

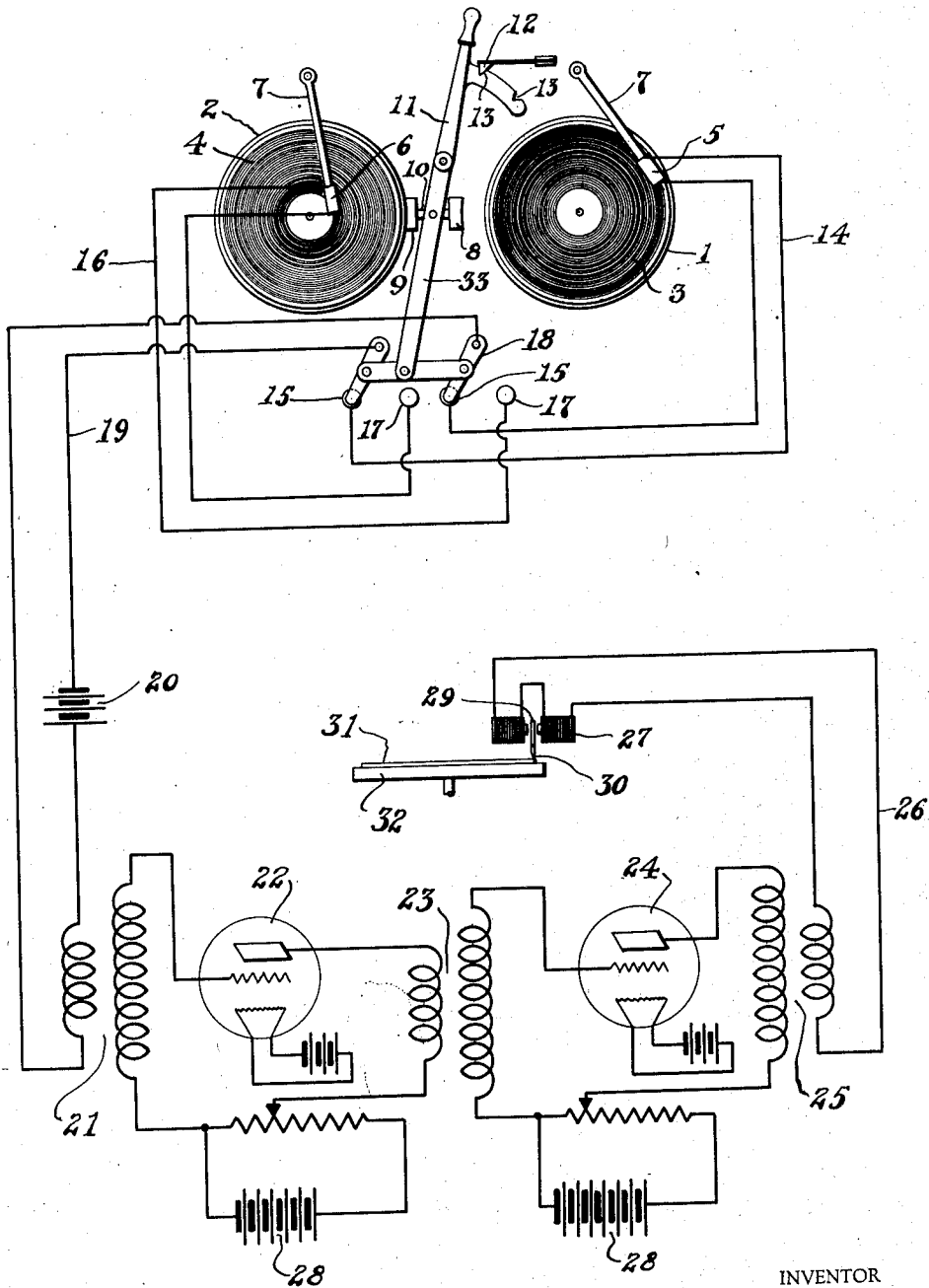
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APPARATUS FOR MAKING PHONOGRAPH RECORDS

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APPARATUS FOR MAKING PHONOGRAPH RECORDS.

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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 19, 1926 and No. 1,628,658 of May 17, 1927.

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-thousandth 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 invention 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 27, 1926.

My invention 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 trans-

ferring 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, with my invention 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 departs 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 invention, 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 pickups 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.

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 pickup mechanism cooperating with the record 3 and 6 is a similar pickup mechanism cooperating with record 4. Both of these pickup 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 pickup 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 pickup 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 pickup 5 is shown as engaging the beginning of the groove on the record 3 and it is therefore assumed that turntable 1 has just been started so as to transfer the matter on record 3 to the micro-master. The pickup 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 pickup 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 pickup 6 to the starting position on the succeeding record.

I show a circuit 14 for pickup 5, leading to switch contacts 15, 15 and a corresponding circuit 16 for pickup 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 30, 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 means 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 pickup 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. An apparatus for recording sounds of long duration comprising in combination, two turntables for receiving alternately successive records each representing a fraction of the sounds to be recorded, an electrical pick-up mechanism cooperating with the record on each of said turntables, whereby the sounds recorded on said records will be converted into telephone currents, a third turntable rotating at a substantially reduced speed, a micro-blank thereon, and magnetic recording mechanism operated by the telephone currents for forming a groove in said micro-blank, substantially as set forth.

2. An apparatus for recording sounds of long duration comprising in combination, two turntables for receiving alternately successive records each representing a fraction of the sounds to be recorded, an electrical pick-up mechanism cooperating with the record on each of said turntables, whereby the sounds recorded on said records will be converted into telephone currents, a third turntable rotating at a substantially reduced speed, a micro-blank thereon, magnetic recording mechanism operated by the telephone currents for forming a groove in said micro-blank, and means for thermionically amplifying the telephone currents located between the magnetic recording mechanism and said pick-up devices, said amplifying means being common to both pick-up devices, substantially as set forth.

3. An apparatus for recording sounds of long duration comprising in combination, two turntables for receiving alternately successive records each representing a fraction of the sounds to be recorded, an electrical pick-up mechanism cooperating with the record on each of said turntables, whereby the sounds recorded on said records will be converted into telephone currents, a third turntable rotating at a substantially reduced speed, a micro-blank thereon, magnetic recording mechanism operated by the telephone currents for forming a groove in said micro-blank, and means for simultaneously starting one of the pair of turntables and stopping the other, substantially as set forth.

4. An apparatus for recording sounds of long duration comprising in combination, two turntables for receiving alternately successive records each representing a fraction of the sounds to be recorded, an electrical pick-up mechanism cooperating with the record on each of said turntables, whereby the sounds

recorded on said records will be converted into telephone currents, a third turntable rotating at a substantially reduced speed, a micro-blank thereon, magnetic recording mechanism
5 operated by the telephone currents for forming a groove in said micro-blank, and a switch for disconnecting one of the pick-up mechanisms from the magnetic recording mechanism and for simultaneously connecting the
10 other pick-up mechanism with said magnetic recording mechanism, substantially as set forth.

5. An apparatus for recording sounds of long duration comprising in combination, two
15 turntables for receiving alternately successive records each representing a fraction of the sounds to be recorded, an electrical pick-up mechanism cooperating with the record on each of said turntables, whereby the sounds
20 recorded on said records will be converted into telephone currents, a third turntable rotating at a substantially reduced speed, a micro-blank thereon, magnetic recording mechanism operated by the telephone currents
25 for forming a groove in said micro-blank, means for simultaneously starting one of the pair of turntables and stopping the other, a switch for simultaneously disconnecting one of said pick-up mechanisms from the mag-
30 netic recording mechanism and connecting the other pick-up mechanism with said magnetic recording mechanism and a connection be-

tween the starting and stopping mechanism and said switch, substantially as set forth.

6. An apparatus for recording sounds of long duration, comprising in combination, two turntables for receiving alternately successive records, each representing a fraction of the sounds to be recorded, a third turntable rotating at a substantially reduced speed, a micro-blank thereon, means for transferring the sounds recorded on the successive records to said micro-blank and means for simultaneously starting one of the pair of turntables and stopping the other, substantially as set forth.

7. An apparatus for recording sounds of long duration, comprising in combination, two turntables for receiving alternately successive records, each representing a fraction of the sounds to be recorded, a third turntable rotating at a substantially reduced speed, means for transferring the sounds recorded on the successive records to said micro-blank, means for simultaneously starting one of the pair of turntables and stopping the other and means cooperating therewith for simultaneously disabling the transfer mechanism coacting with one of the successive records and rendering active the transfer mechanism coacting with the next successive record, substantially as set forth.

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