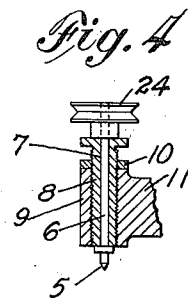
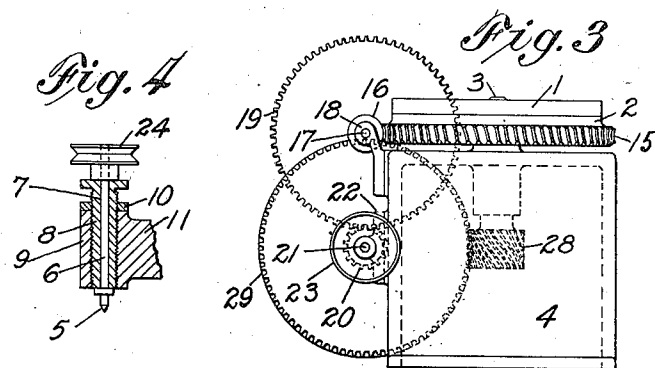
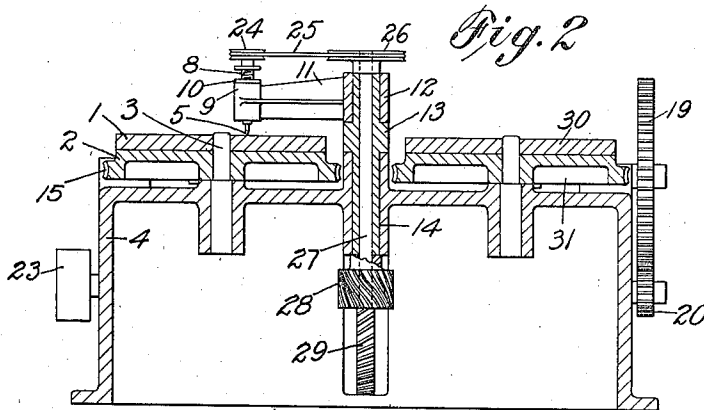
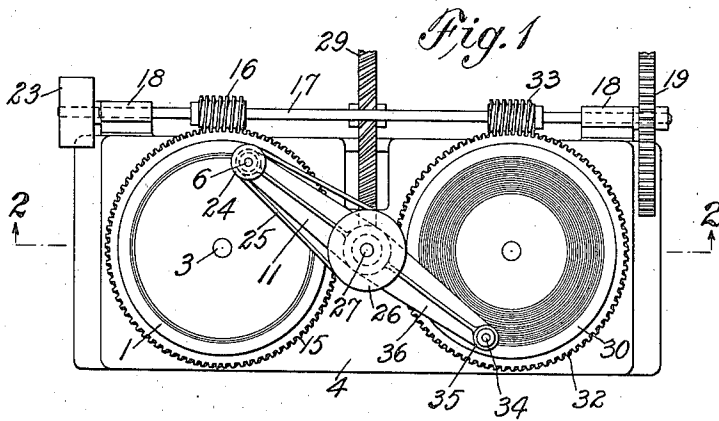


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SOUND RECORD DUPLICATING APPARATUS.
APPLICATION FILED APR. 10, 1909.

965,330.

Patented July 26, 1910.



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SOUND-RECORD-DUPLICATING APPARATUS.

965,330.

Specification of Letters Patent.

Patented July 26, 1910.

Application filed April 10, 1909. Serial No. 489,036.

To all whom it may concern:

Be it known that I, SYDNEY I. PRESCOTT, a citizen of the United States, residing at Camden, county of Camden, in the State of New Jersey, have invented a new and useful Improvement in Sound-Record-Duplicating Apparatus, of which the following is a specification.

This invention relates to an improvement in sound record duplicating apparatus, particularly to that type of sound records known as "disk" records.

In making sound records of this type, what is known as a master record is first made in a waxy substance. This is done by a stylus operated by a diaphragm set in motion by sound waves traveling through the air from a source of sound to the recording apparatus. In this operation the record groove is necessarily scratched, cut or engraved to its full depth. Although the depth and width of the groove is very limited, yet the power of the sound waves acting upon the diaphragm that operates the stylus is also very limited, and very little resistance set up by the material of which the master record is composed results in an uneven or rough groove. Such resistance exists in every known material adapted for use in a master record. The stylus, in plowing through the material, chatters more or less, even when the vibrations are faithfully traced or marked in the face of the master record; that is to say, the speed of the feeding movement of the master record to the tool is so great that the tool is more or less overloaded, and this results in the chattering above referred to. Heretofore, the record groove of a master record has never been perfectly smooth for the above reason. The roughness in the walls of the groove produced by the chattering of the tool results, when the sound is reproduced, in a sort of a scratching noise entirely foreign to the sound to be reproduced. This is objectionable.

It is one of the objects of this invention to provide an apparatus capable of forming a record groove that shall be not only a faithful representation of sound vibrations, but shall have perfectly smooth walls.

Heretofore, after a master record has been made by the usual method, it has been customary to make a negative of the same by an electro-typing process, and from this negative pressing commercial records. Since the groove of the master record is not per-

fectly smooth, it follows that the grooves of the commercial records made therefrom will not be perfectly smooth, even when there are no imperfections produced by the electro-typing and pressing processes.

It is another object of this invention to provide means for making a master record, the groove of which has perfectly smooth walls, so that, by the electro-typing and pressing processes now in use, commercial records can be manufactured in a higher degree of perfection than has been heretofore possible.

In recording, it is necessary that the material be fed to the recording tool at a comparatively high speed, that most commonly used being about seventy feet per minute. Heretofore, the structure commonly used under these conditions included a tool which cut, or plowed out material from the face of the record blank to form a groove of full depth and width. A rotating cutter could not be used because of the high speed of the feeding movement. Where a groove or channel is to be cut in certain material to its full depth and width in one operation, a cutter rotating at high speed will produce a smooth groove free from chattered walls, when the feeding movement is relatively slow.

It is a further object of this invention, therefore, to provide a device in which a rotating cutter or milling cutter may be used to produce a groove the walls of which are free from roughness or chatter, the feeding movement being relatively slow.

Still another object is to provide a device that can be used in connection with a master record, or even with a commercial record produced by the process heretofore used, and that will duplicate the groove in such record, the duplicated groove being free, however, from the chattered walls.

With these and other objects, not specifically mentioned, in view, the invention consists in certain constructions and combinations which will be hereinafter fully described and then specifically pointed out in the claims hereunto appended.

In the accompanying drawings which form a part of this specification and in which like characters of reference indicate the same parts, Figure 1 is a plan view of a machine constructed in accordance with the invention. Fig. 2 is a sectional elevation of the structure illustrated in Fig. 1, the section

being taken on the line 2—2 of Fig. 1. Fig. 3 is an end elevation of the structure shown in Fig. 1, certain parts being omitted. Fig. 4 is a detailed view of the milling cutter illustrated in the structure shown in Fig. 1.

In carrying the invention into effect there is provided a sound record blank upon the surface of which a record groove is to be formed, and this blank may vary within wide limits. It may be of wax or a wax-like substance, or it may be of metal or other substance suitable for the purpose. In the best constructions, a metal sound record blank will be used, because after the groove is cut in its face a permanent practically indestructible master record is obtained, while it is well known that the life of the wax master records heretofore used is relatively limited. Furthermore, the metallic record of the present invention is less liable to injury in handling than the wax records heretofore used. Such a record blank of the disk type is shown in the drawings and is marked 1, although it is to be understood that blanks of other forms, as for instance cylindrical blanks, may be used in certain constructions.

There is provided a support for the sound record blank, and this support may vary within wide limits. Where a cylindrical blank is used the support will, of course, be different from that used when records of the disk type are made. In the best constructions, however, and as shown, a support 2 is shown, this support being in the form of a turntable rotatably mounted upon a post 3 secured in the frame 4 of the structure.

For the purpose of cutting a groove in the record blank having perfectly smooth walls, there is provided a milling cutter, and this cutter may vary within wide limits. In the best constructions, however, a milling cutter 5 rotating at high speed will be employed. This cutter has a point corresponding in shape to the shape of the groove to be produced and is provided with a shank 6 journaled in a bearing 7 formed in a stem 8 threaded into a boss 9, so that it may be adjusted toward or away from the face of the record. In the device selected to illustrate the invention, there is provided a lock-nut 10 threaded on the stem 8 and contacting with the upper face of the boss 9 before referred to. By means of this structure the depth of the groove may be regulated and the cutter held in adjusted position. While the structure just described provides for an adjustable milling cutter, it is to be understood that other means for adjusting the cutter may be used, and indeed in certain constructions the milling cutter may be mounted in a fixed position and the record blank may be adjusted to the milling cutter, and in certain other constructions both may be adjusted.

While in certain constructions the milling cutter may operate in a fixed position and the record blank be moved with respect thereto; in the best constructions, and as shown, the milling cutter is a traveling and swinging cutter operating in conjunction with a blank mounted in a fixed position. To this end the boss 9 is mounted upon an arm 11 extended from a boss 12 loosely mounted upon a standard 13 fixed at 14 in the frame 4 before referred to.

Means are provided for producing a relative movement of the blank and cutter to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, and this means may vary within wide limits. This may be done by moving either the milling cutter or blank, or both. In certain constructions where it is desired to rotate the blank, the operating connections from a suitable source of motion may cooperate directly with the blank. In certain other constructions, the operating connections may cooperate directly with the support for the blank. In either case the means for rotating the blank may vary within wide limits. The cutter is caused to rotate at high speed by mechanism hereinafter to be described and the blank and support are caused to slowly rotate to produce a slow feeding movement that will give time for the milling cutter to produce a groove having perfectly smooth walls. While other means may, in certain constructions, be used for the purpose of producing the slow movement of the support and record blank, preferably gearing is employed for this purpose. In the best constructions, and as shown, a worm wheel is formed on the support 2 and is indicated conventionally at 15. This worm wheel is in mesh with a worm 16 also indicated conventionally. This worm 16 is mounted upon a shaft 17 mounted in bearings 18 carried by the frame 4 above referred to. Upon one end of this shaft is mounted a spur gear 19, indicated conventionally, which is in mesh with a spur pinion 20 mounted upon the end of a shaft 21, below the shaft 17 above referred to, the shaft 21 being mounted in bearings 22 carried by the frame 4 above referred to. Upon the opposite end of the shaft 21 is a pulley 23 which may derive its motion from any suitable source, such for instance as a line shaft.

The milling cutter may derive its motion from any suitable source. It is preferable, however, that the high speed motion of the milling cutter and the relatively slow motion of the record blank be both derived from a common source of motion. In the best constructions, and as shown, the shank 6 of the milling cutter 5 extends through and beyond the stem 8 and upon its projecting end is mounted a pulley 24. Over this pulley 24 runs a belt 25 which also runs

over another pulley 26 mounted on a shaft 27 journaled in the standard 13 before referred to. Upon the lower end of this shaft 27 is a spiral pinion 28, indicated conventionally in the drawings. This spiral pinion 28 is in mesh with a spiral gear 29 mounted on the shaft 21 before referred to and which is the high speed power shaft of the machine.

The structure so far described provides means for operating the milling cutter at high speed and for producing a slow rotary movement of the blank which constitutes the feeding movement of the material to the tool or cutter.

Means are provided for controlling the path of the record groove in the blank and this means may vary within wide limits. While other suitable means may in certain constructions be employed for this purpose, preferably a guide is employed, and when a guide is employed it may vary within wide limits. In the best constructions, however, and as shown, a rotating guide is employed, this guide being the groove of a master record previously made by the usual process and electro-plated, or a copy of the same, or in fact an ordinary commercial record. Such a record or guide is indicated at 30, the guide being mounted upon a turntable 31 provided with a worm wheel 32 in mesh with a worm 33 mounted on the shaft 17 before referred to. Since the worm wheels 15 and 32 and the worms 16 and 33 are respectively of the same size and pitch it follows that the support and record blank and the guide will be driven at equal speeds.

There is provided a stylus or follower 34 mounted in a boss 35 carried on the end of an arm 36 extended from the boss 12 before referred to, this follower tracking in the groove of the guide 30 above referred to. The engagement of the follower with the groove of the guide controls the position and traveling movement of the milling cutter 5 through the medium of the lever formed by the arms 11 and 36 and boss 12 before referred to. It will be understood that this lever constitutes means supporting the milling cutter and the follower. The feeding movement of the blank to the milling cutter is so slow that any roughness or chatter existing in the wall of the groove of the guide will not be reproduced in the groove formed in the record blank but will be milled out. It may be here remarked in the interest of clearness, that this chatter forms no part of the undulations representing sound vibrations, but is entirely foreign thereto and constitutes an imperfection, the removal of which is desirable. Such removal is accomplished by the present invention.

From the foregoing, it will be understood that any lateral undulations representing sound waves that are in the guide 30 will

cause the lever formed of the arms 11 and 36 and boss 12 to oscillate slightly and that similar undulations will be produced in the groove formed in the record blank. It will be further understood, that since the rotation of the guide and blank is so slow and since the cutter operates at high speed that the cutter has sufficient time to remove material from the surface of the record in the path of the record groove, leaving the walls of the groove free from chatter and perfectly smooth. It will be further understood that the structure selected to illustrate the invention and other structures within the scope of the invention are capable of producing a record groove having smooth walls in a metallic blank, forming a practically indestructible master record. It will be further understood that a master record produced by the present invention may be used in the same way as the present wax master records, and that duplicates may be made therefrom by the well known electro-typing and pressing processes.

A detailed description of the operation of the device is deemed unnecessary and is, therefore, omitted in the interest of brevity and clearness.

Changes and variations may be made in the structure by means of which this invention is carried into effect. The invention is not, therefore, to be restricted to the precise details of the structure shown and described.

What is claimed is:—

1. The combination with a sound record blank, of a traveling milling cutter, and means for producing a relative movement of the blank and cutter to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, substantially as described.

2. The combination with a sound record blank, of a traveling milling cutter, and means for rotating the blank to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, substantially as described.

3. The combination with a sound record blank, of a swinging milling cutter, and means for producing a relative movement of the blank and cutter to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, substantially as described.

4. The combination with a sound record blank, of a swinging milling cutter, and means for rotating the blank to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, substantially as described.

5. The combination with a sound record blank, of a milling cutter, a support for rotating the blank to cause the cutter to produce a record groove in the blank in

accordance with sound vibrations, a rotating guide for controlling the path of the record groove, and gearing driving the support and rotating guide, substantially as described.

6. The combination with a sound record blank, of a milling cutter, a support for rotating the blank to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, a rotating guide for controlling the path of the record groove, and gearing driving the support and rotating guide at equal speeds, substantially as described.

7. The combination with a sound record blank, of a milling cutter, a support for rotating the blank to cause the cutter to produce a record groove in the blank in accordance with sound vibrations, a rotating guide for controlling the path of the record groove, and gearing driving the support and guide at equal speeds and the milling cutter at a relatively high speed, substantially as described.

8. The combination with a sound record blank, of a support for the same, a post carrying the support, a milling cutter, a rotating guide, a post carrying the guide, a frame supporting the posts, and gearing driving the support and rotating guide, substantially as described.

9. The combination with a sound record blank, of a support for the same, a post carrying the support, a milling cutter, a rotating guide, a post carrying the guide, a frame supporting the posts, and gearing driving the support and rotating guide at equal speeds, substantially as described.

10. The combination with a sound record blank, of a support for the same, a post carrying the support, a milling cutter, a rotating guide, a post carrying the guide, a frame supporting the posts, and gearing

driving the support and guide at equal speeds and the cutter at a relatively high speed, substantially as described.

11. The combination with a sound record blank, of a support for the same, a milling cutter, a rotating guide, and worm gearing driving the support and rotating guide, substantially as described.

12. The combination with a sound record blank, of a support for the same, a milling cutter, a worm and worm wheel for rotating the support, a rotating guide, a worm and worm wheel driving the rotating guide, and a shaft carrying the two worms, substantially as described.

13. The combination with a sound record blank, of a support for the same, a post carrying the support, a milling cutter, a rotating guide, a post carrying the guide, a frame supporting the posts, a follower engaging the guide, means supporting the milling cutter and the follower, and gearing driving the support and guide at equal speeds and the cutter at a relatively high speed, substantially as described.

14. The combination with a sound record blank, of a support for the same, a post carrying the support, a milling cutter, a rotating guide, a post carrying the guide, a frame supporting the posts, a follower engaging the guide, a lever supporting the milling cutter and the follower, and gearing driving the support and guide at equal speeds and the cutter at a relatively high speed, substantially as described.

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

SYDNEY I. PRESCOTT.

Witnesses:

ETHEL M. WHITEHEAD,
FRANK B. MIDDLETON, Jr.