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W. E. NEWMAN

2,423,339

REPRODUCING HEAD FOR MAGNETIC TELEGRAPHONES

Filed July 29, 1944

Fig. 1.

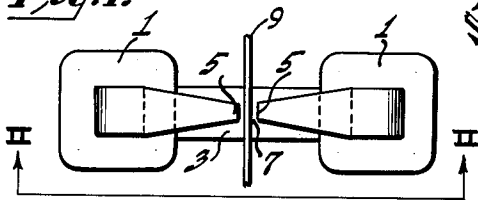
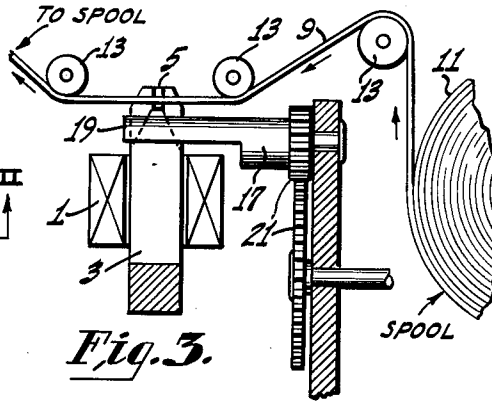


Fig. 2.

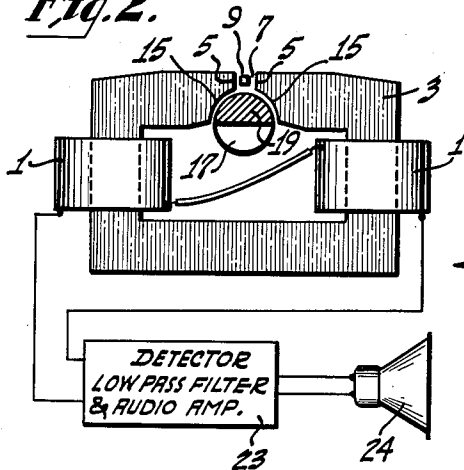


Fig. 3.

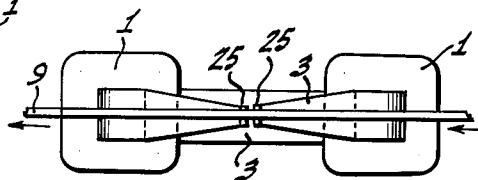


Fig. 4.

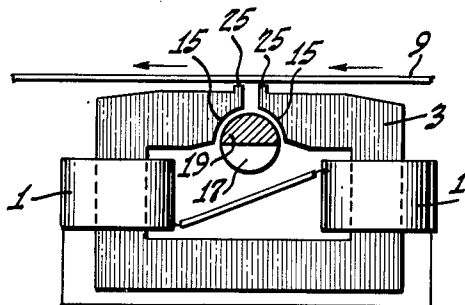


Fig. 5. TO DETECTOR, LOW PASS FILTER, AUDIO AMP. & SPKR.

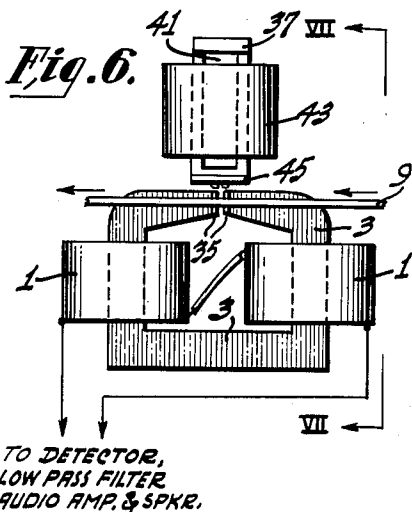


Fig. 6.

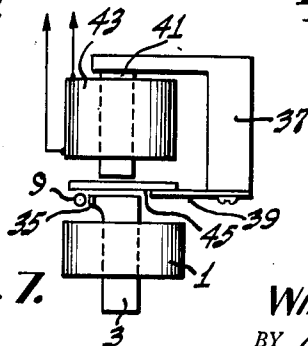


Fig. 7.

INVENTOR.
WILLIAM E. NEWMAN
BY *CD Huska*
ATTORNEY

UNITED STATES PATENT OFFICE

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REPRODUCING HEAD FOR MAGNETIC
TELEGRAPHOES

William E. Newman, Moorestown, N. J., assignor
to Radio Corporation of America, a corporation
of Delaware

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12 Claims. (Cl. 179—100.2)

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This invention relates to signal translating apparatus, and more particularly to sound reproducing apparatus of the type employing magnetic records and generally referred to as "telegraphones."

In apparatus of this type, there is employed a pickup device having a winding provided with a core of magnetic material which terminates in one or more pole elements past which a magnetized record is moved. The record acts as a source of varying flux corresponding to the recorded signals and supplies the flux to the core. The variable flux which links the winding produces in the winding signal voltages or currents which correspond to the original signals and which are converted into sound or other desired, useful signals in well known manner.

Among the factors which determine the voltage induced in the pickup coil is the rate of change of flux through the magnetic structure or core, the greater the rate of flux change, the greater the induced voltage. In telegraphones heretofore known, the rate of change of flux is usually determined solely by the frequency of the recorded signal, so that the voltage generated in the pickup coil is definitely limited. Thus, prior art telegraphones have been limited inherently in the sensitivity of their pickups.

The primary object of my present invention is to provide an improved signal reproducing system of the magnetic type which will be free from the aforementioned limitation.

More particularly, it is an object of my present invention to provide an improved magnetic signal reproducing system or telegraphone which, while utilizing conventional magnetic records, will nevertheless be much more sensitive than telegraphones of the prior art.

Another object of my present invention is to provide, in a magnetic signal reproducing apparatus, an improved pickup system or device which will have great sensitivity, and the sensitivity of which is not dependent upon the record itself.

A further object of my present invention is to provide an improved method of reproducing signals from a magnetic record thereof.

It is also an object of my present invention to provide an improved apparatus and method as aforesaid which will be economical in cost and highly efficient in use.

In accordance with my present invention, I make use of modulation at the pickup of the telegraphone in order to increase the voltage developed when the magnetized wire, tape, or other suitable record advances past the pole pieces of

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the magnetic core of the pickup coil. This modulation is accomplished by adding a magnetic element which is adapted to cooperate with the magnetic core of the pickup to change its effective reluctance, as by diverting therefrom flux supplied by the record, and doing this at a frequency which is considerably higher than the highest signal frequency on the record. A system of this type is particularly useful where one is interested in limiting the recording substantially to speech frequencies, although the invention is by no means limited to this recording range. If the frequencies to be recorded are up to 5000 C. P. S., for example, the flux diverting element may be arranged to operate at from 7000 to 15,000 or 20,000 C. P. S., or at some other suitable superaudible frequency. In this way, there is superimposed on the pickup signal frequencies a constant frequency "tone" which produces a much more rapid change of flux in the magnetic core than would be produced by the speech frequency flux provided by the record. Consequently, the voltage developed in the pickup coil is of much greater intensity than would be the case if only the speech frequency flux variations were relied upon. The superaudible or other high frequency "tone" may be removed by means of a low pass filter after the signal from the voice coil has been suitably detected and amplified, after which the signal can be converted into sound by a loud speaker in well known manner. The low pass filter which passes the desired signals may be omitted if the audio transformer or the speaker coil are designed to provide a suitable high frequency cut-off.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will be best understood from the following description of several embodiments thereof, when read in connection with the accompanying drawing in which:

Figure 1 is a top plan view of one form of pickup device constructed in accordance with my present invention,

Figure 2 is a side elevation thereof as seen from the line II—II of Fig. 1 and with the high frequency flux diverting element shown partly in section,

Figure 3 is an end elevation thereof, and also shows one form of mechanism for operating the flux diverting element,

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Figure 4 is a view similar to Fig. 1 of a slightly modified form of the invention,

Figure 5 is a side elevation of this form of the invention corresponding to Fig. 2,

Figure 6 is a side elevation of still another form of my present invention, and

Figure 7 is an end view of the latter form of my invention.

Referring more particularly to the drawing, wherein similar reference characters designate corresponding parts throughout, there is shown, in Figs. 1-3, a pickup device comprising one or more pickup coils 1 having a core 3 of magnetic material, the core 3 terminating in spaced pole tips 5 to provide an air gap 7 therebetween. A magnetic record 9 of wire, tape, or the like, previously magnetized in well known manner to provide a magnetic record of signals which are to be subsequently reproduced, is fed from a supply reel or spool 11 around a series of successive pulleys 13 to a suitable takeup reel (not shown). In passing from the supply reel to the takeup reel, the record 9 is advanced through the air gap 7 between the pole tips 5 to thereby supply varying flux to the core 3. This flux, in turn, induces signal currents in the windings 1 which may be suitably amplified and reproduced.

The apparatus thus far described is more or less conventional and has the inherent limitation that the voltage or current generated in the pickup coils 1 is of limited intensity. To increase the intensity of the induced voltage in the pickup coils 1 and thereby to increase the sensitivity of the pickup device, the end portions of the core 3 are formed with circular cut-outs 15, and a magnetic flux diverting member 17 is mounted for rotation in proximity to the cut-outs 15. The member 17 is preferably of cylindrical stock with one-half of the forward portion thereof removed so as to provide a semi-cylindrical portion 19. The member 17 is arranged in concentric relation with the cut-outs 15 and rotation is imparted thereto from a suitable power source (not shown) by means of the gears 21.

The member 17 is rotated at a speed which exceeds the highest frequency recorded on the tape or wire 9. When the member 17 is in the position shown in Figs. 2 and 3, that is, with its portion 19 in close coupling relation with the core 3 by reason of the proximity of the portion 19 to the cut-outs 15, a considerable portion of the flux supplied by the record 9 to the magnetic structure 3 will be diverted from the core 3 because the portion 19, bridging the air gap 7, is then in shunt with the core 3 in relation to the record 9. However, when the member 17 has turned a half revolution, its portion 19 will be most remote from the cut-outs 15 and the coupling between the portion 19 and the magnetic core 3 will be relatively loose. In such case, very little flux will be diverted from the core 3, and most of the flux supplied by the record 9 will pass through the core. It is apparent that, by rotating the member 17 at a speed or frequency which is much higher than the highest frequency recorded on the record 9, the flux supplied to the core 3 by the record will be interrupted or diverted at a frequency much higher than the highest recorded frequency, although the modulated flux will have a characteristic which closely follows the curve of the recorded signal. By altering the flux through the coil 1 at a high rate, so that the change of flux per unit of time through the magnetic structure will be much greater than would be the case in the absence of the flux diverting member 17, the signal voltages developed across

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the terminals of the coils 1 will be of much higher intensity. Thus, by adding the flux shunting element 17, the pickup device is made much more sensitive. The output of the coils 1 may be passed through a suitable detector, low pass filter, and audio amplifier, all indicated in Fig. 2 by the block 23, and the output of the audio amplifier may be applied to a loud speaker 24 for conversion of the electrical signal into sound waves.

The pickup device of Figs. 4 and 5 is quite similar to that shown in Figs. 1-3. In the form of my invention shown in Figs. 4 and 5, the core 3 is provided with a pair of outwardly directed pole tips 25, and the record 9 is advanced past the pole tips 25 in proximity thereto, instead of through the air gap, as in Figs. 1-3. Here, again, the magnetic core 3 is provided with circular cut-outs 15, and the flux shunting member 17 is formed in the same way as in Figs. 1-3. It will be obvious, however, that the cut-outs 15 and the member 17 may be elliptical in cross section, or of any other cross section than circular, its shape being dependent upon the degree and time during which the shunting action should take place for each cycle in order to provide the desired output.

In Figs. 6 and 7, I have shown a different arrangement for periodically diverting the flux from the core 3. In this embodiment of my invention, the core 3 is provided with a pair of pole tip elements 35 which extend to one side of the core. Above the core 3 there is provided a magnetic structure 37 of soft iron carrying a vibratory reed 39 and a soft iron core 41 around which is a winding 43. A soft iron armature 45 is secured to the reed 39 and is disposed over the air gap between the pole tips 35 in a position to bridge the air gap. A high frequency power supply (not shown) connected to the winding 43 operates at a frequency much higher than the highest frequency recorded on the wire or other magnetic record 9. When power is supplied to the coil 43, the armature 45 is caused to vibrate at a high frequency to thereby periodically bridge the air gap between the pole tips 35 and thus divert from the core 3 flux supplied thereto by the record 9.

From the foregoing description it will be apparent to those skilled in the art that I have provided a very simple, yet highly effective method of and apparatus for increasing the sensitivity of telegraphophone pickup device. It will also be apparent that my present invention may be applied to existing telegraphophones to improve the sensitivity thereof. Although I have shown and described several embodiments of my invention, it will, no doubt, be readily apparent to those skilled in the art that many other modifications, as well as changes in the particular ones described above, are possible. I therefore desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In a magnetic signal translating system of the type employing a movable magnetic record as a source of variable magnetic flux, the combination of a translating device including a magnetic member adapted to cooperate with said record to receive flux therefrom, and means associated with said magnetic member for varying the effective reluctance thereof.

2. In a magnetic signal translating system of the type employing a movable magnetic record as a source of variable magnetic flux, the combination of a translating device including a magnetic member adapted to cooperate with said

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record to receive flux therefrom, and magnetic means associated with said magnetic member for periodically shunting said member to thereby periodically divert flux therefrom.

3. In a magnetic signal translating system of the type employing a movable magnetic record as a source of variable magnetic flux, the combination of a translating device including a magnetic member adapted to cooperate with said record to receive flux therefrom, magnetic means associated with said magnetic member and movable to and from flux shunting relation therewith, and means for periodically moving said last named means into flux shunting relation with said magnetic member whereby to periodically divert flux therefrom.

4. A translating system according to claim 3 wherein said magnetic means is arranged to be moved into and out of shunting relation with said magnetic member at a frequency which is substantially higher than the highest frequency recorded on the record.

5. In a magnetic signal translating system of the type employing a movable magnetic record as a source of variable flux, the combination of a translating device including a magnetic member having a pair of pole elements for cooperation with said record, said pole elements being separated from each other by an air gap, and magnetic means associated with said pole elements and movable into shunt relation with said air gap for diverting from said magnetic member flux supplied thereto by said record.

6. In a magnetic signal translating system of the type employing a movable magnetic record as a source of variable flux, the combination of a translating device including a magnetic member having an air gap past which said record is adapted to be advanced and constituting with said air gap a normal flux path, and magnetic means associated with said magnetic member movable into position across said air gap to thereby provide a shunt path for diverting flux from said normal path.

7. In a magnetic signal translating system of the type employing a movable magnetic record as a source of variable flux, the combination of a translating device including a magnetic member having an air gap past which said record is adapted to be advanced and constituting with said air gap a normal flux path, magnetic means associated with said magnetic member movable into position across said air gap to thereby provide a shunt path for diverting flux from said normal path, and means for periodically bringing said magnetic means into position across said air gap whereby to periodically divert from said normal path flux supplied to said magnetic member by said record.

8. The invention set forth in claim 7 characterized in that said magnetic means comprises a rotary element having a surface only a portion of which is curved, characterized further in that said magnetic member is correspondingly curved adjacent to said air gap, said rotary element being so arranged in relation to said magnetic member that, upon rotation thereof, its said curved surface will be brought alternately into and out

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of mating relation with the curved portion of said magnetic member to thereby alternately divert and refrain from diverting flux from said normal path, and characterized still further by the inclusion of means for rotating said rotary element at a suitable speed.

9. The invention set forth in claim 7 characterized in that said magnetic member terminates in pole elements at said air gap, characterized further in that said magnetic means comprises a vibratory element disposed in proximity to said air gap and arranged for movement toward and away from said pole elements whereby to alternately become closely and loosely coupled to said magnetic member to thereby alternately divert and refrain from diverting flux from said normal path, and characterized still further by the inclusion of means for vibrating said vibratory element at a suitable rate.

10. The method of reproducing signals from a magnetic record with the aid of a pickup device utilizing a magnetic member in association with the record which comprises causing the record to supply flux to said magnetic member at only the signal frequencies, and simultaneously periodically changing the effective reluctance of said magnetic member at a frequency above that of the highest signal frequency on said record.

11. The method of reproducing signals from a magnetic record with the aid of a pickup device having a winding and a magnetic core for said winding adapted to cooperate with the record which comprises causing the record to supply flux to said core at only the signal frequencies, and simultaneously periodically changing the flux passing through said core at a frequency above that of the highest signal frequency on said record to thereby generate in said winding voltages representing said signals but of greater intensity than the signal voltages that would be generated in said winding by the signal frequencies flux alone.

12. The method of reproducing signals from a magnetic record with the aid of a pickup device having a winding and a magnetic core for said winding adapted to cooperate with the record which comprises causing the record to supply flux to said core at the signal frequencies, and simultaneously periodically diverting from said core at a frequency above that of the highest signal frequency on said record the flux supplied to said core to thereby generate in said winding voltages representing said signals but of greater intensity than the signal voltages that would be generated in said winding by the signal frequencies flux alone.

WILLIAM E. NEWMAN.

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