

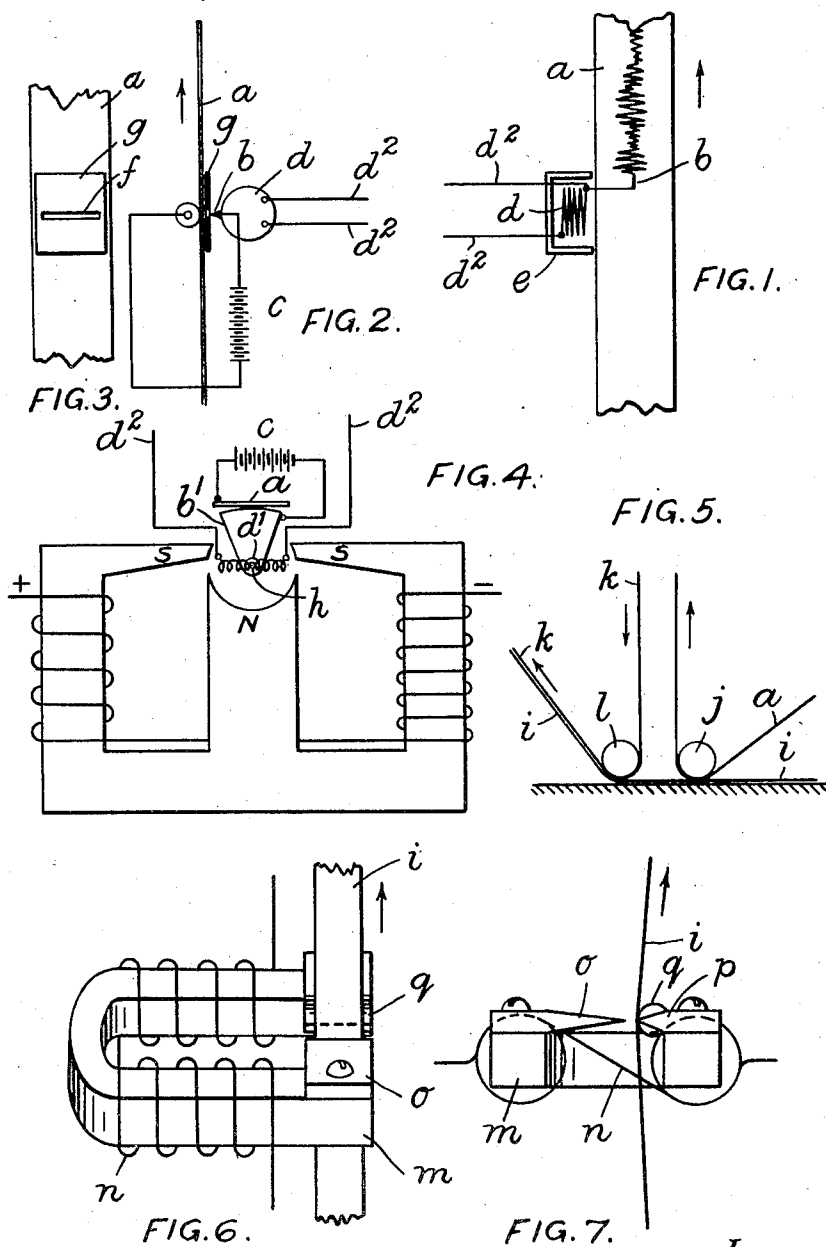
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RECORDING AND REPRODUCING SOUND

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RECORDING AND REPRODUCING SOUND

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This invention relates to making sound records and to reproducing sounds from such records.

The sound record is engraved in a travelling surface by a member displaced relatively to said surface by the effect of sound.

According to the present invention, the engraved sound record is filled-in with magnetic material, thus producing a phonogram of magnetic material. The sounds recorded by the phonogram of magnetic material can be reproduced in the known manner by passing the phonogram in the appropriate direction through the field of a magnet having a winding connected in an electric sound-reproducing circuit, such as the circuit of an electrical amplifier connected to a loud speaker.

The phonogram of magnetic material may and preferably is transferred from the engraved surface to another surface of non-magnetic material, whereby the original engraved surface can be repeatedly used as a master record to produce many copy records.

The sound record may be electrically engraved by being burnt into the travelling surface by an arc developed by an electric current passing between the surface and variably traversed across the surface by the effect of sound.

For example, the burning-in is effected by an electrode consisting of a light metal rod secured to a moving coil in the field of a magnet, such coil being excited and caused to vibrate by sound-varied currents from an amplifier.

A metal tape is moved at a uniform speed past and in close proximity or contact with the electrode, in a direction perpendicular to the sound-induced vibrations thereof.

A source of electricity of suitable type and voltage for providing an arc, is connected respectively to the electrode and to the travelling metal tape. The arc between the electrode and the tape at the sound-vibrated point, causes the sound-varied movements of the electrode to trace a burnt-in record on the metal tape.

A record in magnetic material is prepared from the metal tape bearing the burnt-

in record, by coating the respective face of the metal tape with a mixture of a finely powdered magnetic material and an adhesive, and so wiping off such coating that the burnt-in record groove remains filled with the magnetic material whilst the remainder of the surface is free from magnetic material. A suitable magnetic material is magnetite dust or iron or steel dust.

The filled-in record-bearing face of the metal tape is then run in contact with a paper tape, whereby the record in magnetic material is transferred to the paper tape.

The paper tape bearing the transferred sound record in magnetic material is then either varnished to fix and protect the magnetic material record or such record is covered by another paper tape secured to the first by adhesive.

The metal tape is available for making an indefinite number of records in magnetic material on tapes.

A representative example of a method of carrying out the invention is diagrammatically illustrated on the accompanying drawings, in which:—

Fig. 1 shows in front elevation a travelling metal tape into which a phonogram is being burnt by an electric arc.

Fig. 2 shows the tape in side elevation and

Fig. 3 in front elevation, with means for preventing the arc spreading longitudinally of the tape.

Fig. 4 is a plan showing a modified method of traversing the arc.

Fig. 5 is a diagram showing in side elevation how the phonogram in magnetic material can be transferred from the metal tape to a paper tape.

Figs. 6 and 7 are respectively a perspective front elevation and a side elevation showing a phonogram tape passing through and influencing the field of a magnet.

Referring to Figs. 1 to 3, *a* is a metal tape travelling at a uniform speed in the direction of the arrow. *b* is an electrode connected to one pole of a source of electricity, indicated by the battery *c*, Fig. 2,

the other pole of which is electrically connected to the metal tape *a*.

The electrode *b* is fast with a moving coil *d* in the field of a pot magnet *e*, so arranged that when the coil *d* is excited by sound-varied currents, it vibrates and traverses the electrode *b* transversely across the travelling metal tape *a*.

An electric arc is arranged to exist between the electrode *b* and the tape *a*, which as stated above are in the circuit of the source of electricity *c*, and such arc burns into the tape *a* a record of the traverses of the electrode *b*.

As shown in Figs. 2 and 3, to prevent the arc spreading longitudinally of the tape *a*, the arc may be struck through a narrow slot *f* in a screen *g* of mica or other insulating material masking the face of the tape *a*, with the slot *f* extending transversely thereto in the path of the traverse of the electrode *b*.

The moving coil *d* is connected by its leads *d*² in the output circuit of an amplifier, amplifying currents varied by a microphone in the wellknown manner.

The result of the burning-in is a phonogram engraved in the metal tape *a*.

Fig. 4 shows an arrangement whereby the traverse of the arc across the metal tape *a* can be exaggerated, to compensate for reduced response of the moving coil to impulses of high audio frequencies compared with the response thereof to impulses of lower audio frequencies. The moving coil *d*¹ in the arrangement shown in Fig. 4 is pivoted about an axis *h* and normally extends between two like poles S of an electro-magnet, having an intermediate pole N of opposite polarity to the poles S. The electrode *b*¹ in the circuit of the source of current *c* is a plate fast with the coil *d*¹ and presenting an edge to the travelling tape *a*. As the polarity of the moving coil *d*¹ varies under the effect of the sound-varied impulses which pass through it, one or the other end of the coil *d*¹ will be repelled from an S pole and attracted by the N pole. The plate electrode *b*¹ will accordingly be rocked, causing one end or the other of its edge to approach the tape *a*, and the arc will travel along such edge to the point of closest approach.

The engraved phonogram on the metal tape *a* is filled in with magnetic material, for instance by coating the engraved face of the tape with a mixture of fine magnetite dust and an adhesive medium such as printing ink varnish, and wiping off the mixture from un-engraved portions of the surface of the tape. A phonogram in magnetic material is thus produced, which when the tape *a* bearing same is run through the field of a magnet having a winding in the circuit of an electrical amplifier the output

of which is connected to a loud speaker, will give a reproduction of the original sounds.

However instead of using the engraved metal tape directly for reproducing sound, the engraved tape *a* is preferably employed as a master record by which an indefinite number of copy phonograms of magnetic material can be produced. For this purpose the engraved tape *a* with its recessed phonogram filled in with an adhesive mixture containing magnetic material, is, as indicated in Fig. 5, run with the phonogram in contact with a paper tape *i*, beneath a pressing roller *j*. The adhesive mixture containing magnetic material adheres to the paper tape *i* and is drawn thereby out of the metal tape *a*. The metal tape *a* is diverted around the pressing roller *j* away from the paper tape *i*. To protect the adhesive phonogram of magnetic material which has been transferred to the paper tape *i*, a second paper tape *k* coated on one face with adhesive can be led around a second pressing roller *l*, with its coated face in contact with the printed face of the first paper tape *i*. The two paper tapes then become stuck together with the phonogram of magnetic material interposed between them.

A suitable magnet for being influenced by the phonogram of magnetic material is illustrated in Figs. 6 and 7. This magnetic pick up device consists of a permanent horseshoe magnet *m* with a winding *n* connected in the input circuit of an electrical amplifier, the output circuit of which is connected to a loud speaker. The paper tape *i* bearing the phonogram of magnetic material is caused to travel in the appropriate direction between the poles of the magnet *m*. To confine to a transverse line the effect of the travelling phonogram, the pole pieces *o* and *p* of the magnet *m* terminate at the pole gap in a knife edge. The pole piece *p* is covered by a rounded block of non-magnetic material *q* to provide a guide surface for the travelling tape *i*.

We claim:

1. A method of producing a phonogram of magnetic material, consisting in producing an electric arc between an electrode and a surface travelling relatively to said electrode, displacing by the effects of sound said electrode relatively to said surface, and filling-in with magnetic material the phonogram engraved in said surface by said arc.

2. A method of producing a phonogram of magnetic material, consisting in producing an electric arc between an electrode and a metal tape travelling relatively to said electrode, displacing by the effects of sound said electrode relatively to said metal tape, and filling-in with magnetic material the

phonogram engraved in said metal tape by said arc.

3. A method of producing a copy phonogram of magnetic material, consisting in filling-in an engraved phonogram with magnetic material, and transferring said filled-in magnetic material to a surface of a non-magnetic material.

4. A method of producing a copy phonogram of magnetic material, consisting in engraving a phonogram on a metal tape, filling-in said phonogram with magnetic material, and transferring said filled-in magnetic material to a tape of non-magnetic material.

5. A method of producing a copy phonogram of magnetic material, consisting in engraving a phonogram on a metal tape, filling-in said phonogram with magnetic material, and transferring said filled-in magnetic material to a paper tape.

6. A method of producing a copy phonogram of magnetic material, consisting in producing an electric arc between an electrode and a surface travelling relatively to said electrode, displacing by the effects of sound said electrode relatively to said surface, filling-in with magnetic material the phonogram engraved in said surface by said arc, and transferring said filled-in magnetic material to a surface of a non-magnetic material.

7. A method of producing a copy phonogram of magnetic material, consisting in producing an electric arc between an electrode and a metal tape travelling relatively to said electrode, displacing by the effects of sound said electrode relatively to said metal tape, filling-in with magnetic material the phonogram engraved in said metal tape by said arc, and transferring said filled-in magnetic material to a tape of non-magnetic material.

8. A method of producing a copy phonogram of magnetic material, consisting in producing an electric arc between an electrode and a metal tape travelling relatively to said electrode, displacing by the effects of sound said electrode relatively to said metal tape, filling-in with magnetic material the phonogram engraved in said metal tape by said arc, and transferring said filled-in magnetic material to a paper tape.

In testimony whereof we have signed our names to this specification.

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