June 22, 1937. O. CZEIJA ET AL 2,084,947

APPARATUS FOR REPRODUCING SOUNDS RECORDED ON STRIPS

Filed Dec. 23, 1932

Fig. 1

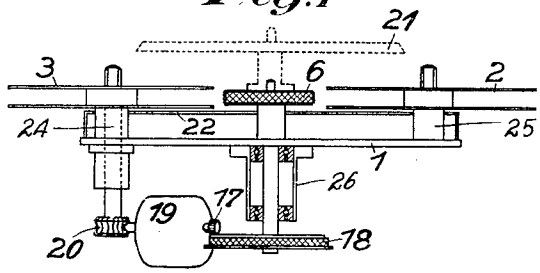
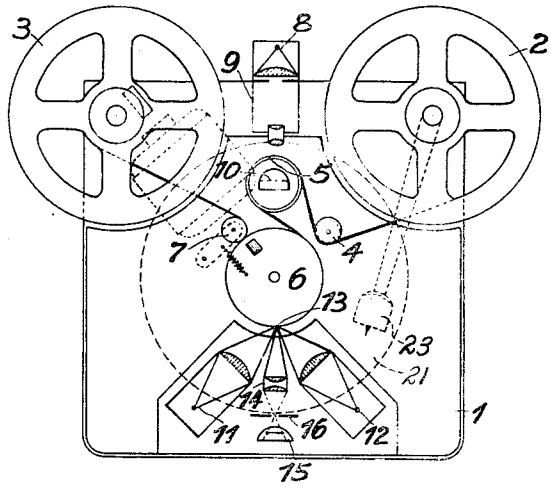


Fig. 2



INVENTORS
OSKAR CZEIJA
JOSEF LEBZELTER
ANTON SCHERENZEL
by their attorneys
Howson and Howson

Patented June 22, 1937 2,084,947

UNITED STATES PATENT OFFICE

2,084,947

APPARATUS FOR REPRODUCING SOUNDS RECORDED ON STRIPS

Oskar Czeija, Josef Lebzelter, and Anton Scherenzel, Vienna, Austria, assignors to "Selenophon" Licht- und Tonbildgesellschaft m. b. H., Vienna, Austria, a company of Austria

Application December 23, 1932, Serial No. 648,688
In Austria December 24, 1931

5 Claims. (Cl. 274—5)

In the talking machines heretofore in use mechanically prepared sound records were used almost exclusively, for instance the well known gramophone plates. It would offer various advantages to depart from this method and to resort to photographic sound records heretofore mainly used in sound films. This would be of advantage also in connection with apparatus suitable for private use.

In the well known method of reproducing sound records prepared by optical and photographic means in general, a record carrier in the form of a strip is used, whereby a number of particular advantages is secured. The employment of the optical and photographic method of recording permits the recording of sound vibrations in within a much wider range of frequencies than can be usually arrived at, for instance in gramophone discs. Moreover the strip shaped record carrier permits an almost unlimited length of the records to be obtained, and also the arrangement of a plurality of music records etc., in any succession. Furthermore a strip shaped record carrier may include a plurality of records. It is possible to make the record carrier of a transparent material, in which case the reproduction is advantageously effected by transmitted light; or the record carrier may be made of an opaque material, in which case the record is read by incident or reflected light.

An apparatus permitting all the advantages above mentioned to be utilized, must also be simple in construction and reliable in operation so that it may be handled by unskilled persons. Furthermore the apparatus must be made simple also for the reason that it may be cheaply made at a large commercial scale. The reading of the record being effected by a light sensitive cell it is also indispensable to make use of an amplifier permitting currents of an intensity required for instance for the operation of a loud speaker, to be derived from the weak currents furnished by the said light sensitive cell.

According to the present invention such an apparatus for the reproduction of sound from strip shaped record carriers is so constructed that it may be used for as many purposes as possible, that is to say, the amplifier already present for amplifying the currents of the cell sensitive to light is advantageously utilized also as a receiver for broadcast radio transmission. For permitting reproduction from ordinary gramophone records, the amplifier is so constructed that an electric sound box may be connected to the same. In order to enable gramophone records to be reproduced by the same apparatus, the part of the apparatus serving for the feed of the strip shaped record carrier is so proportioned that the normal speed of the gramophone discs, 78 revolutions per minute, is secured. The possibility of using the apparatus in various ways does not only permit use of the apparatus in the three ways above indicated separately, but also combined use thereof; for instance as a broadcast radio receiver and an optical talking machine simultaneously, or as a gramophone disc reproducer and an optical talking machine simultaneously. Also accessory parts may be constructed according to the invention which permit the completion of already existing amplifying apparatus of any kind, so as to realize the above said combinations.

In the apparatus heretofore used the structural elements used in sound film reproducing apparatus are generally resorted to, so that complicated and expensive means for uniformly feeding the record carrier must be provided. In this connection for instance the difficulties may be referred to which arise by the use of toothed wheels, since for equalizing the irregularities of the engagements of the toothed wheels special mechanical means must be provided. The simplest apparatus known up to now for reproducing optical sound records, in which apparatus small, nonperforated strips serve as record carrier, the latter is fed by the pull of the winding up drum or by the pull of a separated feed wheel suitably controlled by extraneous means. The uniform running of the record carrier at the point where the record is read is secured by masses acting in the manner of a fly wheel in clutch engagement with the record carrier. For avoiding all these disadvantages and for simplifying the construction of the apparatus in the latter, an arrangement is provided in which no toothed wheel is made use of and in which no equalization of speed by fly wheel action is required owing to a simplification of the drive. The desired operation is arrived at according to the invention by the use of a feed wheel for the record carrier of a roller of sufficiently large periphery and of a sufficiently high adhesion on the record carrier, the said roller being driven through the medium of a uniformly operating friction wheel gearing by a driving electric motor in direct clutch engagement with the said roller. The result of this arrangement is that, in the first place, owing to the large surface of contact between the feed roller and the record carrier, the latter is driven without appreciable slip. Furthermore

since the feeding speed of the strip and therefore also the circumferential speed of the feed roller are given, an angular speed of the feed roller of 78 to 80 revolutions per minute may be readily arrived at, that is to say the same angular speed that is normally required for gramophone discs. According to the invention the ratio of the friction wheel gearing is made not too small, for instance with a motor of 1500 revolutions per minute this ratio will be about 1 to 18, thus securing the normal gramophone disc speed of 80 revolutions per minute. This number of revolutions as also the diameter of the friction feed roller for the record carrier is defined; in the case of records for the normal sound film speed of 456 millimetres per second the diameter of the friction feed roller will be about 109 millimetres.

The drive of the feed roller according to the invention may be equally used for the apparatus whether the reproduction is effected by transmitted or by reflected light. In the latter case the reading point will be directly on the periphery of the feed roller, since at this point the record carrier has a perfectly uniform speed. If instead of the opaque record carrier, a transparent one is used, the feed roller will carry the record past a properly constructed film gate, so that the record may be guided past the same in a simple manner. If for instance, the record carrier is made of paper and has to be read by reflected light, it is important for securing a good reproduction to illuminate the reading point from a plurality of directions at a time whereby the otherwise detrimental influence of the grain of the record carrier is done away with.

In apparatus for reproducing optical sound records it is of great importance to facilitate their handling as far as possible. Therefore the winding up and the unwinding rollers, and also the guide and the feed rollers, are so arranged that the path of the record carrier is as simple as possible. Furthermore, all rollers are disposed so closely above a plane covering plate that the insertion of the fore end of the record carrier and the laying of the same around the various rollers takes place in proper succession, and that at the moment of starting the apparatus and tightening the strip, the latter is automatically pressed against the proper point. The covering plate prevents the strip from sinking, for instance, into too low a position, from being led round stationary shafts, etc.

Furthermore by the aforesaid auxiliary strip not only the handling is facilitated, but as experience teaches, it is also made possible to automatically stop the apparatus after playing the record carrier by means of marks, indentations or the like on the auxiliary strip or on the record carrier. The automatic stopping may be effected mechanically or also for instance by controlling the beam of light falling on the light sensitive cell. For instance by an indentation of the strip an intense beam of light may be given access to the cell or the like. Besides the various parts of the invention above referred to in the apparatus according to the present invention may also be provided with a device for multiplying at will the speed of the record carrier in order that, if at any time an interruption of the sound reproduction just taking place, is desired, the entire sound record may be run off as rapidly as possible. Such a device may be readily built up by means of friction wheels of different diameters mounted on the motor shaft and adapted to be thrown into and out of gearing as may be required.

In the drawing Fig. 1 is an elevation and Fig. 2 a plan view showing diagrammatically by way of example an embodiment of the present invention.

In these figures 1 is a base plate having mounted at two corners thereof two rollers 2 and 3 having wound thereon the record carrier, roller 2 being for instance the supply roller and roller 3 the winding up roller. The record carrier passes from the supply roller 2 round a guide roller 4 and past a light gate 5 circular in shape, as here shown, and then round the feed wheel 6 and past a pressure roller 7 to the winding up roller 3. The plan view Fig. 2 also indicates the two devices for optically reproducing the sound record by transmitted or reflected light. For this purpose serves the source of light 8, which projects, by means of a suitable well known system of lenses in a casing 9, an intense luminous thin line of light onto a light sensitive cell 10, through the light gate 5. Owing to the uniform rotation of the feed wheel 6 the record carrier is moved with uniform speed past the light gate 5. This arrangement is used when the record carrier is transparent. When the record carrier is opaque, for instance one consisting of paper then two sources of light in casings 11 and 12 are used, projecting light through lenses on the reading point 13. A suitable system of lenses 14 projects an image of the intensely illuminated part 13 of the record through a suitable diaphragm 16 onto a light sensitive cell 15.

The mechanical part of the apparatus is more clearly shown in elevation in Fig. 1. The base plate 1 is provided with bearings 24, 25 for the two rollers 2 and 3 and a bearing 26 for the feed wheel 6 the shaft of which carries below the base plate 1 a frictional gearing comprising the two wheels 17 and 18, 17 being the smaller driving wheel on the shaft of the electric motor 19 while 18 is covered with rubber for obtaining the necessary friction and has the required angular speed of the feed wheel 6. The other end of the shaft of the electric motor 19 preferably serves for driving the shaft of the winding up roller 3 by a worm and worm wheel 20. As already stated the shaft of the feed wheel 6 has the normal number of revolutions for reproduction from gramophone discs and, as indicated in dotted lines, such a gramophone disc can be simply pushed onto the top end of the shaft of the feed wheel 6. The gramophone disc 21 cooperates with a conventional sound box 23 in the usual manner as indicated in Fig. 2 in dotted lines.

In order to facilitate, as already mentioned, the insertion of the strip shaped record carrier, a covering plate 22 is provided, which is arranged just below the lower edge of the record carrier, and mounted in such position, that with a loosely inserted record carrier, on starting the apparatus and the tightening of the record carrier due thereto, the proper position of the record carrier relatively to the guide rollers and other parts is secured.

What we claim is:

1. An apparatus for sound reproducing comprising a shaft constructed and arranged to have a gramophone disc pushed onto the top end thereof, a toothless feed wheel on said shaft below said top end adapted to feed a band shaped optical record carrier without requiring perforations therein, a sound box adapted to cooperate with said gramophone disc, a cover plate, and a supply roller and a winding up roller mounted near the corners of said plate and in the plane

of said feed wheel, whereby adjacent portions of the peripheries of said rollers underlie the overhang of said gramophone disc and more remote portions thereof extend beyond said cover plate, frictional gearing carried by said shaft below said feed wheel, and a motor constructed and arranged to drive said frictional gearing and thereby drive said shaft at the normal number of revolutions for reproduction from gramophone discs.

2. An apparatus for sound reproducing comprising a shaft constructed and arranged to have a gramophone disc pushed onto the top end thereof, a feed wheel on said shaft below said top end and adapted to feed a band shaped optical record carrier, a sound box adapted to cooperate with said gramophone disc, a supply roller and a winding up roller mounted in the plane of said feed wheel, means for directing a thin line of light onto said band at a point in its path between said rollers and under the area defined by said gramophone disc, and a light sensitive cell responsive to said light cooperating with said band at said point.

3. An apparatus for sound reproducing comprising a shaft constructed and arranged to have a gramophone disc pushed onto the top end thereof, a feed wheel on said shaft below said top end and adapted to feed a band shaped optical record carrier, a sound box adapted to cooperate with said gramophone disc, a supply roller and a winding up roller mounted in the plane of said feed wheel, means for directing a thin line of light onto said band at a point in its path between said rollers, and a light sensitive cell located in the space below the area defined by said gramophone disc and responsive to said light cooperating with said band at said point, a high speed motor shaft, a first friction wheel of small diameter on said motor shaft, a second friction wheel of large diameter on said feed wheel shaft and in direct engagement with said first friction wheel.

4. An apparatus for sound reproducing comprising means for supporting a band shaped record carrier for movement along a predetermined path, a feed wheel adapted to feed said carrier, a plurality of sources of light simultaneously illuminating a predetermined reading point in the path of said carrier in a plurality of directions, a light sensitive cell, and means for directing light reflected by said carrier at said reading point from both said light sources to said light sensitive cell, a second light sensitive cell, means for directing a thin line of light through said band to said second cell at a second predetermined reading point, the shaft of said feed wheel being constructed and arranged to have pushed onto the top end thereof a gramophone disc defining an area overlying both of said predetermined reading points.

5. An apparatus for sound reproducing comprising means for supporting a band shaped record carrier for movement along a predetermined path, a feed wheel adapted to feed said carrier, a light gate at a predetermined point in said path, a light sensitive cell, and means for projecting light through said gate to said cell, a pair of sources of light simultaneously illuminating a predetermined reading point in the path of said carrier in a different direction, a second light sensitive cell, and means for directing light reflected by said carrier at said reading point from both of said light sources to said light sensitive cell, the shaft of said feed wheel being constructed and arranged to have pushed onto the top end thereof a gramophone disc defining an area overlying said first light sensitive cell and the reading point for said second light sensitive cell.

OSKAR CZEIJA.
JOSEF LEBZELTER.
ANTON SCHERENZEL.