

Feb. 4, 1941.

E. SCHÜLLER

2,230,913

MAGNETIC SOUND RECORDER

Filed Aug. 17, 1939

Fig. 1

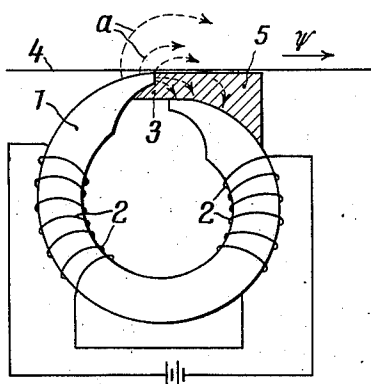


Fig. 2

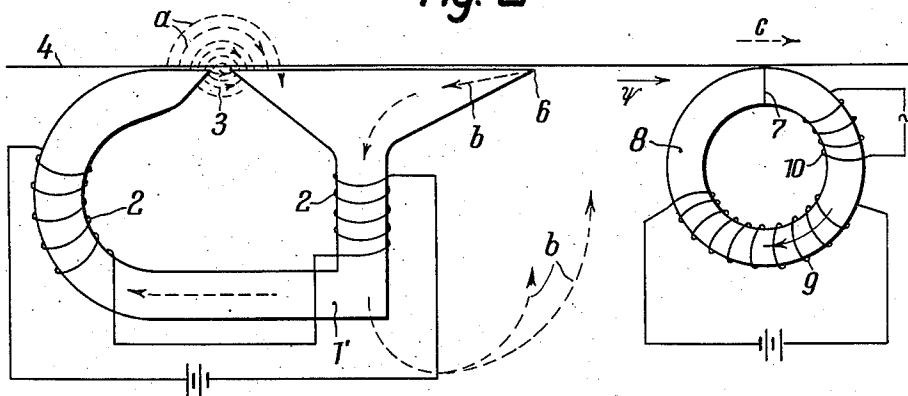


Fig. 3

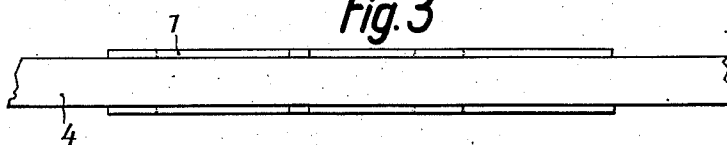
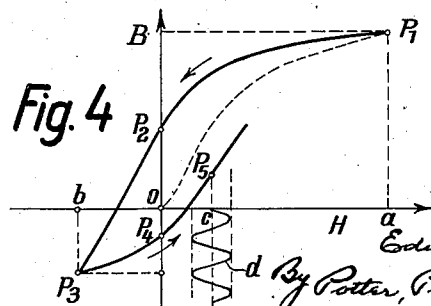


Fig. 4



Inventor:
Edward Schüller,
By Potter, Pierce & Schaffer,
Attorneys.

UNITED STATES PATENT OFFICE

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MAGNETIC SOUND RECORDER

Eduard Schüller, Berlin-Johannisthal, Germany,
 assignor to Licentia Patent-Verwaltungs-Ge-
 sellschaft, Berlin, Germany

Application August 17, 1939, Serial No. 290,689
 In Germany March 3, 1936

6 Claims. (Cl. 179—100.2)

This invention relates to magnetic sound re-
 corders, and particularly to telegraphones or
 devices of the type in which the sound is record-
 ed by selectively magnetizing successive portions
 of a traveling wire or band in accordance with
 the magnitude and frequency of the sound waves.

The practice has been to pass the sound track
 or magnetic band through the field of a strong
 magnet as it approaches the recording electro-
 magnets, thereby erasing any previous history
 before a record is entered on the moving band.
 The magnets and electromagnets previously em-
 ployed for this purpose have not been entirely
 satisfactory as the magnetic field between the
 two poles of the magnet varied greatly both as to
 intensity and direction. A part of the magnetic
 field would extend longitudinally of the sound
 carrier but the adjoining leakage field extended
 in various directions and was of such strength
 that the magnetization that ultimately remained
 on the sound carrier deviated considerably from
 the desired longitudinal direction.

An object of this invention is to provide a
 magnetic sound recorder having erasing mag-
 nets with pole pieces of such design that the ac-
 tive stray field extends in the longitudinal di-
 rection of the sound carrier. An object is to
 provide an electromagnet for removing any
 prior records from a magnetic sound carrier as
 it approaches the recording head; the core of
 the electromagnet being approximately circular
 with a small radial gap across which the sound
 carrier travels in a direction tangential to the
 core, the pole piece at the departure side of the
 core having a longer active surface than the pole
 piece at the advance side of the core. A fur-
 ther object is to provide a magnetic system for
 conditioning a magnetic sound carrier as it ap-
 proaches the recording head, the magnetic sys-
 tem including an approximately circular magnet
 having a short gap across which the sound car-
 rier passes and a trailing pole piece at which the
 leakage flux extends longitudinally of the sound
 carrier and in a direction opposite that of the
 flux at the gap of the magnet. Another object
 is to provide a magnetic system of the type stated
 that includes a direct-current winding on the
 sound recording head for superimposing a polar-
 izing magnetic field upon the alternating-cur-
 rent field corresponding to the sound waves, the
 polarizing field being in a direction opposite to
 that of the stray field at the tip of the erasing
 magnet.

These and other objects and advantages of the
 invention will be apparent from the following

specification when taken with the accompanying
 drawing in which:

Fig. 1 is a schematic view of an erasing elec-
 tromagnet that constitutes one embodiment of
 the present invention;

Fig. 2 is a schematic side elevation of another
 construction;

Fig. 3 is a fragmentary plan view of the same;
 and

Fig. 4 is a curve sheet showing the magnetiza-
 tion of the sound carrier at different points along
 its path of travel across the erasing magnet and
 the recording head.

In Fig. 1, the core 1 is approximately circular
 and carries a direct-current magnetizing wind-
 ing 2 that establishes a strong magnetic field at
 the gap 3 across which the magnetizable sound
 carrier 4 travels in a tangential direction. The
 sound carrier moves from left to right as indi-
 cated by the arrow x and the pole piece at the
 right or departure side of the core 1 is spaced
 from the sound carrier 4 by a greater distance
 than is the pole piece at the left or approach
 side of the core, the terms "departure" and "ap-
 proach" having reference to the travel of the
 band 4. The modification of the core 1 from a
 true circular shape, such as was previously used,
 has been greatly exaggerated in Fig. 1 as the
 desired distribution of the magnetic field can be
 obtained when one pole piece is bent inwardly
 of the other by as little as about 1 mm. A block
 or strip of non-magnetic material 5 may be lo-
 cated in the space between the inturned pole
 piece and the band 4 to provide a supporting
 table for the moving band.

The broken line vectors a indicate the mag-
 netic field that extends longitudinally of the
 band 4 at the gap 3. The particular shape of
 the magnetic core extends the field along the
 record carrier and the active polar surface of
 the pole piece at the departure side of the core
 is substantially longer than the active polar
 surface at the approach side.

In the construction shown in Figs. 2 and 3, the
 core 1' carries a direct-current winding 2' for
 establishing a strong magnetic field across the
 gap 3 between the pole pieces that are of differ-
 ent effective lengths, as measured in the di-
 rection of travel of the record carrier 4. Both
 pole pieces have plane surfaces along which the
 record carrier travels, and the pole piece at the
 departure side of the core is extended beyond the
 adjacent leg of the core to form a polar tip 6
 at which the leakage flux, indicated by the dot-
 ted line vectors b , is approximately longitudi-

nal of the record carrier but in a direction opposite to that of the field *a* at the gap 3. A polarizing field *c*, in the same direction as the saturating magnetic field *a*, is established at the narrow slot 7 of the recording magnet 8 by the direct-current winding 9. The alternating field corresponding to the sound or signal to be recorded is produced by current flow in winding 10 on the core 6.

The method of operation may be best understood from a consideration of the typical hysteresis curve of Fig. 4. Each magnetic particle of the record carrier passes the gap 3 for which the magnetic field intensity is represented in Fig. 4 by the vector quantity *a*. The flux density in the ferromagnetic band 4 rises to the value *P*₁ along some line such as *OP*₁ as the magnetic particle approaches the gap 3, the exact shape of this part of the curve depending upon the prior magnetic condition of the particle. The intensity of field *a* is sufficiently great to produce saturation and therewith the extinction of the prior magnetic history of the particle. The field intensity is zero at some point along the pole piece beyond the gap 3 and the induction falls to a value *P*₂ that is determined by the retentivity of the carrier 4. The particle then enters the field *b* at the polar tip 6 where the flux density of the carrier is represented by point *P*₃ of the curve. The flux density has a value corresponding to point *P*₄ after it leaves the field *b*, and then rises to a value *P*₅ under the influence of the unidirectional polarizing field *c* that is superimposed upon the alternating field *d* of the signal at the recording head. The point *P*₅ is the operating point on the magnetization curve about which the induction is varied by the alternating field *d*.

It has been demonstrated that telegraphphone record carriers treated by the described erasing magnetic systems give a higher sound output at the reproducer, for equal intensity input signal currents, than the record carriers from which the prior history was removed by the previously known erasing magnets. The record carriers exhibited a lower noise level when pretreated by the new erasing magnets and thus permit higher amplification of the reproduced signals.

I claim:

1. In magnetic sound recording apparatus, a magnet for eliminating prior recordings from a magnetic record strip, said magnet comprising an approximately circular core with pole pieces to provide a radial gap across which the record strip is to be moved substantially tangentially to the polar surfaces at the outer edge of the gap, and a direct-current winding on said core; the pole piece at the departure side of the core hav-

ing a longer active surface than the pole piece at the advance side of the core.

2. In magnetic sound recording apparatus, a magnet as claimed in claim 1, wherein the pole piece at the departure side of the core is more distant from the path of travel of the record strip than is the other pole piece, and a strip of non-magnetic material is located between the path of the record strip and said pole piece at the departure side of the core.

3. In magnetic sound recording apparatus, the invention as claimed in claim 1, wherein the pole piece at the departure side of the core extends along the path of travel of the record strip and terminates in a polar tip at which the direction of the leakage flux is opposite that of the flux at said radial gap.

4. In apparatus for the recording of signals on strips of magnetic material, a magnet for eliminating prior recordings from a strip as it approaches a recording unit; said magnet comprising an approximately annular core and a direct current winding on said core, said annular core having an air gap over which the record strip travels, the core section at the departure side of the gap being spaced from the record strip by a distance substantially greater than that between the core and record strip at the advance side of the air gap.

5. In magnetic sound recording apparatus, an erasing head comprising a core having pole pieces spaced apart by a gap across which the record carrier travels, and a direct current winding on the core, the pole piece at the departure side of the core being extended along the record carrier path to form a leakage polar tip at which the direction of the leakage flux is opposite to the direction of the flux at the air gap.

6. In magnetic sound recording apparatus, the combination with means creating a strong magnetic field substantially longitudinally of a moving record strip, means acting upon a record strip after the strip passes beyond said first means to establish a magnetic field of less intensity and extending longitudinally of the strip in a direction opposite that of the first field, and a recording head for magnetizing said record strip after it passes from the second means, said recording head including a magnetic core and a winding on said core for connection to a source of audio frequency energy, of polarizing means for establishing a magnetic field longitudinally of the record strip and in the same direction as the field of said first means, said polarizing means comprising a direct current winding on the magnetic core of the recording head.

EDUARD SCHÜLLER.

CERTIFICATE OF CORRECTION.

Patent No. 2,230,913.

February 4, 1941.

EDUARD SCHÜLLER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 53, claim 1, after the word "pieces" insert --spaced--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of February, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.