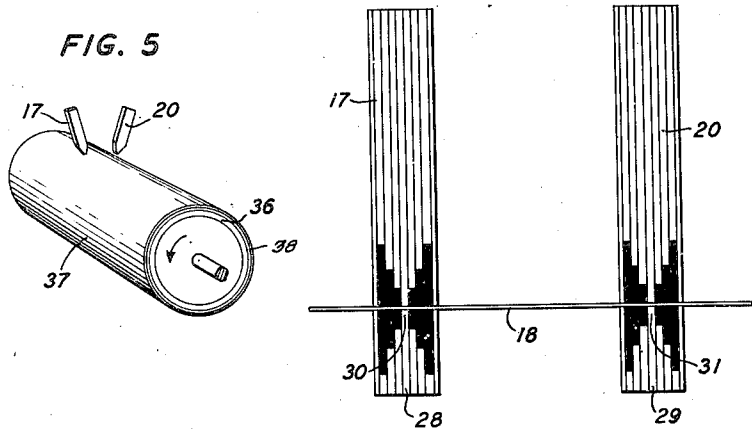


FIG. 2



INVENTOR
C. N. HICKMAN
BY
G. M. Campbell
ATTORNEY

UNITED STATES PATENT OFFICE

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TELEGRAPHONE

Clarence N. Hickman, Jackson Heights, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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This invention relates to magnetic telegraphone systems and the object of the invention is a system of this type which is capable of high quality reproduction with a single pole-piece.

Telegraphones comprising a single pole-piece contacting a wire record member are very old in the art as shown for example by Patent 788,728 to Poulsen May 2, 1905. In these prior systems, however, the flux spreads along the wire and produces what is commonly known as longitudinal magnetization. Records of this type have also been made by using two pole-pieces spaced along and on opposite sides of the wire. These longitudinal magnetization systems in general do not give as good quality as can be obtained by means of perpendicular magnetization and the single pole-piece system is particularly deficient in high frequencies. A perpendicular system comprising a very thin tape of high retentivity and pole-pieces with thin pole tips in accurate alignment on opposite sides of the tape is shown in Patent 1,944,238, granted to me January 23, 1934. While this latter system gives good quality and satisfactory efficiency, in some cases space requirements or other considerations make it impractical to use two opposed pole-pieces. It will be noted that in my prior patent the expression "transverse magnetization" was used in describing this system but since "transverse" has been applied to a system in which the flux flows laterally across a tape the term "perpendicular" is now used to designate a system in which the flux flows through the thickness of the tape.

According to this invention perpendicular magnetization is obtained with a single pole-piece by using a highly permeable material of low retentivity on the side of the highly retentive record member opposite the pole-piece to concentrate the flux in a path perpendicular to the surface of the member. This permeable material may be in the form of a thin stationary block opposite the pole-piece or it may consist of a continuous backing which moves with the member. In either case the thickness of the block or layer of backing material may be very much less than the length of the companion pole-piece ordinarily used so that the invention is particularly adapted for telegraphone applications in which the space available back of the record member is very small.

When the record member is very thin, such as of the order of 1 mil and the pole-piece contacts the tape no appreciable spreading of the flux occurs so that, in a system using a stationary block the surface of the block against the tape may

be large as compared with the area of the pole tip and accurate alignment of the block with the pole tip is not required.

When the record member is operated at high speeds it is desirable to mount the pole-piece and the stationary backing block (when used) out of actual contact with the member to keep the noise and wear within permissible limits. Particularly when high speeds are used the record member may be of the order of 10 mils thick and when either or both of the above conditions obtain the flux path is considerably longer so that spreading of the flux is more effectively prevented by tapering the block and accurately aligning the tip portion with the tip of the pole-piece.

The block is preferably composed of a material of high resistivity such as chrome permalloy or molybdenum permalloy to keep the eddy current losses small and, when necessary, this loss may be further reduced by suitably laminating the block in a manner similar to that used for the pole-piece.

In the drawing Fig. 1 is a diagram of a telegraphone system according to the invention;

Fig. 2 is a detail view showing tapered, laminated backing blocks adapted to contact the tape;

Fig. 3 shows a single backing block for both the polarizing and the translating pole-piece;

Fig. 4 shows a non-magnetic piece having magnetic backing block inserts; and

Fig. 5 shows one type of recording member having backing material which moves with it.

In the system of Fig. 1 the microphone 11 generates currents corresponding to the sounds to be recorded and when the switch 12 is closed upwardly these currents pass through an amplifier 13 and a transformer 14 to one winding 15 of a translating magnet 16 and set up an alternating flux in the pole-piece 17. The record member 18 is moving from right to left as indicated and, as it passes the polarizing magnet 19, is highly magnetized to erase any previous history by a steady flux in the pole-piece 20 set up by a current flowing in the winding 21 from the battery 22. The depolarizing winding 23 of the translating magnet 16 is connected to the battery 22 through a variable resistor 24 to produce a flux in the pole-piece 17 in the opposite direction and bring the record member 18 to the proper magnetic condition to receive the record as explained more fully in the patent referred to above.

The record member is therefore first polarized by the magnet 19 and then subjected simultaneously to both a depolarizing and a signal flux by the magnet 16. In the system of my earlier pat-

ent companion pole-pieces were used with their pole tips directly opposed to insure perpendicular magnetization of the record member. When the space available behind the member is very small or when cylindrical or disc type record members are used it is sometimes very inconvenient or impossible to use the companion pole-piece construction. In such cases it is found that small magnetic backing blocks 25 and 26 disposed under the tape opposite the tips of the pole-pieces 17 and 20 will prevent the flux from these pole-pieces from spreading along the tape and cause it to pass directly from the pole-piece tips through the tape in a perpendicular direction. In a high speed system it is desirable to operate without actual contact with the member but even in these cases the flux will be concentrated in a very short element of the member to produce true perpendicular magnetization if the blocks 25 and 26 are tapered and their tip portions accurately aligned with the pole tips as shown in Fig. 1.

When the switch 12 is closed downwardly the polarizing and depolarizing windings 21 and 23 are deenergized and when the magnetized member 18 again passes the pole-piece 17 a flux varying in accordance with the recorded signal is produced therein which induces corresponding currents in the winding 15. A circuit from the winding 15 now extends through the amplifier 13 to the receiver 27 which reproduces the original sounds.

Fig. 2 shows in detail the preferred construction of the pole-pieces 17 and 20 and backing blocks 28 and 29 which may be used instead of those shown in Fig. 1. The pole-pieces are identical with those shown in Patent 2,003,968 granted to C. N. Hickman and E. C. Wente, June 4, 1935, and the blocks 28 and 29 may be short sections of similar construction which require much less space than would a full companion pole-piece with its associated coil. The tips 30, 31 of these blocks may be accurately aligned by means of suitable guides with the tips of the pole-pieces to insure true perpendicular magnetization and as stated above the laminated construction and the high resistivity of the permalloy of which the laminations are made keep the eddy current losses in the blocks very small.

Figs. 3 and 4 show other forms of backing blocks which are particularly well adapted to cases where the available space is very small. In Fig. 3 a single block 32 is used for both pole-pieces 17 and 20. Since both the tape 18 and tips of the pole-pieces are very thin the flux will not spread appreciably so that substantially true perpendicular recording is obtained. In Fig. 4 small magnetic inserts 33 and 34 are used as the backing blocks and the two blocks are held in proper spaced relation by a non-magnetic piece 35. In the construction of Figs. 3 and 4 the blocks are relatively large compared with the pole tips so that accurate alignment is not required to obtain perpendicular magnetization.

Fig. 5 shows one type of record member having permeable backing material moving with it. The body 36 of the cylinder may be of chrome permalloy, molybdenum permalloy or other suitable material of high permeability and low retentivity and the recording surface 37 is a thin layer of chrome steel or other suitable recording material. In a system of this type it is important that the backing material be of uniform mag-

netic properties for any appreciable variations will introduce noise and variations in the volume level of the signal reproduced.

Since the best record members now available are in the form of thin chrome steel tapes, it will be advantageous in some cases to build up the surface 37 by winding thin tape in a spiral over the body of the cylinder. If this construction is used the tape may tend to buckle slightly away from the cylinder in places thereby greatly increasing the reluctance offered to the flux and correspondingly impairing the reproduction. This effect can be substantially eliminated, however, without causing appreciable spreading of the flux by first applying a spacer 38 in the form of a thin layer of non-magnetic material such as paper or copper to the body of the cylinder. This non-magnetic layer materially increases the reluctance of the flux path so that any other slight variations due to buckling of the tape will not produce prohibitive variations in the total reluctance.

Since other materials, such as nickel, have many advantages as telegraphophone record materials, a plating or other thin layer of such metal may be applied directly to the body of the cylinder in intimate contact with it so that no non-magnetic spacing layer is required.

It will be understood that the record member of Fig. 5 may also be made up in various other forms such as a composite disc or as a composite tape.

While both the volume and frequency ranges of these single pole-piece systems are slightly less than those obtainable with the standard two pole-piece systems described in the patents referred to above, the invention is of considerable utility for special applications such as tone generators and delay systems and the volume range and quality are much superior to those of a single pole-piece system of the Poulsen type.

What is claimed is:

1. A telegraphophone record member comprising a continuous layer of magnetic material of high retentivity and a layer of magnetic material of high permeability and low retentivity in direct contact with said continuous layer.

2. In a telegraphophone system, a magnetic pole-piece carrying signal flux and having a pole tip and means for concentrating the flux in the space adjacent the pole tip comprising a separate thin block of magnetic material spaced from the pole tip to permit the passage of a record member between the block and the pole tip for the purposes of recording or reproduction.

3. A system according to the preceding claim in which the block is tapered toward and aligned with the pole tip.

4. A system according to the second preceding claim in which the pole tip is very thin and the area of the block facing the pole tip is large as compared with the area of the pole tip.

5. In a telegraphophone system, a magnetic pole-piece carrying signal flux and having a pole tip and means for concentrating the flux in the space adjacent the pole tip comprising a block of magnetic material of high resistivity tapered toward and aligned with the pole tip and spaced therefrom to permit the passage for the purposes of recording or reproduction of a record member therebetween without actual contact with either the pole tip or the block.

CLARENCE N. HICKMAN.