No. 648,935. Patented May 8, 1900.

T. A. EDISON.

APPARATUS FOR DUPLICATING PHONOGRAPH RECORDS.

(Application filed Oct. 28, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

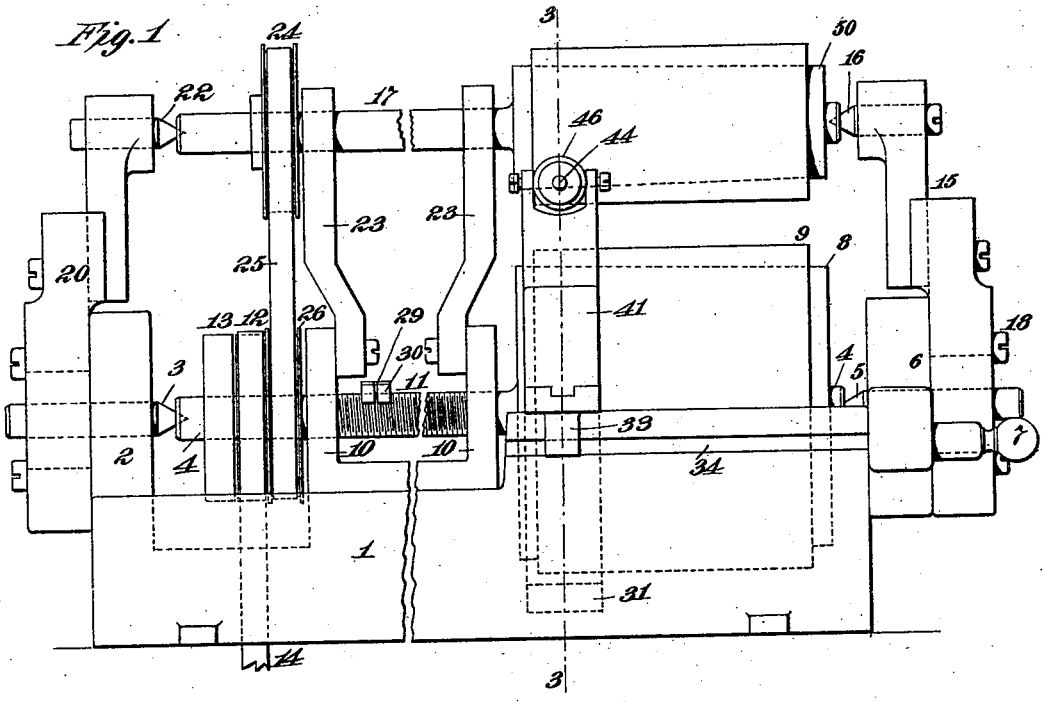
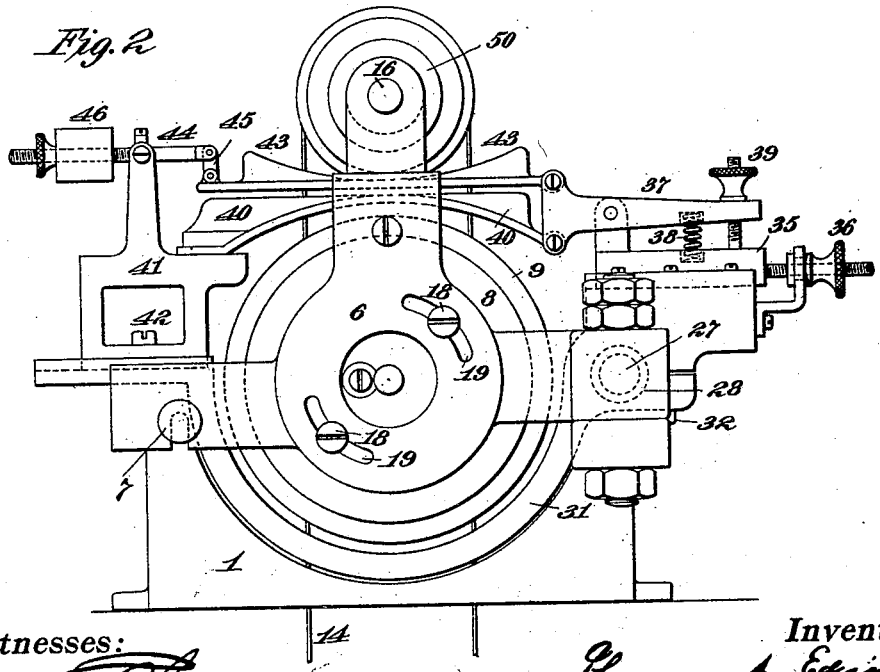


Fig. 2



Witnesses:

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Fig. 3

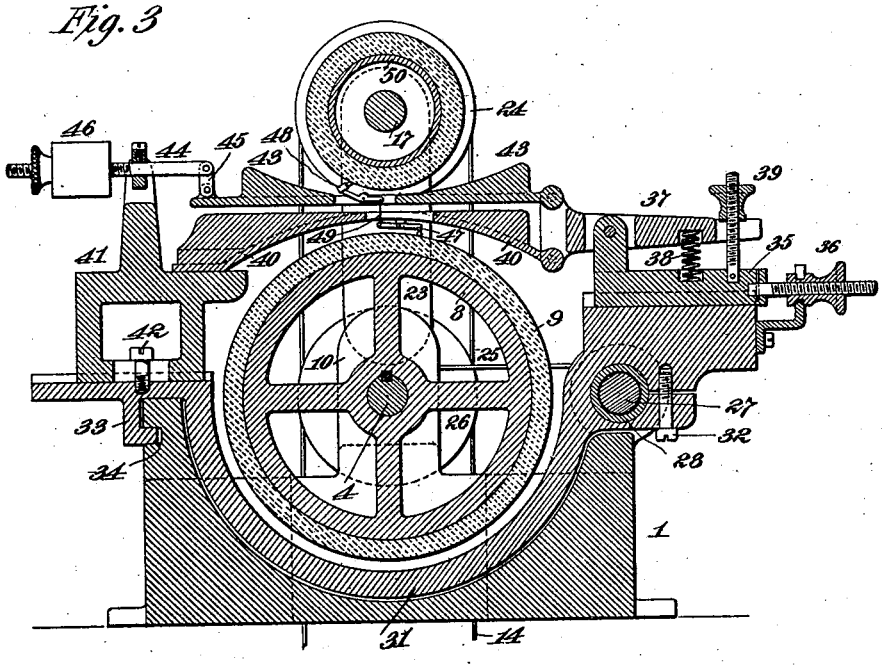
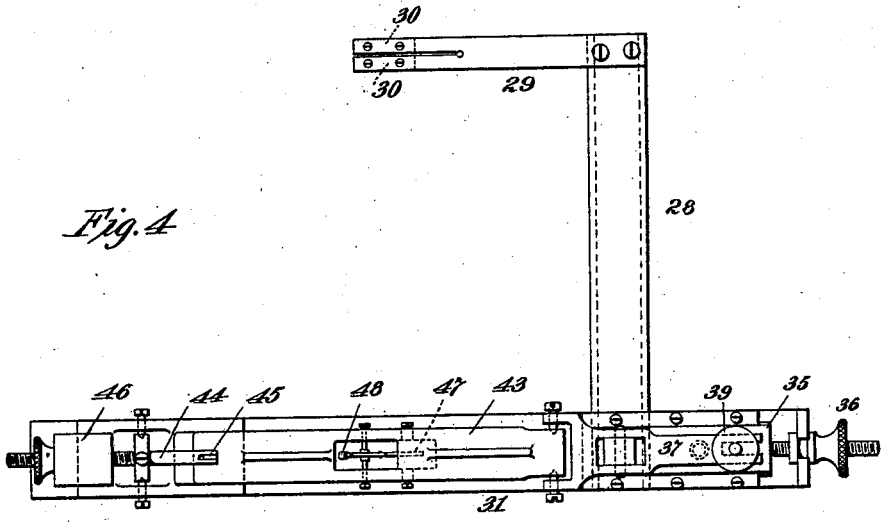


Fig. 4



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

APPARATUS FOR DUPLICATING PHONOGRAPH-RECORDS.

SPECIFICATION forming part of Letters Patent No. 648,935, dated May 8, 1900.

Application filed October 28, 1899. Serial No. 735,043. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citzen of the United States, residing at Llewellyn Park, in the county of Essex, State of New Jersey, have invented a certain new and useful Improvement in Apparatus for Duplicating Phonograph-Records, (Case No. 1,016,) of which the following is a description.

My invention relates to improvements in apparatus for duplicating phonographic records from a master by a mechanical process.

In duplicating phonograph-records from masters a reproducing-ball is engaged with the master and communicates its vibrations to a cutting or recording device which is maintained in engagement with a blank on which the duplicate record is to be formed, both master and duplicate blank being simultaneously rotated in the process of duplication. Most, if not all, musical records as at present made on the standard phonographs are characterized in whole or in part by the formation of waves which are of such a character that they cannot be tracked easily by the usual reproducing-ball, since the latter will not be permitted to enter to the full depth of the record-groove. In consequence the reproduced record is not an accurate copy of the master, and the phonographic reproductions obtained therefrom are not equal in volume and quality to reproductions which may be secured directly from the master.

The object of my invention is to provide an apparatus for obtaining duplicate phonographic records which shall be equal in volume and quality to an original or master record and from which in consequence superior reproductions can be secured, particularly if the reproducing device is of a character to accurately track all portions of the reproduced record.

In carrying my invention into effect I provide a master-record of such a character that all portions of the record-groove can be accurately tracked by the usual reproducing device, and to this end I employ a master-record which is of a sufficient diameter to provide for the formation of a record-groove which can be engaged throughout its length and accurately tracked by the usual reproducing device, and I engage with such a master-record a suitable reproducing device, which is mechanically connected with a recording or cutting device, the latter engaging a phonograph-blank, preferably of standard size, and which will be turned at a lower surface speed than the master. In this way the reproducing device will accurately track all portions of the groove on the master-record, and the reproduced record obtained therefrom will be characterized by the full depth of cut of an original standard phonograph-record.

In order that the invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a side view of the improved apparatus; Fig. 2, an end view thereof; Fig. 3, a sectional view on the line 3 3 of Fig. 1, and Fig. 4 a detached plan view of the reproducing mechanism.

In all of the above views corresponding parts are represented by the same numerals of reference.

1 represents a suitable base carrying a lug 2 at one side, in which is carried an adjustable cone 3, forming one of the end bearings of a main shaft 4. A bearing-cone 5 for the other end of said shaft is carried in a gate 6, pivoted at one side to the frame 1 and adapted to be locked at the other side by the usual locking-knob 7. The shaft 4 carries the mandrel 8 for the master 9, which is of an abnormally-large external diameter, preferably from five to six inches. A record made on a cylinder having a diameter of from five to six inches and rotated at the usual shaft speed of about one hundred and twenty turns per minute will be sufficiently extended as to be practically free from waves or depressions which cannot be accurately tracked to the full depth by a spherical reproducing device. Obviously, however, if the shaft speed is increased the formation of objectionable waves or depressions will be avoided on a record of less diameter. Guides 10 support the shaft 4 and the mandrel 8 when the gate 6 is opened to permit of the insertion upon and the removal from the mandrel 8 of a master-record. The shaft 4 is screw-threaded at 11, as shown, to provide for the feed of the reproducing mechanism, as will be explained. Said shaft carries a tight pulley 12 and a loose pulley

13, and a driving-belt 14 normally engages with the former to rotate said shaft. By shifting the belt to the loose pulley 13 rotation of the shaft will be arrested. The gate 6 carries an arm 15, provided at its upper end with a bearing-cone 16 for a supplemental shaft 17. The arm 15 is pivoted to the gate 6 concentrically with the bearing-cone 5 and is secured in place to the gate by means of screws 18, which work in slots 19 and by which an adjustment is provided for the arm 15. A corresponding arm 20 is carried by the lug 2 by means of adjusting-screws 21, and a bearing-cone 22 is mounted at the upper end of said arm to form the other bearing for the supplemental shaft 17. Supporting-arms 23 are carried from the guides 10 and are adjustable with respect to said guides for supporting the supplemental shaft 17 when the gate 6 is swung open, as will be understood. The supplemental shaft 17 carries a pulley 24, which connects by a belt 25 with a pulley 26 of the same diameter mounted on the shaft 4, whereby the shafts 4 and 17 will have the same velocity of rotation. These shafts may be connected together in any other suitable way, although I prefer a belt for this purpose owing to the absence of vibration therein.

A supporting-bar 27 is carried in the frame 1, preferably in line with the shaft 4, parallel therewith and at the back of the machine. Sliding upon this bar is a sleeve 28, from which a spring-arm 29 extends, said arm carrying threaded blocks 30 at its end, which engage with the screw-threaded portion 11 of the shaft 4, so that when the said shaft is rotated the sleeve 28 will be fed laterally upon the supporting-bar 27. A frame 31 for the reproducing mechanism is clamped upon the sleeve 28 by means of a screw 32 or is secured to said sleeve in any other suitable way, and said frame is provided with a curved portion which extends beneath the master on the mandrel 8 and clears the same. The front portion of the frame 31 bears upon the front edge of the frame 1 and is provided with an inturned hook 33, engaging a groove 34 in the frame 1, so as to hold the frame from upward movement. The frame 31 carries at its rear upper surface an adjusting-block 35, the position of which is adjustable by a thumb-nut 36, so that said block may be moved toward and away from the master-record. This block supports a pivoted lever 37, normally forced upward at its rear end by a heavy spring 38 and adapted to be adjusted downward at that end by an adjusting-nut 39. Pivoted to the lower forward end of the lever 37 is a bridge 40, which extends between the master-record and the blank and is supported at its forward end on a frame 41, adjustably secured to the frame 31 by means of a screw 42. Pivoted to the lever 37, above the bridge 40, is a floating bridge 43, connected at its forward end to a weighted lever 44 by means of a link 45. The weight 46 of said lever is adjustable thereon, as shown. Pivoted to the bridge 40 is a suitable pivoted reproducing device 47, comprising, essentially, a lever carrying at one end the usual reproducing-ball, and pivoted to the floating bridge 43 is a recording or cutting device 48, comprising, preferably, a pivoted lever carrying at one end a cutting or gouging tool of the usual circular form at its cutting edge. The free ends of the reproducing and recording levers are connected together by a link 49, comprising, preferably, a fine wire.

When a master-record of the proper size is placed on the mandrel 8 and a blank on which the record is to be reproduced, preferably of the standard size, is placed on a mandrel 50, carried by the supplemental shaft 17, the weight 46 will elevate the floating bridge 43 to engage the reproducer 47 with the master and the recorder 48 with the blank. The degree of pressure with which the recorder 48 engages the blank is dependent upon the effect of the weight 46, as will be understood, and said weight will therefore be adjusted so as to give to the recorder the proper amount of cut necessary to secure the best results. The effect of the weight 46 being to hold the reproducer in engagement with the master and the recorder in engagement with the blank with a definite pressure, any movement of the reproducer due to the engagement of the master will be communicated to the recorder, and hence a record will be cut in the blank, it being understood that the inertia of the weight 46 is so relatively great that the small vibrations to which the reproducing and recording devices are subjected will not affect the same.

By using a master-record of such a size as to enable a record to be formed which can be accurately tracked by the reproducing device and by running such a master at the same shaft speed as a standard blank I am enabled to obtain reproduced records on standard-blanks which will be equal in every respect, and especially in the depth of cut, to original standard records and which are not open to the objection which now exists to reproduced records obtained by present methods. By providing for an adjustment of the block 35 toward and away from the blank or master and for the pivotal adjustment of the lever 37 it will be possible to regulate the inclination of the reproducer or recorder to any angle which may be necessary with respect to the blanks and by which the best effects will be secured. Any slight adjustment which may be imparted to the block 35 will be compensated at the free end of the floating-bridge 43 by the link 45; but if this adjustment is considerable the supplemental frame 41 may be correspondingly adjusted by loosening the screw 42 and by shifting such supplemental frame toward or away from the master.

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

1. In an apparatus for reproducing phono-

graph-records, the combination with a mandrel carrying a record of large size, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a second mandrel extending parallel therewith and carrying a blank of smaller size, of means to rotate both mandrels, a reproducer engaging the master-record, a recorder engaging the blank, and connections between the reproducer and the recorder, substantially as set forth.

2. In an apparatus for reproducing phonograph-records, the combination with a mandrel carrying a record of large size, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a second mandrel extending parallel therewith and carrying a blank of smaller size, of means to rotate both mandrels at the same shaft speed, a reproducer engaging the master-record, a recorder engaging the blank, and connections between the reproducer and the recorder, substantially as set forth.

3. In an apparatus for reproducing phonograph-records, the combination with a mandrel carrying a record of large size, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a second mandrel extending parallel therewith and carrying a blank of smaller size, of means to rotate both mandrels at the same shaft speed, a bridge straddling the master, a reproducer pivoted to said bridge, a recorder engaging the blank, and connections between the reproducer and the recorder, substantially as set forth.

4. In an apparatus for reproducing phonograph-records, the combination with a mandrel carrying a record of large size, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a second mandrel extending parallel therewith and carrying a blank of smaller size, of means to rotate both mandrels at the same shaft speed, a bridge straddling the master, means for adjusting the bridge laterally toward and away from the master, a reproducer pivoted to said bridge, a recorder engaging the blank, and connections between the reproducer and the recorder, substantially as set forth.

5. In an apparatus for reproducing phonograph-records, the combination with a mandrel carrying a record of large size, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a second mandrel extending parallel therewith and carrying a blank of smaller size, of means to rotate both mandrels at the same shaft speed, a bridge straddling the master, means for adjusting the bridge vertically with respect to the master, a reproducer pivoted to said bridge, a recorder engaging the blank, and connections between the reproducer and the recorder, substantially as set forth.

6. In an apparatus for reproducing phonograph-records, the combination of a mandrel of large diameter carrying a master-record, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width, a mandrel of less diameter carrying a blank, a stationary bridge straddling the master, a floating bridge pivoted above the stationary bridge, an overbalance-weight for the floating bridge, a reproducer pivoted to the stationary bridge, a recorder pivoted to the floating bridge, and connections between the reproducer and recorder, substantially as set forth.

7. In an apparatus for reproducing phonograph-records, the combination with a mandrel of large diameter carrying a master-record, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a mandrel of less diameter carrying a blank, of a stationary bridge straddling the master, a floating bridge pivoted above the stationary bridge, an overbalance-weight for the floating bridge, a reproducer pivoted to the stationary bridge, a recorder pivoted to the floating bridge, connections between the reproducer and recorder, and an adjusting-lever to which the stationary bridge and the floating bridge are pivoted, substantially as set forth.

8. In an apparatus for reproducing phonograph-records, the combination with a mandrel of large diameter carrying a master-record, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a mandrel of less diameter carrying a blank, of a stationary bridge straddling the master, a floating bridge pivoted above the stationary bridge, an overbalance-weight for the floating bridge, a reproducer pivoted to the stationary bridge, a recorder pivoted to the floating bridge, connections between the reproducer and recorder, an adjusting-lever to which the stationary bridge and the floating bridge are pivoted, and means for adjusting said lever on its pivot, substantially as set forth.

9. In an apparatus for reproducing phonograph-records, the combination with a mandrel of large diameter carrying a master-record, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and a mandrel of less diameter carrying a blank, of a stationary bridge straddling the master, a floating bridge pivoted above the stationary bridge, an overbalance-weight for the floating bridge, a reproducer pivoted to the stationary bridge, a recorder pivoted to the floating bridge, connections between the reproducer and recorder, an adjusting-lever to which the stationary bridge and the floating

bridge are pivoted, means for adjusting said lever on its pivot, and means for adjusting said pivot laterally, substantially as set forth.

10. In an apparatus for reproducing phonograph-records, the combination of a shaft carrying a mandrel of large diameter, a master-record mounted on said mandrel, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width, conical bearings for the shaft, a pair of arms concentrically mounted with respect to said bearings, said arms carrying conical bearings at their upper ends, a supplemental shaft carried in the last-mentioned bearings, a mandrel carried by said shaft of relatively-small diameter, a phonograph-blank mounted on said mandrel, means for rotating both of said shafts, and means for effecting a reproduction from a master-record upon the blank, substantially as set forth.

11. In an apparatus for reproducing phonograph-records, the combination of a shaft carrying a mandrel of large diameter, a master-record mounted on said mandrel, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width, conical bearings for the shaft, a pair of arms concentrically mounted with respect to said bearings, said arms carrying conical bearings at their upper ends, means for adjusting the inclination of said arms, a supplemental shaft carried in the last-mentioned bearings, a mandrel carried by said shaft of relatively-small diameter, a phonograph-blank mounted on said mandrel, means for rotating both of said shafts, and means for effecting a reproduction from a master-record upon the blank, substantially as set forth.

12. In an apparatus for reproducing phonograph-records, the combination of a shaft carrying a mandrel of large diameter, a master-record mounted on said mandrel, said record being of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width, conical bearings for the shaft, a pair of arms concentrically mounted with respect to said bearings, said arms carrying conical bearings at their upper ends, means for adjusting the inclination of said arms, a supplemental shaft carried in the last-mentioned bearings, a pair of pivoted supporting-arms similarly adjustable for supporting the supplemental shaft when its end bearings are released, a mandrel carried by said shaft of relatively-small diameter, a phonograph-blank mounted on said mandrel, means for rotating both of said shafts, and means for effecting a reproduction from a master-record upon the blank, substantially as set forth.

13. In an apparatus for reproducing phonograph-records, the combination of a main shaft mounted at one end in a stationary conical bearing and at the other end in a movable conical bearing, a gate for carrying the movable bearing, an adjustable arm mounted concentrically to the stationary bearing and carrying a stationary conical bearing at its upper end, an adjustable arm mounted concentrically to the movable bearing and carried also by said gate, a conical bearing at the upper end of said arm, a supplemental shaft mounted between the bearings carried by said arm, a mandrel mounted on said shaft, a blank carried by said mandrel, means for rotating both of said shafts, a mandrel on the main shaft, a master-record carried by said mandrel and of a sufficiently-large diameter as to be free of waves or depressions which are of less length than width and means for effecting a reproduction from a master on the first-mentioned mandrel to a blank on the mandrel of the supplemental shaft, substantially as set forth.

This specification signed and witnessed this 27th day of October, 1899.

THOMAS A. EDISON.

Witnesses:
J. F. RANDOLPH,
F. C. DEVONALD.