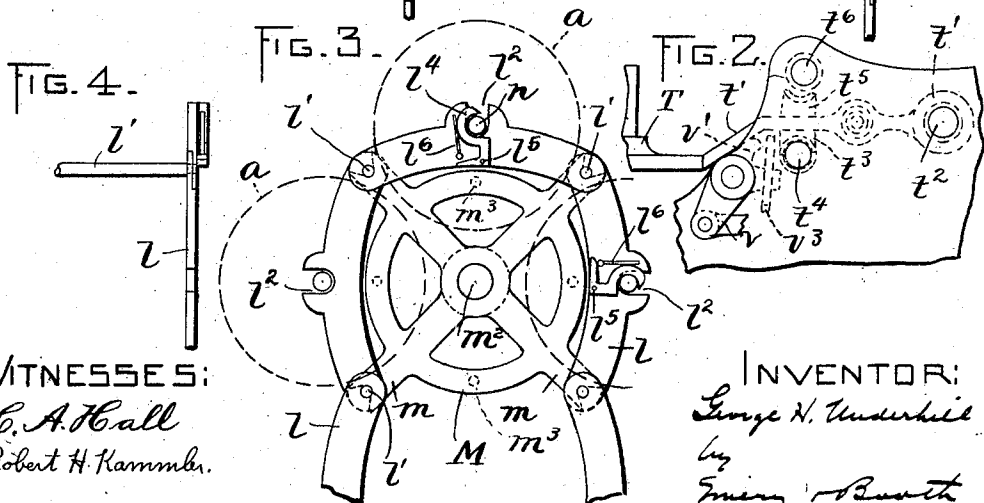
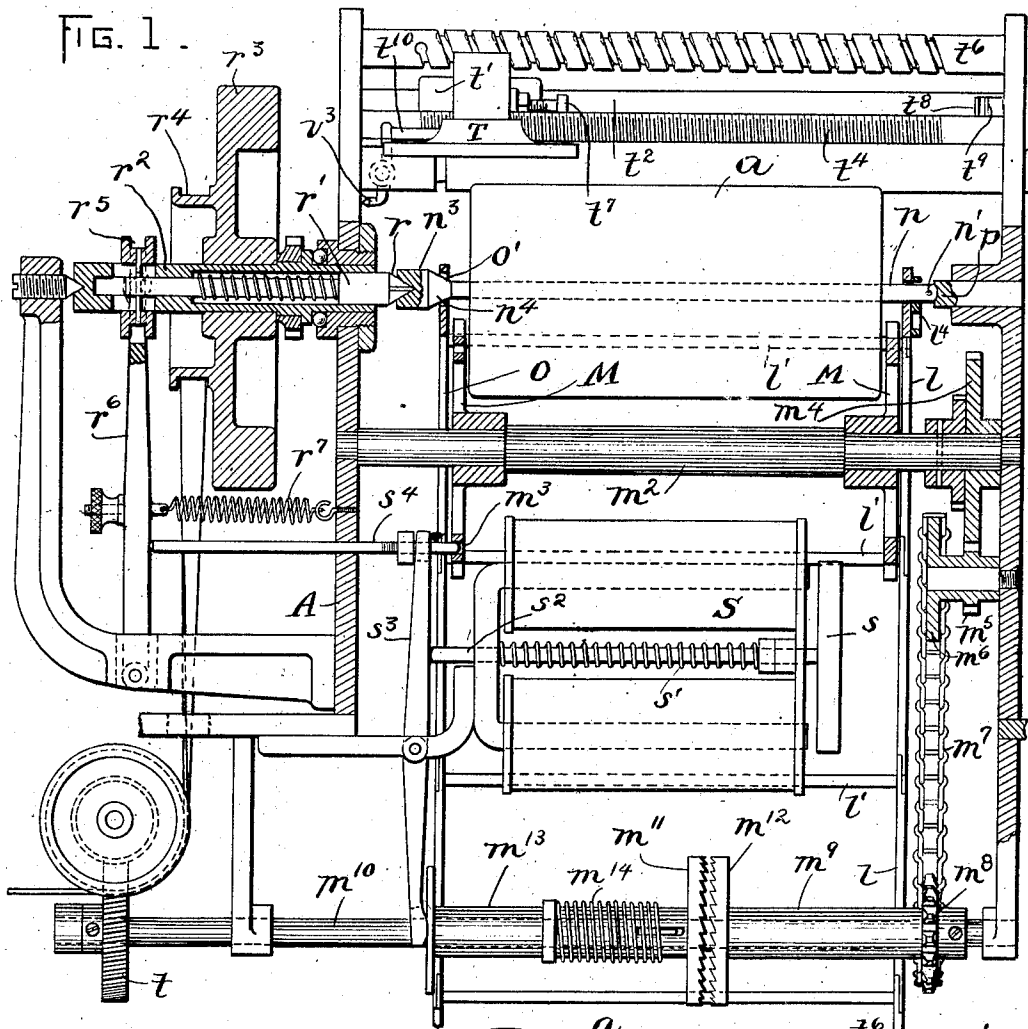


G. H. UNDERHILL.
 PHONOGRAPH.
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PHONOGRAPH.

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To all whom it may concern:

Be it known that I, GEORGE H. UNDERHILL, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Phonographs, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to sound-reproducing or sound-recording machines. While many features thereof have useful application to other types of such machines, and to those employing but a single record, my invention is particularly applicable and is here illustrated with reference to one type of multiple record machine employing a plurality of cylindrical records adapted automatically and successively to be brought into reproducing or recording relation with reference to suitable reproducing or recording mechanism, the latter being caused automatically to traverse the face of each record as the same is presented.

My invention will be best understood by reference to the following description when taken in connection with the accompanying illustration of one specific embodiment thereof, which it will be understood represents but a single form, while its scope will be more particularly pointed out in the appended claims.

In the drawings,—Figure 1 is a central, vertical section, partially broken away, showing the principal operating parts of a phonograph embodying one form of my invention; Fig. 2 is a partially broken away end elevation showing the support and traversing mechanism for the sound box; Fig. 3 is a side elevation showing the flexible linked record carrier and its relation to the driving sprockets of the machine, and Fig. 4 is an end view of the same linked carrier.

In the drawings, for illustrative purposes, I have shown the various features of my invention embodied in a multiple record phonograph employing a series of record cylinders *a*, which may be of any usual or ordinary type. The term "phonograph" I herein employ in its generic sense to signify a machine of any type for producing or re-

producing sounds, it being immaterial whether such machine is of the graphophone or gramophone type or whether it employs cylindrical, disk or other records.

The specific type of machine here shown is provided with a record holder, which may be of any suitable type or construction but which is shown as of the linked or chain type, comprising two chains or sets of jointed links, in the individual links of which are held the several records of the series.

One chain is constructed of a series of similar links *l*, which may be and herein are jointed by means of rods *l'*, each of which extends across to a corresponding and opposite joint in the other chain. The several rods are adapted to engage with the forked arms *m* of the two sprockets *M*, *M*, mounted upon the sprocket shaft *m*², the latter journaled in the machine frame *A*, so that the linked holder is sustained by the sprockets and carried about as the sprocket shaft is turned.

The link *l* has an open pocket or depression *l*² formed on its upper edge in which one end of the mandrel shaft *n* is adapted loosely to rest, the semi-circular bottom of the pocket being of appreciably greater diameter than the diameter of the shaft. A pin *n'* in the overhanging end of the shaft prevents lateral withdrawal thereof in one direction.

The other chain member is composed of links *o*, jointed as are the links *l*, but having in place of the open pockets, apertures *o'*, also of greater diameter than the diameter of the mandrel shaft. The latter at its end nearest to the link *o* terminates in an enlarged head *n*³ of greater dimensions than the aperture *o'*, there being provided between the shaft and the enlarged head an abruptly tapered portion *n*⁴.

Each mandrel when placed upon the carrier is effectually held against longitudinal displacement by the pin *n'* at one end and the enlarged head *n*³ at the other, the latter, however, permitting a comparatively free lateral or swinging movement of the mandrel upon the head as a fulcrum. At the opposite end however, the mandrel shaft is normally held against swinging movement by the

retaining hook l^4 , which is pivoted (Fig. 3) upon the link at l^5 and pressed forward by the light spring l^6 to overlie the end of the mandrel shaft. The shaft end is therefore readily released when the hook is forced backward, leaving the mandrel free to be swung away from the linked carrier for the withdrawal of its record if desired. The shaft end is replaced by merely snapping in the end of the shaft against the inclined end of the hook to force the latter open. For withdrawal, a sharp quick pull on the mandrel shaft will also open the hook.

When the record is in position (see Fig. 1) one end of the mandrel shaft is seated in the step bearing p , which is slightly cupped to receive the shaft end and retain it in position. This bearing is shown stationary but, if desired, the same might itself be journaled in ball or other frictionless bearings acting thereby to reduce the friction of the machine.

At its opposite end the enlarged end of the mandrel shaft is recessed to receive the winged point r upon the head of the driving shaft r' , which latter is constantly driven through the sleeve r^2 , in which the driving shaft is mounted for axial sliding movement, although keyed or pinned thereto to rotate therewith. To the sleeve is secured the fly wheel r^3 and driving pulley r^4 , the latter having a connection by a belt with any suitable source of driving power. The fly wheel tends to keep constant the speed of rotation of the driving shaft by being clutched to and unclutched from successive records, tending therefore to start up the new record instantly at its normal speed. The outer end of the driving sleeve r^2 has the grooved collar r^5 , which is attached to the driving shaft r' by a pin working in a slot in the sleeve, so that the collar turns with the latter, but may be moved longitudinally to cause the longitudinal clutching or unclutching of the driving shaft. The sprocket and chain-carrier have a position of rest such that a record is then held, as shown in Fig. 1, in approximately its operative position and in a position to have its mandrel shaft engaged by the driving shaft. In that position as shown the winged head r of the driving shaft engages the recessed or socketed end of the mandrel shaft, forcing the opposite end of the shaft into the cupped bearing p and lifting the shaft substantially free from contact with the chain carrier. The mandrel shaft is then supported at one end by the bearing p and at the opposite end by the head of the driving shaft which holds it in suitable and accurate alinement for coöperation with the sound box and stylus, and simultaneously imparts thereto the necessary rotary movement.

When the sound box reaches the end of its

travel, by means hereafter referred to, it is elevated and returned to its initial position. Simultaneously, the record is released by the driving shaft and restored to the carrier and the sprocket is given a partial revolution, sufficient to bring a fresh record into its approximate operative position, whereupon the fresh record is in turn engaged by the driving shaft and presented to the stylus.

For the purpose of releasing and shifting the records, the sound box or its arm is caused to complete an electric circuit, energizing the controlling magnet S , which is shown (Fig. 1) placed beneath the sprocket shaft in a central location. The energization of the magnet attracts its armature s , normally retracted by the spring s' . This forces the armature rod s^2 against the upright pivoted lever s^3 , causing the latter to withdraw the horizontal locking bar s^4 from the locking aperture m^3 in the face or side of the sprocket M . Simultaneously, the driving shaft r^1 is withdrawn from clutching engagement with the enlarged socket of the mandrel shaft by pressure of the opposite end of the locking rod against the upright pivoted lever r^6 , which is connected to move the grooved collar r^5 outwardly and release the record.

The moment the record is released by the clutching head of the driving shaft, the tapered portion n^4 upon the mandrel shaft engages with the aperture of the link and slides or withdraws the mandrel out of the cupped bearing p , so that the shaft when restored to its seat on the carrier is entirely clear of its end support and free to advance with the carrier or holder.

The record having been restored to the carrier and the sprocket released, the sprocket shaft is free to be turned by mechanism to be described, the clutch shaft in the meantime being held retracted by the latch rod s^4 , the latching end of which remains pressed against the face of the sprocket until the sprocket is turned far enough to bring the next locking aperture in registration therewith, which does not occur until the next record has advanced to the desired position.

The sprocket shaft is turned through engagement of the gear m^4 and the pinion m^5 , the latter being mounted upon a sleeve with the sprocket m^6 , which is driven through the chain m^7 and sprocket wheel m^8 from the counter-shaft sleeve m^9 . The latter is mounted upon the counter-shaft m^{10} and constantly driven through suitable and appropriate gearing t and is adapted to be clutched to or unclutched from the counter-shaft by means of engagement between the movable clutch member m^{11} and a clutch member m^{12} . The latter is secured to the sleeve m^9 , while the movable clutch member is secured to a sleeve m^{13} slidably mounted

upon the counter-shaft but keyed thereto and provided with a spring m^{14} which acts to retract the clutch member from engagement. When the magnet S is energized, a depending end of the upright lever s^3 throws the sleeve m^{13} over against the spring m^{14} and clutches the counter-shaft sleeve m^9 to the rotating counter-shaft, thereby causing the turning of the sprockets. The movement of the sprocket shaft continues until the locking rod s^4 enters the next aperture, whereupon the spring m^{14} disengages the clutch. The same movement of the locking rod frees the upright rod r^6 which under influence of the spring r^7 forces the driving shaft into engagement with the mandrel shaft of the fresh record lifting the latter from the chain and alining it in operative position.

The sound box, stylus and attached parts may be of any usual or suitable construction and the same are not here shown in detail. The sound box T, however, is secured to the arm t' , mounted to slide upon the rod t^2 . For its forward movement the arm has a nut t^3 adapted to engage the finely threaded screw t^4 when the arm is depressed. The arm, however, is also provided with a second nut t^5 , adapted to engage with the overlying coarse threaded return feed screw t^6 when the arm is swung slightly upward. The two feed screws are given a constant and suitable rotary movement by gearing (not shown) driven from the sleeve r^2 .

During forward movement of the sound box, the arm is depressed and engages the finely threaded feed screw. When the stylus nears the end of the record an adjustable contact screw t^7 (Fig. 1) carried by the arm causes a spring contact t^8 to touch the contact t^9 and complete an electrical circuit for energizing the controlling magnet S. Completion of this circuit also energizes a second magnet (not shown), the armature of which is connected to the lever v (Fig. 2), movement of which swings the cam shelf v' upward. The latter underlies the sound box arm and causes elevation of the sound box and stylus and its engagement with the coarse threaded return feed screw. A swinging spring-pressed pin v^3 (Fig. 1) pivoted at the end of the cam shelf snaps into a depression in the adjacent machine frame when the shelf is elevated and there maintains it until the sound box has returned to its initial position, whereupon a projection t^{10} upon the sound box arm is caused to strike the pin and withdraw it from the machine frame, permitting the shelf to drop and lower the sound box and stylus into engagement with the new record, which in the meantime has been advanced.

Obviously, various other ways of controlling the movement and action of the sound

box, as well as the automatic operation of the various parts, may be employed, this specific form of machine being submitted for illustrative purposes only.

Since the mandrel shafts require no positive alinement upon the links of the machine, as has heretofore been the case in linked carriers, the individual links may be made of cheap construction and, if desired, stamped out of sheet metal, thereby considerably lessening the cost of a machine of this type.

While I have shown and described a machine embodying one form of my invention, it is to be understood that the latter is not limited to the specific details or form or relative arrangement of parts here shown, but extensive deviations therefrom may be made without departing from the spirit of the invention.

Claims—

1. A phonograph having a linked carrier for loosely holding a record and record-rotating means for engaging a record freeing it from said carrier and alining it in operative position.
2. A phonograph having linked record-holding means and record rotating means for freeing it from the holding means.
3. A multiple record phonograph having a chain carrier for loosely holding a plurality of records, and record-rotating means for successively engaging the several records freeing each from the carrier and alining it in operative position.
4. A multiple record phonograph having flexible means for holding a plurality of records, and record-rotating means for successively freeing the records from the holding means and alining each in operative position.
5. A phonograph having flexible holding means for holding a record, and record-supporting means adapted to free the record from the holding means and support the same in operative relation to the sound producing mechanism.
6. A phonograph having flexible holding means for holding a record, and a rotary support adapted to move to engage with the record and free the same from the holding means.
7. A phonograph having a chain carrier for holding a plurality of records, end supporting means for rotatably holding a record in playing position, means for causing said records successively to pass between said end supporting means while still on the carrier, and means for there freeing a record from the carrier and there alining it in operative position.
8. A multiple record phonograph employing a chain record holder, the latter comprising a plurality of links and having openings to receive the record mandrels, said

openings being of greater diameter than the diameter of the mandrels and means to free successive record mandrels from the holder.

9. A multiple record phonograph having
5 a flexible record carrier in which the record mandrels are held loosely, means for bringing successive records substantially into operative position, and end engaging means for freeing the records from the carrier and

rotating them without substantial change of position.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE H. UNDERHILL.

Witnesses:

THOMAS B. BOOTH,
EDITH E. CHAPMAN.