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COMBINED ELECTRICAL RECORDER AND REPRODUCER FOR PHONOGRAPHS

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FIG. 1

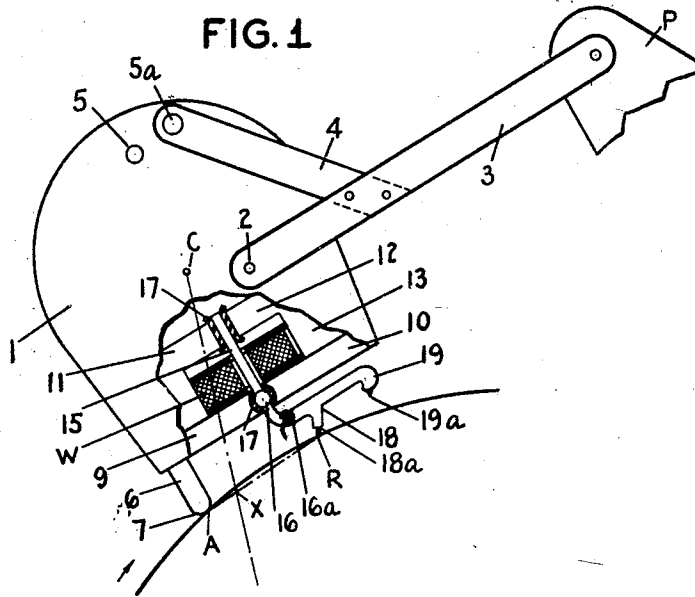


FIG. 2

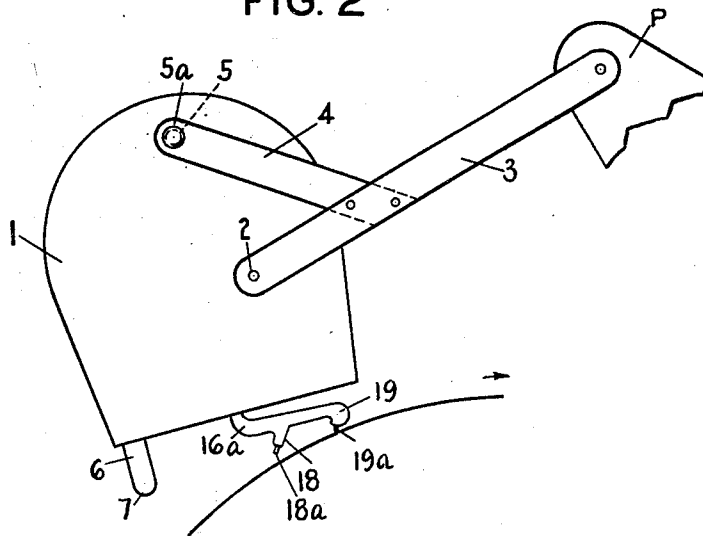
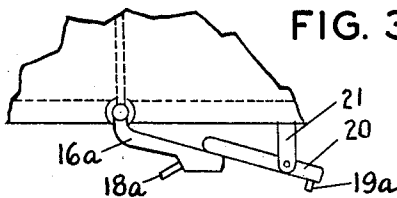


FIG. 3



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COMBINED ELECTRICAL RECORDER AND REPRODUCER FOR PHONOGRAPHS

Application filed July 10, 1920. Serial No. 466,902.

This invention relates to a combined electrical recorder and reproducer for phonographs; such for example, as dictating machines.

Such machines require to be reversible in operation since the operator may desire to dictate for a time and then may desire to have the machine reproduce what has been dictated. In the past, various arrangements have been suggested for rendering the diaphragm mechanism reversible where the recording and reproducing is done mechanically, that is to say where the sound waves actuate a diaphragm which in turn vibrates a stylus in recording or wherein a stylus vibrates a diaphragm and reproduces the sound waves.

When, however, it is attempted to provide a single reversible mechanism for selectively recording and reproducing sound waves electrically, that is to say, for converting the sounds to be recorded into electrical currents and utilizing such currents to vibrate an armature which is connected to a stylus engaging the record, and for converting the recording into motion of an armature and thence into electrical currents, and thence into sound, certain difficulties are encountered, particularly in attempting to realize in practice the maximum possible benefits of the electrical method of recording and reproducing.

It has been found that the relative position of the stylus and record and the pressure exerted by the stylus on the record should be different for recording and reproducing if best results in each operation are to be obtained. Since it is impractical and inadvisable to change the armature and magnetic structure by substituting a recorder unit for a reproducer unit (commonly called a "pickup") in changing from the recording to reproducing condition, the pickup and its associated stylus mechanism should be arranged to fulfill as far as possible in either the recording or reproducing positions the conditions which should obtain for optimum results. To this end it has been suggested to make use of a sort of leverage or linkage arrangement which may be interposed between

the stylus and the vibrating armature in changing from recording to reproducing position and which may be removed in returning again to recording position.

In my opinion, it is very difficult to realize to the maximum the advantages inherent in electrical recording and reproducing when an adjustable linkage arrangement is interposed and removed. The difficulties inherent in designing a linkage system which will be acoustically and mechanically satisfactory and which will be practical and at the same time capable of quick shifting as required, are very great. In my opinion, best results are obtained when the adjustable linkage is dispensed with and when the pickup itself is so constructed and arranged and mounted upon a record that no change is required in changing from the recording to the reproducing position other than a change in position of the pickup.

It is an object of this invention to provide a simple electrical pickup apparatus which is so arranged as to be capable of functioning with high quality and efficiency either as a recorder or reproducer without any change in the pickup structure.

It is a further object of this invention to provide an arrangement of the class described which dispenses with adjustable linkages.

It is a further object of this invention to provide a pickup structure of the class described which can be easily and quickly shifted from recording to reproducing position and vice versa.

It is a further object of this invention to provide an arrangement of the class described in which the only change necessary to be made in changing from recording to reproducing position is a mere change in the position of the entire pickup apparatus.

It is a further object of this invention to provide apparatus of the class described in which the predetermination and design of the apparatus itself provide for the optimum operating constants in either the recording or reproducing condition.

It is a further object of my invention to provide apparatus of the class described

which shall be simple, reliable, and positive in operation, even in the hands of an unskilled operator.

Still other objects and advantages of my invention will be apparent from the specification.

The features of novelty which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its fundamental principles and as to its particular embodiments, will best be understood by reference to the specification and accompanying drawings, in which

Fig. 1 is a side view partially broken away, of apparatus according to my invention in position for recording;

Fig. 2 is a similar view of the apparatus in position for reproducing, and

Fig. 3 is a detail view on an enlarged scale of a modified form of apparatus according to my invention.

Referring now more particularly to Fig. 1, 1 designates the so-called pick-up unit which is pivoted on an axis 2 and carried by a bracket 3 which is movable and which is arranged in a manner with which I am not here concerned so as to permit of lifting the pick-up off the record, and of carrying the pickup along the record, either manually, or through feed screw mechanism not shown. For this purpose the arm 3 may be pivoted upon a support at a suitable point such as P and if desired suitable mechanism may be employed for exerting pressure upon the lever 3 for the purpose of lifting the pickup off the record.

The bracket 3 is provided with an angularly projecting extension 4 which may be a spring arm pressing against the face of the pickup. A stud 5 may be provided on the face of the pickup and a depression 5a to receive the stud may be formed in the arm 4 in such a manner that when the pickup is lifted off the record and rotated clockwise the stud 5 will force the arm 4 outwardly until the stud 5 passes into depression 5a which serves to maintain the angular position of the pickup with respect to the arm 3.

The detail of the electromagnetic structure of the pickup itself is not per se a part of this invention and I have therefore shown the same only diagrammatically, it being understood that any suitable electromagnetic or dynamic structure may be utilized. The form of pickup shown is one with which good results have been obtained but different forms of pickup may be utilized if desired.

In the form shown there is provided a magnet 13, preferably of the horseshoe type, and having a pair of lower pole pieces 9 and 10 in contact with the magnetic pole faces and extending toward each other. There is also provided a pair of upper pole pieces 11 and 12 likewise in contact with the pole faces of

the magnet and extending toward each other.

Gaps are left between the lower pole pieces 9 and 10 and the upper pole pieces 11 and 12 and there is provided within these gaps a vibrating armature 15 surrounded by a winding or coil W. The armature 15 may be provided with central extensions 16 projecting from opposite sides thereof and defining the axis of vibration of the armature and the corresponding faces of the pole pieces 9 and 10 may be cut away to hold the armature in position. Layers 17 of rubber, felt or similar damping material may be interposed between the projection 16 and the pole pieces 9 and 10, and may also be interposed between the upper ends of the armature and the pole pieces 11 and 12.

Just below the axis of vibration the armature is preferably given a bend of approximately 90° as at point 16a and provided with two projections 18 and 19 at the extremities of which there may be mounted respectively the recording and reproducing styli or jewels 18a and 19a which engage the record.

The lower face of the pickup is provided with a downwardly projecting arm 6, the lower end of which has a spherical or other suitably shaped surface 7 adapted to engage the record. This surface is termed the advance ball, and is displaced laterally with respect to the recording stylus 18 so that the advance ball rests upon the record in an uncut part thereof. It is usually a sapphire or diamond having a surface in contact with the record which is made large enough so that the record is not appreciably marked by it.

In the position shown in Fig. 1 in which the recording stylus 18 and the advance ball 7 engage the record, the pickup is so placed relative to the record cylinder that when the advance ball and stylus are in contact with the record the center line of the pickup is approximately normal to the surface of the cylinder and displaced through an angle of about 20° from the vertical, and the various dimensions are so chosen that a vertical line passing through the center of gravity C intersects a line AR drawn between the point of the advance ball 7 and the recording stylus 18a at point X. As more particularly explained and claimed in my application, Serial No. 466,901, entitled "Phonographic apparatus", filed concurrently herewith, the pressure on the recording stylus is then that proportion of the weight of the unit equal to

$$\frac{AX}{AR}$$

Under such conditions when the record rotates electrical currents supplied to the pickup are converted into vibrations of the recording stylus 18a and inscribed on the record. When the operator desires a machine to reproduce it is only necessary to lift the pickup off the record and to rotate it clockwise

from the position shown in Fig. 1 to the position shown in Fig. 2 in which stud 5 engages the depression 5a in arm 4 after which the pickup is lowered until the reproducing stylus 19a engages the record. The length of the stylus holders 18 and 19, the angular position of the pickup in both the recording and reproducing positions are all so chosen and controlled that in the recording position the entire weight of the pickup is carried upon the advance ball 7 and the recording stylus 18a, and the reproducing stylus 19a does not engage the record, whereas under the reproducing position as shown in Fig. 2 both the advance ball 7 and the recording stylus 18a are out of contact with the record and the reproducing stylus 19a is in engagement with the record.

In the recording position the angular position of the pickup is controlled by the engagement of the advance ball and the stylus with the record, the pickup being free to take the proper position supported on these two points. In the reproducing position however since only the reproducing stylus is in engagement with the record, it is necessary that the pickup be locked in position with respect to arm 3 which is done by engagement of stud 5 with depression 5a. It will be noted that in the reproducing position since no upward force is exerted on the pickup by the arm 3 the weight of the pickup is carried upon only the reproducing stylus, whereas in the recording position the weight is distributed between the advance ball and the recording stylus whereby a very much less pressure is exerted upon the recording stylus which is the desired condition for best results.

Since the pressure on the recording stylus can be reduced very materially by proper choice of the fraction

$$\frac{AX}{AR}$$

as already pointed out, by changing the position of the advance ball 7 or the recording stylus 18a, or both, or by changing the angle of the pickup in recording position, the pickup may be made as heavy as desired in order to obtain the best results in the reproducing condition, while at the same time the desired pressure on the recording stylus may be maintained as small as desired.

In the arrangement shown in Figs. 1 and 2 it will be observed that the recording stylus 18a is closer to the pivot of the armature than the reproducing stylus 19a. Consequently, if a record which has been made by the recorder stylus is played with the pickup in reproducing position, the reproducing stylus will be vibrated through the same amplitude which was traversed by the recording stylus, but since the reproducing stylus is further from the pivot, but since the reproducing stylus is further from the pivot, the motion of

the armature will not be so great in reproducing as it was in recording.

Under some conditions it may be desired to provide for an increase of the ratio of motion of the armature over the arrangement shown in Fig. 1. This may be accomplished by the arrangement shown in Fig. 3, in which the reproducer stylus 19a is not mounted upon an extension of the arm 16 but in this case is mounted upon a separate lever 20 which in turn is pivoted on bracket 21 mounted on the pickup in such position that when the pickup is in reproducing position on the record, the end of lever 20 engages the upper side of the arm 16.

It will be observed that when the pickup is placed in reproducing position on the record, the weight of the unit tends to rotate the lever 20 counter clockwise in bracket 21 and thereby tends to rotate the arm 16 clockwise. As the stylus 19a is vibrated by the record the vibrations are thus transferred to the lever 16 and if lever 20 is pivoted off center, for example, as shown, the amplitude of the vibrations of the stylus will be multiplied before being transmitted to the lever 16.

While I have shown and described certain preferred embodiments of my invention it will be understood that modifications and changes may be made without departing from the spirit and scope thereof as will be understood by those skilled in the art.

I claim:

1. A combined electrical sound recorder and reproducer unit comprising, in combination, a frame, a recording stylus carried by said frame, a reproducing stylus carried by said frame, reversible means for converting electric currents into mechanical vibrations associated with said styli, an advance ball mounted on said frame, and means for selectively supporting said unit in different positions on a record, in one of which said advance ball and said recording stylus engage said record, and in the other said reproducing stylus only engages said record.

2. A combined electrical sound recorder and reproducer unit, comprising, in combination, a frame, a recording stylus carried by said frame, a reproducing stylus carried by said frame, reversible means for converting electric currents into mechanical vibrations associated with said styli, said styli being positioned on the same side of one face of said unit, an advance ball positioned on the opposite side of said face of said unit, and means for selectively maintaining said unit with said advance ball and recording stylus in engagement with said record, or with said reproducing stylus in engagement with said record.

3. A combined electrical sound recorder and reproducer unit comprising, in combination, a frame, a vibratile arm carried by said

frame, a recording stylus carried by said arm, a reproducing stylus carried by said arm, reversible means for converting electric currents into mechanical vibrations associated with said arm, an advance ball mounted on said frame, and means for selectively maintaining said unit with said reproducing stylus only in engagement with a record, or with said recording stylus and said advance ball in contact with said record.

4. A combined electrical sound recorder and reproducer unit, comprising, in combination, a frame, a vibratile arm carried by said frame, a recording stylus carried by said arm, a reproducing stylus carried by said arm on a different part thereof, reversible means for converting electric currents into mechanical vibrations, associated with said arm, an advance ball mounted on said frame, and means for selectively maintaining said unit in different angular positions on a record, in one of which said reproducing stylus only engages said record, and in the other both said recording stylus and said advance ball engage said record.

5. A combined electrical sound recorder and reproducer unit comprising, in combination, a frame, a recording stylus carried by said frame, a reproducing stylus carried by said frame, reversible means for converting electric currents into mechanical vibrations associated with said styli, said styli being disposed on one side of the center of said unit, an advance ball carried by said frame and disposed on the other side of said center, and means for selectively maintaining said unit with said reproducing stylus only in contact with said record, or with said recording stylus and said advance ball in contact with said record.

6. A combined electrical sound recorder and reproducer unit comprising, in combination, a frame, a recording stylus carried by said frame, a reproducing stylus carried by said frame, reversible means for converting electric currents into mechanical vibrations associated with said styli, said styli being disposed on one side of the center line of said unit, an advance ball positioned on said frame on the other side of said center line, and means for selectively maintaining said unit in two playing positions on a record, in one of which said recording stylus and said advance ball engage said record, and in which a vertical line passing through the center of gravity of said unit intersects a line projected between said advance ball and said recorder stylus, and in the other of which said reproducing stylus only engages said record.

7. A combined electrical sound recorder and reproducer unit, comprising, in combination, a frame, a recording stylus carried by said frame, a reproducing stylus carried by said frame, reversible means for converting electric currents into mechanical vibrations

associated with said styli, an advance ball mounted on said frame, said advance ball and said styli being positioned on opposite sides of the center line of said unit and means for selectively maintaining said unit in two different playing positions on a record with either of said styli engaging said record and with said advance ball engaging said record in recording position, said unit in recording position being disposed with its center line at an angle to a vertical line passing through its center of gravity.

8. A combined electrical sound recorder and reproducer unit comprising, in combination, a frame, a vibratile arm carried by said frame, a recording stylus mounted on said arm, reversible means for converting electric currents into mechanical vibrations associated with said arm, a vibratile lever pivoted on said frame, a reproducing stylus mounted on said lever arm, said lever having its free end engageable with said arm in reproducing position, an advance ball mounted on said frame, and means for maintaining said unit in a plurality of playing positions on a record, in one of which said advance ball and said recording stylus engage said record, and in the other of which said reproducing stylus only engages said record.

9. A combined electrical sound recorder and reproducer comprising, in combination, a frame, a vibratile arm carried by said frame, a recording stylus mounted on said arm, reversible means for converting electric currents into mechanical vibrations associated with said arm, a vibratile lever carried by said frame, a reproducing stylus mounted on said lever, and said lever having a portion developing larger amplitudes of motion than said reproducing stylus in driving relation with said arm in reproducing position, an advance ball on said frame and means for maintaining said unit in playing position on a record with said reproducing stylus only in engagement with said record, or with said recording stylus and said advance ball in engagement with said record.

This specification signed this 9th day of July, 1930.

ORVILLE M. DUNNING.