June 20, 1944. E. SCHÜLLER 2,352,023

SOUND REPRODUCER

Filed Aug. 23, 1939

Fig. 1.

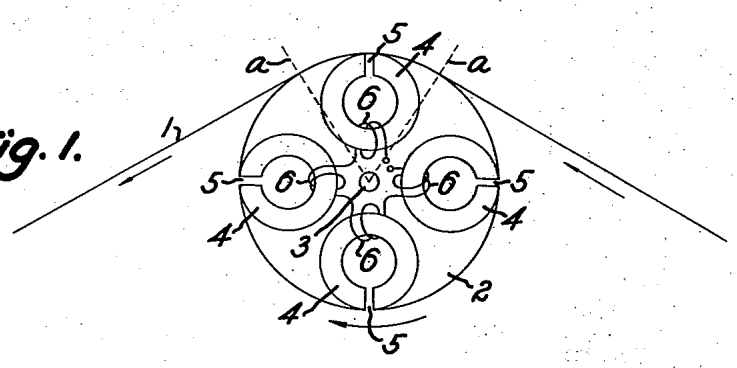


Fig. 2.

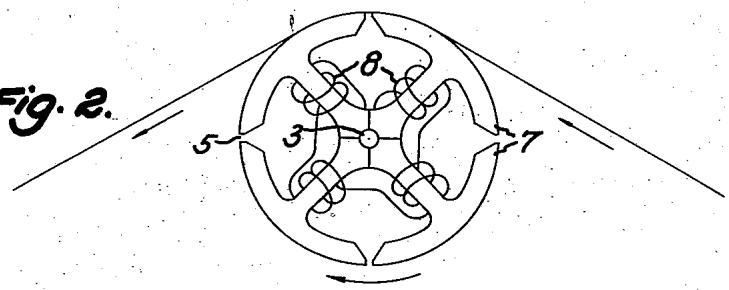
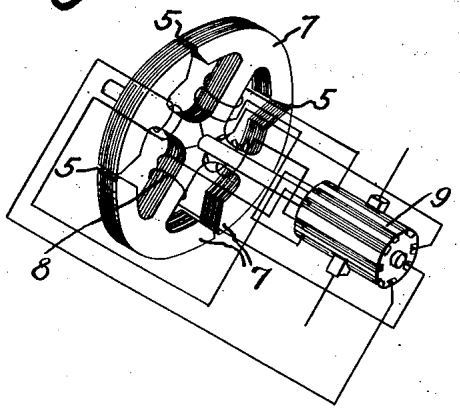


Fig. 3.



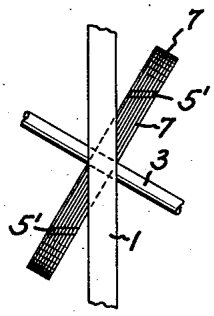


Fig. 4.

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Patented June 20, 1944

2,352,023

UNITED STATES PATENT OFFICE

2,352,023

SOUND REPRODUCER

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Application August 23, 1939, Serial No. 291,620
In Germany August 26, 1938

5 Claims. (Cl. 179—100.2)

This invention relates to sound reproducers and particularly to a sound head for use with magnetic sound carriers or strips.

It is frequently desired to reproduce speech or music more rapidly or more slowly than it was recorded. Special precautions must of course be taken if the signals are to be reproduced at their original frequencies.

According to the present invention, the sound head is so designed as to vary the ratio of the pitch of the reproduced sound to the speed at which the magnetic carrier moves across the sound head, the variation being in such sense that the original pitch or frequency is reproduced whether the speed of the magnetic carrier is higher or is lower than the speed during the recording step. The sound recording head and the sound reproducing head are electromagnetic devices having cores with short air gaps or slots across which the magnetic carrier travels. Frequency distortion will arise when the magnetic carrier passes the gaps of the recording head and the reproducing head at different speeds, and the invention eliminates this speed difference by moving the gap of the reproducing head along the traveling magnetic carrier to make the relative speed of the carrier with respect to the gap of the reproducing head the same as the relative speed of the carrier with respect to the recording head.

An object of the present invention is to provide a sound head or reproducing head including a rotatable core member having a plurality of circumferentially spaced gaps that are brought in succession into a reading-off position adjacent the moving magnetic carrier. A further object is to provide a sound head including a rotatable core member with a plurality of reproducing gaps that progressively travel across and along the moving magnetic carrier, the gaps being inclined to radial planes through the axis of the rotating core member and the record carrier moving along a path inclined to the axis in the reverse direction, whereby the gaps extend transversely across the record carrier as they move along it. A further object is to provide a rotatable sound head of the types stated in which the record carrier travels circumferentially around the rotating head over an arc equal approximately to the circumferential spacing of adjacent reproducing gaps of the sound head. Another object is to provide a rotatable sound head having a multipart core with a winding and a reproducing gap for each core part, and a commutator system for connecting to the reproducing amplifier only the winding of the core part that is in reading-off position adjacent the record carrier. Another object is to provide a rotating sound head including a multi-part core of the type last stated in which the overlapping of reading-off periods of successive reproducing gaps is determined by the dimensions of the commutator segments and the record carrier extends about the rotating head over an arc substantially greater than that of the spacing of adjacent reproducing gaps.

These and other objects and advantages of the invention will be apparent from the following specification when taken with the accompanying drawing in which:

Figs. 1 and 2 are diagrammatic side elevations of embodiments of the invention;

Fig. 3 is a perspective view of a rotatable sound head and slip ring connections for the windings as shown in Fig. 2; and

Fig. 4 is a fragmentary plan view of the sound head and record carrier.

In the drawing, the reference numeral 1 identifies the sound record strip or magnetic carrier that runs from right to left, as indicated by the arrows, in proximity to the rotating sound head. As shown in Fig. 1, the sound head consists of a plurality of individual sound reproducers carried by a disk 2 on the shaft 3. Each reproducer unit comprises a circular core 4 with its reproducing gap or slot 5 at the circumferential edge of the disk 2, and a winding or coil 6. The windings may be connected in parallel to the reproducing amplifier, or they may be in series, as shown in Fig. 1.

The displacements of the record strip during recording and during reproduction are at substantially different speeds but the sound head assembly rotates, as indicated by the arrow, in that direction and at such speed that the relative speed of the several reproducing gaps 5 along the record strip 1 is identical with that at which the record strip 1 moved across the recording gap. The partial reproduction by each reproducer unit therefore accurately duplicates the pitch of the original signal whether that signal was of a single frequency or, in the case of speech or music, of a plurality of frequencies. Each small partial portion of the record strip is read off repeatedly at its original pitch but over a time interval that may be greater or less than that required for the recording of that small partial portion of the signal. The displacement of the record strip 1 with respect to the sound head takes place at a relatively slow rate, and the partial reproductions by successive reproducing gaps therefore

overlap to a considerable extent and each includes a relatively extended group of sound waves of a single or of mixed frequencies. The integrated partial reproductions provide an exactly faithful reproduction of any sound or signal that continues over a substantial time interval, and an intelligible and fairly accurate reproduction even in the case of signals that comprise a succession of signal components of short time duration and widely different frequencies.

The magnetic carrier 1 extends circumferentially about the sound head over a substantial angle, between the dotted line radii *a*, that is approximately equal to the angular spacing of the gaps of adjacent core units 4 of the sound head. The spacing of the adjacent reproducing gaps, as measured along the circumference of the sound head, is preferably less than $\frac{1}{10}$ of the distance traveled by the magnetic carrier in one second during the recording operation. This relationship provides a good quality of reproduction for even the shortest length of recorded signals.

Assuming that the signals are to be read off at about one-half the recording speed, the sound head is rotated, as indicated by the arrow, in the direction opposite to that of the travel of the magnetic carrier 1. Each part of the record strip is thus read off repeatedly as the reproducing gaps move along the record strip, and the final effect is that of an acoustical time expanding action. The original frequency of the recorded signals is obtained but the duration of the reproduced signals is twice that of the original signal. If the sound head is rotated in the same direction as that of the travel of the record strip, the opposite effect of an acoustical time compressing is obtained and the reproduced signal has its original frequency but is read off in less time than was required for the recording.

As shown in Figs. 2 and 3, the sound head is constructed of T-shaped laminations that are assembled in groups on the shaft 3 to form T-shaped core segments 7, the heads of the T-segments being at the circumference of the sound head and spaced from each other by the recording gaps 5. The core legs carry windings 8 that are connected to the commutator 9 on the shaft.

The transition from one reproducing unit to another should take place progressively for high quality of reproduction. The gradual transition may be effected by running the magnetic carrier strip upon and away from the reading-off zone with a slight turning or twist, so that only gradually does the full width of the carrier strip come into close proximity to the reproducing slots. Alternatively, the slots 5' may be at an angle to radial planes through the shaft 3, with the path of the magnetic carrier strip 1 at the reverse angle to the shaft, as in Fig. 5. The slots 5' thus extend transversely of the record strip, and move across the strip from one side to the other as they travel along the strip.

Since the approach of a reproducing slot to the sound carrier strip, and its departure from the strip affect the quality of the reproduction, the effective operating periods of the reproducing slots may be controlled by connecting the windings to a commutator. The length of the circumferential arc of closely adjacent travel of the magnetic carrier and the sound head may then be increased as much as desired without introducing distortion. The length of the commutator segments may be such that only one sound head unit is effective at any instant, or the segments may be designed for an overlapping of the reproductions from successive reproducing slots.

It is to be understood that the invention is not limited to the particular constructions herein described and diagrammatically illustrated as various changes may be made without departure from the spirit of my invention as set forth in the following claims.

I claim:

1. A sound head comprising a core assembly having a plurality of circumferentially spaced recording slots, a shaft supporting said core assembly for rotation about an axis inclined to the direction of travel of a magnetic sound carrier, the slots of the core assembly being reversely inclined to the axis of the shaft, whereby the slots extend transversely of the magnetic sound carrier path and sweep across that path as the rotation of the sound head carries the slots in succession along the path of the magnetic sound carrier, and a winding on said core assembly.

2. A sound head for reproducing signals from a magnetic sound carrier strip, said sound head comprising a multiple section core assembly having a plurality of circumferentially spaced reproducing gaps, a winding associated with each core section, a shaft supporting the core assembly and windings for rotation, and a commutator on said shaft and connected to said windings.

3. A sound head according to claim 2 wherein said core sections are T-shape, with the heads of the T-shaped sections forming the circumference of the sound head, said heads being spaced apart from each other to form said reproducing gaps.

4. A sound head according to claim 2 wherein said core sections are T-shape, with the heads of the T-shaped sections forming the circumference of the sound head, said heads being spaced apart from each other to form said reproducing gaps, and wherein said windings are disposed on the legs of the respective T-shaped sections.

5. A sound head for the continuous reproduction of signals from a magnetic sound carrier strip, comprising a core assembly having a plurality of circumferentially spaced recording slots, means for supporting the periphery of said core assembly for rotation in a direction inclined to the direction of travel of said magnetic sound carrier, and in a direction inclined to the axis of rotation of the coil, the slots of the core assembly extending substantially at right angles to the direction of travel of said carrier whereby the slots sweep transversely across the path of the carrier as the rotation of the sound head carries the slots in succession along the path of the magnetic sound carrier, and a winding on said core assembly.

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