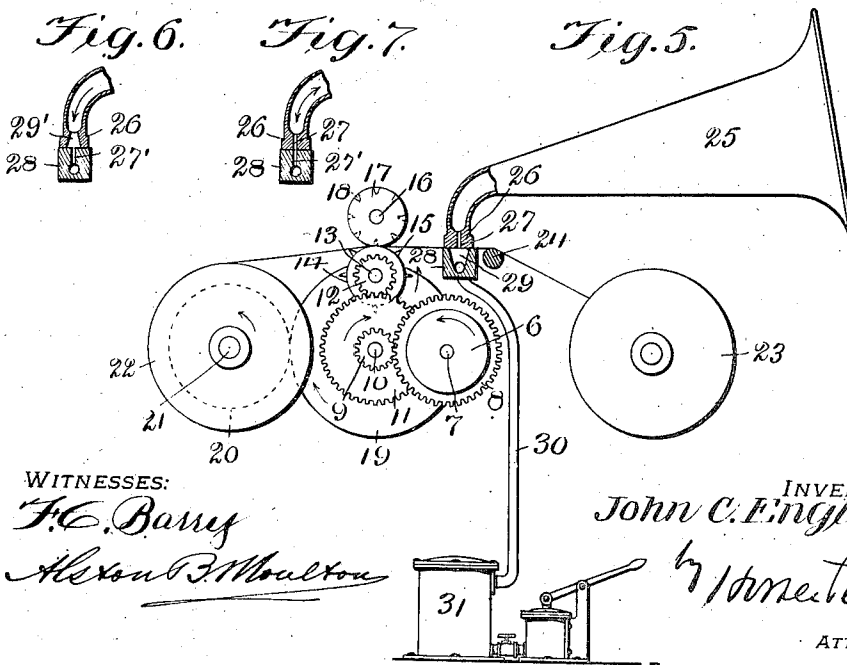
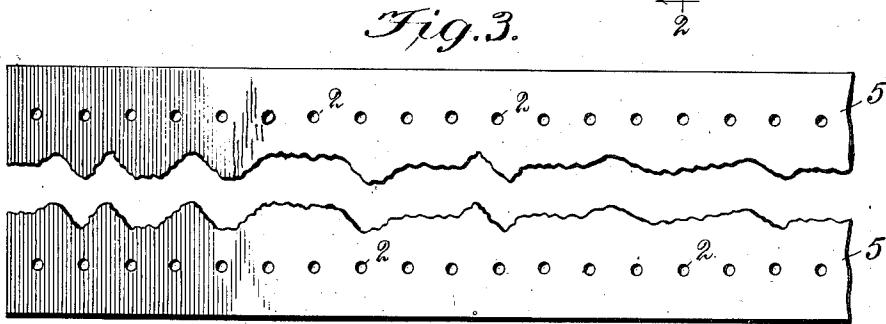
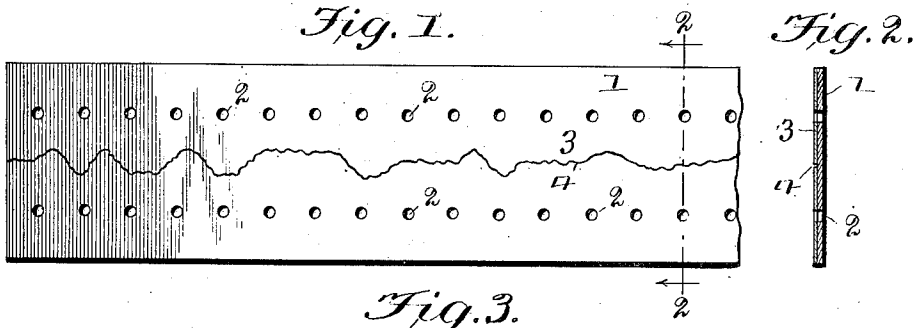


J. C. ENGLISH.
METHOD OF RECORDING AND REPRODUCING SOUNDS.
APPLICATION FILED OCT. 14, 1905.

957,195.

Patented May 10, 1910.



UNITED STATES PATENT OFFICE.

JOHN C. ENGLISH, OF CAMDEN, NEW JERSEY, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

METHOD OF RECORDING AND REPRODUCING SOUNDS.

957,195.

Specification of Letters Patent.

Patented May 10, 1910.

Application filed October 14, 1905. Serial No. 232,732.

To all whom it may concern:

Be it known that I, JOHN C. ENGLISH, a citizen of the United States, and resident of the city of Camden, county of Camden, State of New Jersey, have invented certain new and useful Improvements in Methods of Recording and Reproducing Sounds, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a method of making a permanent undulatory record of sounds, articulate, musical or produced in any manner, and, further to the method whereby recorded sounds are reproduced without the use of a reproducing stylus.

In the methods of reproducing sound heretofore known, it has been proposed to record upon a suitably prepared surface, a record of the sound waves produced in the vicinity of the recording mechanism; to make from said record a duplicate in some suitable and durable material; and then to cause a reproducing stylus to follow the undulations recorded on said record to produce vibrations in a reproducing diaphragm similar to those originally impressed upon the recording diaphragm. In instruments constructed in accordance with the above principle, however, the sounds emanating from such reproducing apparatus, while approximately close to the sounds originally produced, are more or less imperfect and unsatisfactory by reason of the additional sounds and tones, added to the sounds originally recorded, and caused by the scraping or scratching of the reproducing stylus upon the record, as it follows the undulatory groove in the same.

The present invention has for one of its objects the forming of an original or master record of sound in the form of a tape, one of the edges of which is provided with undulations corresponding to sound waves to form a master record of sound and to form from said master record one or more duplicate copies of said master record for commercial use.

A further object of my invention is to form commercial duplicate profile tapes for use in connection with sound reproducing machines, which profile tapes are substantially duplicates or copies of an original record.

A further object of my invention is to pro-

duce commercial duplicate records from a master record of sound by means of a profile mechanism.

A further object of my invention will appear in the specification and claims below.

My invention consists in forming a permanent record of the sound originally produced and causing said record to travel through a fluid current and to impress upon said fluid current the undulations recorded on the said record.

More specifically my invention consists in forming along one edge of a suitable tape a series of undulations or serrations corresponding to the waves of the sound originally produced, and causing the edge of said tape to travel over a narrow slit or elongated opening through which a current of air is caused to pass, said tape being so located with respect to said opening that the edge of the tape having the undulations thereon, will at all times partially close said opening, whereby the size of opening is constantly varied by the variations on the edge of the tape, and the current of air passing through said opening will have impressed upon it vibrations or undulations which are an exact reproduction of the sound originally recorded on the tape.

My improved method of recording and reproducing sound may be put into effect by means of a variety of apparatus, one method being illustrated in the accompanying sheet of drawings, in which—

Figure 1 represents on an exaggerated or magnified scale, a portion of a suitably prepared tape upon which the sound waves have been recorded in the form of longitudinal series of transverse undulations; Fig. 2 is a section thereof on the line 2, 2, Fig. 1; Fig. 3 illustrates the manner in which the tape shown in Fig. 1 is divided longitudinally along the line of the record to form two master records; Fig. 4 illustrates a paper duplicate made from said master record; Fig. 5 shows one form of a reproducing apparatus employed to produce the sounds recorded on the edge of the record; Fig. 6 illustrates a modified construction in which the air is drawn through the aperture from the horn and Fig. 7 illustrates another modification in which the air may be forced through the aperture in either direction.

In carrying out my invention, I prepare a

flexible metallic tape, 1, provided preferably with two longitudinal series of equally spaced perforations 2, by coating one or more surfaces thereof with any suitable substance which will serve to record the vibrations of a recording stylus, the cutting point of which oscillates in a plane substantially parallel to the said record surface. The point or cutting edge of said stylus is made of a suitable hard material and is so located with respect to said tape, that the tracing made thereby cuts through the coating material 3, and forms an undulatory channel 4, the bottom of which is formed by the metal tape itself. The perforations in the tape serve the purpose of engaging the teeth of a suitable feed roller, which may be driven at a constant rate of speed, to feed the prepared tape under the record stylus in the direction of its length, without slip or variation in speed. In Figs. 1 and 2 is illustrated a tape upon the surface of which a record groove has been traced in the manner above described, the coating 3 being cut through to the metal tape 2, as shown in Fig. 2.

In the actual practice of my invention, I may increase the amplitude and sharpness of the undulations recorded on the tape, with a view to making the variations on the profile as pronounced as possible, and I accomplish this by a variety of means such as by locating the position of the center of oscillation of the stylus bar nearer to the center of the recording diaphragm, or by increasing the length of the stylus bar on that side of the center of oscillation which carries the stylus, and also by causing the record surface to travel at a lower rate of speed than is now usually employed.

The next step in my improved process consists in removing one half of the material of the tape at one side of the groove. I preferably do this by dividing the tape longitudinally along the line of the record by filling the groove with some suitable chemical agent which will not act upon the coating material but will cut through the metal tape along the line of the record. I then remove the coating material in any suitable manner. By these or similar steps, I am enabled to produce two metallic tapes 5, 5, each of which has on its edge an exact profile record of the sounds originally produced, and each of which also has a series of perforations 2 by which said tape may be positively fed, or caused to travel over or under a reproducer. It is, however, within the scope of my invention to remove one half of the metallic record tape in any suitable manner, and in removing it, to completely destroy the same, in order to produce one perfect profile tape, although I preferably form two master tapes in the manner described above.

In Fig. 5 I have illustrated one form of apparatus in which my improved method of reproducing sound may be performed in which 6 represents a driving drum mounted upon shaft 7 to which is secured a gear 8 adapted to mesh with the gear 9 fixed to the shaft 10. The shaft 10 has also secured to it a second gear 11 meshing with the gear 12 fixed to the shaft 13. Also secured to the shaft 13 is a feed roller 14 having pins 15 adapted to engage perforations 2 of the tape 5'.

For the purpose of securing a positive engagement of the pins 15 with the tape, I may mount on a suitable shaft 16 located above the feed roller 14, a roller 17 provided with holes 18 which will register with the teeth or pins 15 and press the pins through perforations of the tape. Also mounted upon the shaft 10 is a friction roller 19 which is adapted to contact and drive the cooperating roller 20 mounted on the shaft 21 of the winding reel 22.

23 indicates reel from which the profile tape is supplied and from which tape is led over the guide roller 24 to the sound reproducing device.

Mounted in a suitable position adjacent to profile tape is a horn 25 or other suitable sound amplifying device, with the small end 26 adjacent to the surface of the tape. In the form of my invention illustrated in Fig. 5 this smaller end of the horn is provided with a narrow elongated slit or opening 27, the direction of which is transverse to the direction of the tape. The relation of the position between end slit or opening of the tape is shown diagrammatically in two positions in Fig. 4.

In Fig. 5 beneath the narrow opening 27 and adjacent to tape is a block 28 provided with a chamber 29 connected by a pipe or tube 30 with the air chamber 31, off a suitable pump, which may be used to produce either a pressure or a partial vacuum in the chamber 31.

The operation of this device is as follows: The drum being driven from any suitable source of motive power, its motion is communicated through the gears 8, 9, 11 and 12 to the feed roller 14, and through the friction drums 19 and 20 to the winding drum 22, the relation of the friction drums 19 and 20 being such that the winding drum 22 will always be driven at a speed which will keep the tape taut between the feed roller 15 and said winding drum 22. Air being forced from the chamber 31 through pipe 30 to the chamber 29 and one end of the elongated opening being always open and free to permit a column of air to pass through the same, as indicated in Fig. 4, the tape 5' is driven over the opening 27. The varying contour of the tape will constantly change the size of the opening through which the

air may pass, and consequently will produce variations in the column of air passing through the opening. The undulations or vibrations in the column of air allowed to pass through the opening will correspond to the undulations recorded on the profile of the tape. In this manner, the column of air will have impressed upon it undulations or vibrations which are the exact reproductions of the sound originally produced and recorded on the tape and when such vibrations are amplified through the horn 24, the result is a clear, loud and exact reproduction of the original sounds free from any disagreeable and undesirable qualities resulting from the scratch of a reproducing stylus over a record.

Fig. 6 indicates a modified construction in which the narrow slit or elongated opening 27' is located in the lower block 28 and the smaller end 26 of the horn 25 has a chamber 29' adjacent to tape. In this form of my invention the direction of the current of air would be reversed to what it is in apparatus shown in Fig. 5, and the pump would be used to produce a partial vacuum in chamber 31.

In Fig. 7 I have shown both the smaller end of the horn and the lower block as being provided with registering elongated openings 27, 27' respectively, and in this form of my invention the current of air may be impelled in either direction.

While I have described my invention in the form above set forth, it is obvious that it would be impracticable to use a metallic profile tape, formed as above described as a commercial record. I therefore propose to use either one or both of the tapes shown in Fig. 3 as master tapes, and produce duplicates thereof in a material suitable for commercial purposes. I have found that a tape of a good quality of stiff paper will answer all the requirements. The commercial paper tapes may be produced in large quantities from said master tapes in the following manner: A large number of plain strips of paper having been brought together and stacked under compression, the master tape is caused to guide or form a templet for a suitable profiling machine, while the cutting end of the machine is caused to travel transverse to the stacked tapes and to reproduce upon the edges thereof an exact copy of said master tape. A paper duplicate of the original master record made in this manner is indicated by Figs. 4 and 5.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States, is:—

1. The method of forming commercial profile tapes for use in sound reproducing devices which consists in forming a master

profile tape, and duplicating said master record by means of a suitable profiling machine upon a plurality of layers of paper tapes.

2. The method of forming commercial profile tapes for use in sound reproducing devices which consists in forming a master profile tape, using said master tape as a templet in a suitable profiling machine, and causing the cutting point of said profiling machine to reproduce the undulations of the master tape simultaneously on the edges of a plurality of stacked blank paper tapes.

3. The method of forming commercial profile tape for use in sound reproducing devices, which consists in forming a master profile metallic tape, and using said master tape as a templet for reproducing simultaneously a plurality of commercial duplicates thereof.

4. The method of forming commercial profile tape for use in sound reproducing devices, which consists in forming a master profile metallic tape, and using said master tape as a templet for reproducing simultaneously a plurality of commercial paper duplicates thereof.

5. The method of forming commercial profile tapes for use in sound reproducing devices, which consists in forming a master profile tape and duplicating said master tape by means of a profiling machine acting upon a plurality of stacked and compressed tapes.

6. The method of forming commercial profile tapes for use in sound reproducing devices, which consists in forming a master profile record and duplicating said master record simultaneously upon the edges of a plurality of tapes.

7. The method of forming commercial profile tapes for use in connection with sound reproducing devices which consists in forming a master tape one edge of which is provided with an undulating contour corresponding to sound waves, stacking and compressing together a plurality of paper tapes and placing them in a profiling machine, substantially simultaneously cutting one edge of said stacked tapes by said profiling mechanism, in which the said master tape is used as a templet for guiding the cutting tool, whereby a plurality of paper tapes substantially identical with each other and corresponding to said master tape are produced.

In witness whereof, I have hereunto set my hand this thirteenth day of October, A. D., 1905.

JOHN C. ENGLISH.

Witnesses:

ALSTON B. MOULTON,
ALEXANDER PARK.