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METHOD OF MAKING PHONOGRAPH RECORDS

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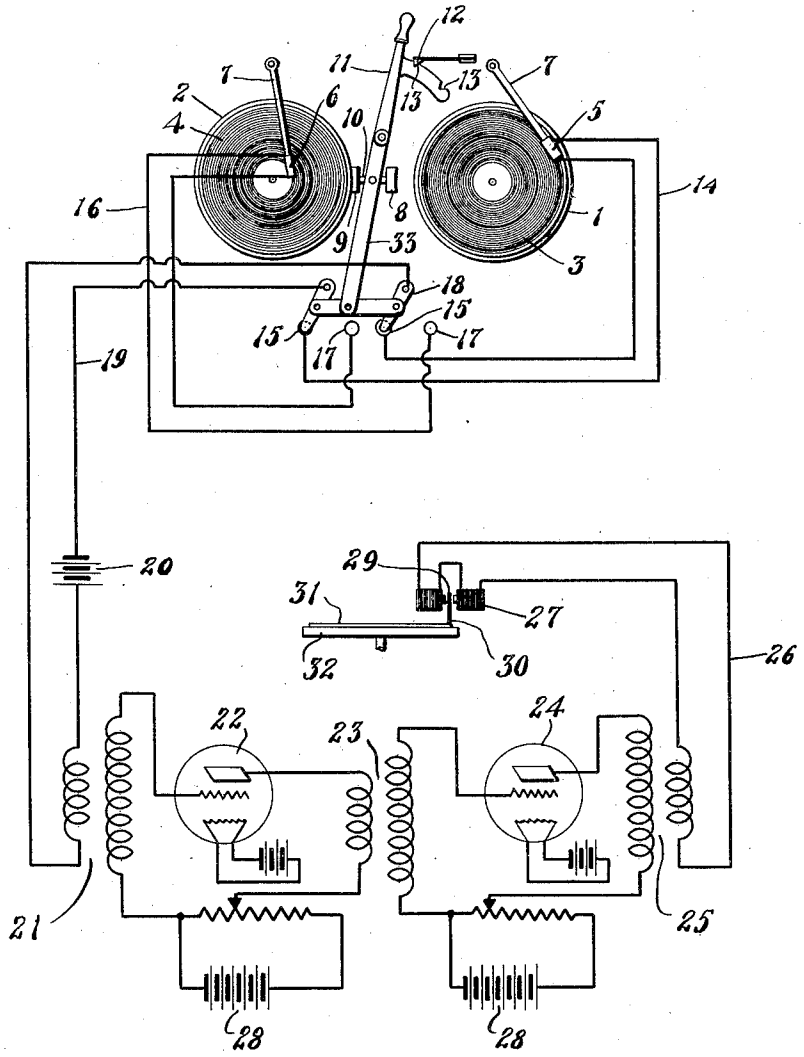

INVENTOR

Frank L. Dyer

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FRANK L. DYER, OF NEW YORK, N. Y.

METHOD OF MAKING PHONOGRAPH RECORDS

Original application filed October 19, 1927, Serial No. 227,191. Patent No. 1,726,546, dated September 3, 1929. Divided and this application filed June 28, 1929. Serial No. 374,314.

My invention relates to the art of making phonograph records and especially records which are capable of playing, without interruption, for long periods of time, as disclosed in my Patents, No. 1,570,297 of January 19th, 1926, and No. 1,628,658 of May 17th, 1927, and the present application is a division of application filed October 19th, 1927, Serial No. 227,191, issued as Patent No. 1,726,546, Sept. 3, 1929.

In my patents, just referred to, I describe an improved talking machine record, hereafter referred to as a micro-record, employing a groove of greatly reduced width, as compared with the standard practice in vogue at the time the applications for the same were filed, said micro-record being made at a surface speed substantially less than said standard, and being preferably of minute amplitude so as to correspond substantially in its proportions to a standard record on a very reduced scale. In this way the increase in playing time will be greatly extended. As an example, by forming a micro-record with a groove one one-thousandths of an inch in width, five hundred threads to the inch, and recorded at a mean surface speed of about eight inches per second, it becomes possible to record on one face of a standard ten inch disk, selections of one hundred minutes in duration. Therefore, on both sides of two such disks, it will be possible to record an entire book requiring almost seven hours in which to read it. The possibility of recording musical selections will be correspondingly extended.

One difficulty presents itself in the making of these very long records. The task of reading continuously for upwards of an hour from printed pages is great. Almost inevitably mistakes will be made, such as the omission or mispronunciation of words, and if this occurs, the work has to be started all over again on a fresh blank. The same is true in making a long musical record, since a single false note would necessitate a new start. My present invention is designed to overcome the difficulty referred to.

In carrying my improved method into effect, I first make a series of original records, comprising in the aggregate the entire matter to be recorded, whether talking or music. Each of these records will be, say five minutes in duration, so that in order to record for one hundred minutes on the single face of a ten inch disk, twenty of such original records will be required. Manifestly these original records may be shorter or longer than five minutes, the idea being that in case a mistake is made, either in the reading or the music, only a fraction of the entire recorded material on one face of my improved micro-record will require to be repeated. Thus, in making a talking record of a book for example, it will only be necessary for the reader to record a portion of the contents thereof at one time, occupying only a few minutes, and in case an error is made, it becomes a simple matter to start again at the point where the recorded matter on that particular record commenced.

The procedure to be followed in making a musical micro-record will be obvious, the orchestra, band, vocalist or chorus simply making a succession of records, one at a time, representing the successive portions of the music to be recorded.

Preferably these original records, which in the aggregate comprise the matter to be transferred on one or both faces of my improved micro-record, will be formed with a groove of standard width, surface speed and amplitude, thus permitting a very accurate recording of the sounds. This may be done in the old way or by modern electrical recording methods as disclosed for example in the patent to Vreeland and Dyer, No. 1,593,735 of July 27th, 1926.

My improved method next contemplates the transfer of the sounds from the series of successive records to the face or faces of my improved micro-record. This transfer may be made from the original master records themselves or from copies thereof made in the usual way in harder and more durable material. It will be entirely feasible to make the transfer from the original master records, since it probably will not be necessary to run them more than once under the reproducing stylus and it is not important that

there shall be great pressure on the reproducing stylus and therefore the wear will not be objectionably great. At the same time it is perfectly feasible, though somewhat more expensive, to effect the transfer from copies obtained in the usual way from successive masters. When the latter procedure is adopted it will be possible to make any desired number of micro-masters, in case a very large number of copies of the improved micro-records are to be made.

In effecting a transfer from the successive records or copies to the desired micro-master, it is necessary that there should be no substantial time interval between the records, because the micro-record has to be continuous, just as though it represented a long connected reading or musical performance. In order to effect this result, I perform the transferring operation electrically by the use of pickup mechanism which transforms the record variations into telephone currents which are caused to actuate a magnetic recorder controlling the cutting stylus. A pair of turntables will be used, on one of which will be the master or copy from which the transfer is taking place to the micro-master and on the other turntable will be placed the successive master or copy so that when the first record has been completed, it will be only necessary to operate a simple electric switch and start the second turntable. The only interval of time between succeeding records therefore, will be the second or two necessary for the second turntable to reach its operating speed. This may represent the time interval between successive paragraphs or chapters of a book or corresponding portions of a musical selection.

Furthermore, in my improved method I prefer to operate both the original masters or copies and the micro-master at speeds substantially below normal. For example, if the normal shaft speed of a standard master is eighty revolutions per minute and the standard shaft speed of the micro-master is sixteen revolutions per minute, the former may, in the transferring process, be rotated at a shaft speed of forty revolutions per minute and the latter at a shaft speed of eight revolutions per minute. By thus correspondingly reducing the surface speeds of the master records and the micro-master, I am able to substantially reduce distortion effects due to inertia.

As I have stated, the master records which I make in the first place, preferably correspond with the present standards as to the shaft speed, surface speed and amplitude and in making my improved micro-record, I prefer to reduce the amplitude to substantially the same extent that the width and surface speed of my improved micro-record depart from standard practice. Drawing an analogy from a pantograph, in other words, I reduce all the dimensions of the copy which is being made from the original. In this way, I substantially reduce any loss in definition in the copy due to lost motion or other energy losses in the complete system.

Finally with my improved method, I prefer to make use of one or more thermionic amplifiers, whereby very feeble telephone currents, developed by the electrical pick-up may be amplified to any desired extent for the actuation of the magnetic recording mechanism. Thus it becomes possible to make use of pick-ups in which excessively minute telephone currents are developed and which respond with great accuracy to the sound variations recorded on the original masters.

In order that my invention may be better understood, attention is directed to the accompanying drawing, showing in diagram my improved apparatus, designed to carry the method into effect.

The turntables 1 and 2 are driven in any suitable and usual way, preferably by electric motors (not shown) of sufficient power to permit either turntable, when started, to very quickly reach its operating speed.

3 is a record on turntable 1 and 4 is a record on turntable 2. These records may be either original masters representing two successive portions of the complete matter to be transferred to the micro-master or they may be copies thereof in hard material made in the usual way.

5 is an electrical pick-up mechanism cooperating with the records 3 and 6 and a similar pick-up mechanism cooperating with record 4. Both of these pick-up mechanisms are shown as being carried by pivoted arms 7—7 so as to be fed across the respective record with which it cooperates.

The pick-up mechanisms are of any suitable and desired type for the development of telephone currents corresponding with the recorded sounds. They may operate upon any desired principle, such as by variable resistance or upon the principle of a magnetic telephone or condenser telephone, all of which are well known. A pick-up operating upon either of the latter principles will be responsive with great accuracy to the recorded sounds, but the currents developed will be extremely feeble. This difficulty may be remedied by the use of thermionic amplifiers, as I will hereafter describe, whereby the currents may be amplified without distortion to any desired value.

The pick-up 5 is shown as engaging the beginning of the groove on the record 3 and it is therefore assumed that that turntable 1 has just been started so as to transfer the matter on record 3 to the micro-master. The pick-up 6 is shown in engagement with the termination of the groove of record 4 and it is therefore assumed that the turntable 2 has just been stopped.

The stopping of one turntable and the starting of the other may be performed simultaneously at a single operation. As an illustration of mechanism for this purpose, I show a brake shoe 8 adapted to cooperate with the turntable 1 and a brake shoe 9 adapted to cooperate with the turntable 2, these brake shoes being connected by a rod 10 and operated by a handle 11. The latter is adapted to be locked in either position by a spring latch 12 engaging two notches 13—13, as will be obvious. Thus by swinging the handle 11 to the left the brake shoe 9 will be disengaged from the turntable 2 to permit the latter to start and will be engaged with the turntable 1 to stop it.

During the time the pick-up 5 is traversing the record 3, the operator will have an opportunity to remove the record 4 on the turntable 2 and replace it with a record which succeeds the matter on record 3, and return the pick-up 6 to the starting position on the succeeding record.

I show a circuit 14 for pick-up 5, leading to switch contacts 15, 15 and a corresponding circuit 16 for pick-up 6 leading to switch contacts 17, 17. An ordinary two blade switch 18 is adapted to connect either of the circuits 14 or 16 with a common circuit 19 having a battery 20 therein.

I preferably employ one or more thermionic amplifiers, to amplify the telephone currents and in the drawing I show two of such amplifiers arranged in cascade in a well known way. The circuit 19 includes the primary of a step-up transformer 21, the secondary of which connects with the grid of a three-electrode vacuum tube 22. The plate circuit of this vacuum tube includes the primary of a step-up transformer 23, the secondary of which leads to the grid of a second three-electrode vacuum tube 24. The plate circuit of the latter vacuum tube includes the primary of a step-down transformer 25, the secondary of which is included in a circuit 26, which includes a magnetic recording mechanism of any suitable type, such as shown for example in my Patent No. 1,544,379, dated January 30th, 1925.

The B-batteries 28, 28 supply current of the desired voltage to the plate circuits of the vacuum tubes.

The armature 29 of the magnetic recording mechanism carries a fine pointed cutting tool 30, such armature being so pivoted, as shown, that the amplitude of the cut will be substantially less than the maximum swing of said armature. In other words, the armature is pivoted so as to partake substantially of the amplitude of the record groove on the records 3 and 4, while the cutting stylus 30 will partake of a greatly reduced amplitude. If the width of the record groove is one-fifth the width of a standard groove and if the mean surface speed is one-fifth of a standard groove, then I prefer to so pivot the armature 29 as to secure an amplitude in the neighborhood of one-fifth that of a standard groove.

The cutting stylus 30 cooperates with the micro-master 31, carried on the turntable 32, whereby the original records alternately placed on the turntables 1 and 2 will be successively transferred and recorded upon the micro-master 31. It will be, of course, understood that the shaft speed of turntable 32 and the pitch of the record groove formed by the cutting stylus 30, will be substantially reduced from those of standard practice as I have described in my patents first referred to herein.

In order that the operation of the switch 18 may be effected concurrently with the start and stopping of the respective turntables 1 and 2, I show a connection 33 between the handle 11 and said switch so that when the handle is moved the switch will be operated. Thus when the handle 11 is moved to the left to start the turntable 2 and stop the turntable 1, the switch 18 will be moved into engagement with the contacts 17, 17 so as to connect the pick-up 6 with the battery circuit 19.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent is as follows:

1. The method of recording sounds of long duration which consists in making successive records, each representing a fraction of the sounds to be recorded and in electrically transferring the recorded sounds from the successive records to a micro-blank turning at slower speed than the original records, substantially as set forth.

2. The method of recording sounds of long duration which consists in making a series of records each representing a fraction of the sounds to be recorded, said record being of substantial width and in electrically transferring the sounds recorded on the successive records to a micro-master and forming a groove therein of greatly reduced width, substantially as set forth.

3. The method of recording sounds of long duration which consists in making a series of records each representing a fraction of the sounds and being of substantial width and recorded at a substantial surface speed and in electrically transferring the sounds recorded on the successive records to a micro-master and forming a groove therein of greatly reduced width and speed, substantially as set forth.

4. The method of recording sounds of long duration which consists in making a series of records each representing a fraction of the sounds and of substantial width and amplitude and in electrically transferring the sounds recorded on the successive records to a micro-master and forming a groove therein

of greatly reduced width and amplitude, substantially as set forth.

5. The method of recording sounds of long duration which consists in making a series of records each representing a fraction of the sounds and being of substantial width, surface speed and amplitude and in electrically transferring the sounds recorded on the successive records to a micro-master and forming a groove therein of greatly reduced width, surface speed and amplitude, substantially as set forth.

6. The method of recording sounds of long duration which consists in making successive records each representing a fraction of the sounds to be recorded, in playing said records in succession at a substantially reduced speed and in electrically transferring the recorded sounds from the successive records to a micro-blank turning at a substantially slower speed than the original record, substantially as set forth.

7. The method of recording sounds of long duration which consists in making successive records each representing a fraction of the sounds to be recorded, in playing said records in succession and causing the said records to generate telephone currents, in amplifying said telephone currents, and in causing the amplified telephone currents to form, in a micro-master, a single sound groove representing the total sounds recorded on the successive records, substantially as set forth.

FRANK L. DYER.