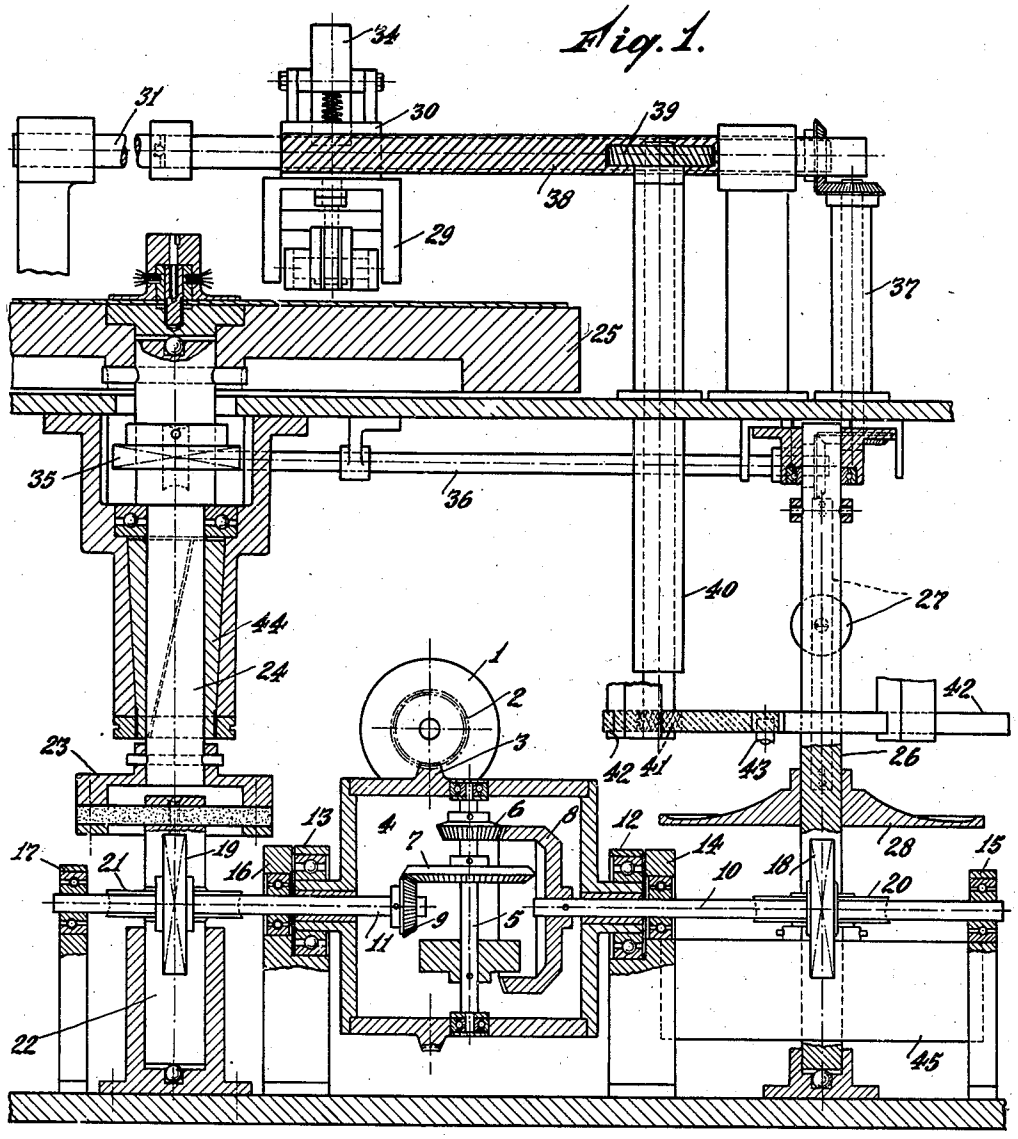
Jan. 2, 1940. J. H. TIELAND 2,185,933

APPARATUS FOR RECORDING AND REPRODUCING SOUND

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Fig. 1.



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Fig. 2.

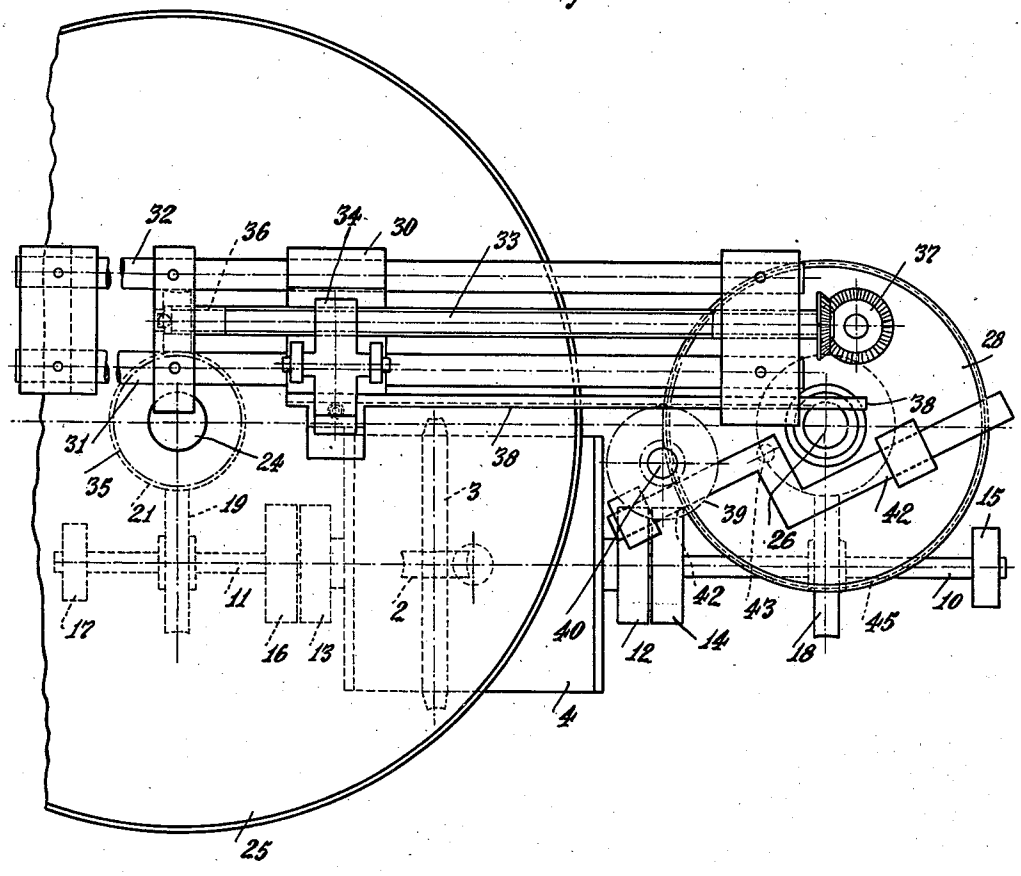
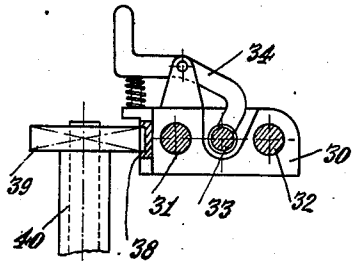


Fig. 3.



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APPARATUS FOR RECORDING AND REPRODUCING SOUND

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Application December 1, 1937, Serial No. 177,621
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4 Claims. (Cl. 274—9)

The present invention relates to apparatus for recording and reproducing sound and more particularly pertains to driving means for the turntables of such apparatus.

The duration of the playing time of the known gramophone records is rather restricted and it is determined by three factors—namely, the diameter of the record, the number of grooves per inch and the number of revolutions per minute of the record.

With records having a diameter of 40 centimetres, a number of 125 grooves per inch and a number of revolutions of 78 per minute, provide a good quality of the sound and a duration of the playing time of 7 minutes for each side of the record may be attained. Of course the velocity of the groove, with respect of the pick-up, is considerably smaller near the centre of the record than near the edge and for a good reproduction one is bound to a minimum value of said velocity of normally 50 centimetres per second. Consequently this velocity should be attained in the inner sound grooves. In the grooves which are nearer to the edge the velocity increases, so that the duration of the playing time is reduced.

An object of the invention is to increase the duration of the playing time and the invention is based on the idea that the velocity of rotation of the record during the cutting or the reproducing operation is changed according to a definite law in such a manner that the instantaneous velocity of the pick-up with respect to the groove is constant all over the surface of the record.

With a velocity of 50 centimetres per second 3000 cms. per minute are cut. The total length of the groove of a record having a diameter of 40 cms. and 750 grooves is 56,520 cms., so that the total duration of the playing time is increased to 18.8 minutes per side of the record or to 37.6 minutes per record, if the velocity of 50 cms. per second is maintained all over the surface of the record.

If special electrical pick-ups are applied and corrected amplifiers are used the cutting and the reproduction velocity can be reduced to 30 cms. per second and the number of grooves can be increased to 150 per inch. In that case, when the invention is applied, the total duration of the playing time will be over 78 minutes.

Other and further features of the invention will be more apparent to those skilled in the art upon a consideration of the annexed drawings and the following description wherein an exemplary embodiment of the invention is disclosed.

In the drawings—

Fig. 1 is a sectional elevational view showing the general organization of the elements of the apparatus.

Fig. 2 is a plan view of the apparatus.

Fig. 3 is an elevational view of part of the needle or pick-up support.

The device according to the invention is based on the idea that the speed of the turntable should be decreased, following a certain law, when the pick-up moves towards the outer edge of the record.

The device is driven by an electric motor 1 of sufficient power, having a constant speed. To this end a squirrel cage motor with an auxiliary starter winding is very suitable. The motor 1 drives a gear 3 formed on the housing of a differential gear 4 by means of a worm 2.

The spindle 5 of the differential gear carries gear wheels 6 and 7, meshing with gear wheels 8 and 9 of the two side-spindles 10, 11. In case of equal load the differential gear may be considered a unit and consequently the spindles 10 and 11 will have the same speed as the differential gear.

The differential gear is supported on the frame in ball bearings 12, 13, whereas the spindle 10 is supported by ball bearings 14, 15 and the spindle 11 by ball bearings 16, 17.

The two side spindles 10, 11 are provided near their free ends with worms 18 and 19 respectively, co-operating with worm wheels 20, 21.

The worm wheel 21 is mounted on a vertical spindle 22 which is connected by a stiff rubber coupling 23 to the spindle 24 of the turntable 25. The weight of the turntable is supported on a bushing 44 having a conically shaped exterior surface which is wedged in the upper bearing of the spindle 24 to provide a brake action for the turntable. The friction provided by the bushing 44 is sufficient for preventing the turntable to rotate freely so that the brake means hereinafter described will be more positive in controlling speed of the sound record.

The vertical spindle 26, which is arranged at the right hand side of Fig. 1, is provided with a governor with springs and centrifugal weights 27 said governor being provided with a regulating disc 28 with a curved active upper face. The curvature is such that it controls the change of speed of the turntable in such a way that a constant cutting- and playing-velocity is obtained all over the record, and that the angular velocity is varied in accordance with the instan-

taneous distance between the pick-up and the turntable spindle, as will be described hereinafter. The spindle 26 is also provided with a heavy flywheel 45, which guarantees a smooth motion.

Driving mechanism of the pick-up

The radial displacement of the pick-up should vary in dependence of the variation of the velocity of the turntable. To this end a pick-up support 29 is arranged to move with a block 30 along two parallel rods 31 and 32.

These rods are attached to the frame and between which a threaded spindle 33 is arranged. The transmission between the block 30 and the threaded spindle 33 is effected by a spring-actuated pawl 34 provided with a matching thread at its one end. If the block 30 with the support for the pick-up 29 is moved backwards the coupling with the threaded spindle 33 is disconnected.

The threaded spindle 33 is driven by the turntable spindle 24 over a worm gear 35, a spindle 36 and a spindle 37 coupled by suitable gear wheels.

Control of the governor

The governor is driven by means of a rack gear 38 attached to the block 30 of the pick-up support 29 and supported in the frame in such a way that it is easily movable, so that the rack gear is moved together with the pick-up. The rack gear 38 drives a pinion 39 having a diameter of approximately 6 centimetres. This pinion is mounted on a vertical spindle 40, bearing a smaller pinion 41 having a diameter of approximately 2 cms. which is in engagement with rack gear teeth of bar 42. The bar 42 is provided with a regulating member 43, such as a piece of raw hide, co-operating with the curved upper face of the regulating disc 28. When the upper rack gear moves a distance of 15 cms., the lower bar 42 is displaced over a distance of 5 cms., so that the force exerted on the governor becomes almost three times as high and said governor is controlled very slowly and smoothly. The apparatus is designed to maintain a constant speed of the turntable with respect to the needle or pick up device. If the recording or reproducing element carried by the support 29 is moved towards the outer edge of the record the gear rack 38 and the block 30 will be displaced to the right in Fig. 1. The rack gear teeth carried by the bar 42 will displace the element 43 to the left in Fig. 1 and the transmission ratio provided by the gear wheels 39 and 41 will move the bar 42 at a speed which is one-third of the movement of the rack gear 38. The outer displacement of the raw hide element 43 will decrease the frictional engagement thereof with the disk 28 and the speed of the shaft 26 will thus increase.

The increase in speed of the shaft 26 will remove part of the load from the spindle 10 and the rotation of the shaft 11 which drives the turntable 25 will decrease by reason of the differential gear mechanism arranged between the shafts 10 and 11. The curvature of the upper face of the disc 28 is such that the angular velocity of the turntable decreases in a ratio which is inversely proportional to the length of the groove of the sound record.

If the sound record is cut or the sound is reproduced from grooves therein by starting from the outer periphery the angular velocity of the shaft 24 should increase as the pick-up support 29 moves towards the center of the sound record.

While the invention has been described with reference to specific constructional details it is apparent that changes may be made therein by those skilled in the art. Such changes may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. In a device for driving the turntable of a sound recording and reproducing device by a constant speed motor wherein the speed of rotation is dependent on the radial travel of a needle over the turntable so as to provide constant linear speed for recording and reproduction, a differential gear driven by the motor, a shaft driven by the differential gear, a turntable spindle coupled to said shaft, another shaft driven by the differential gear, and means associated with said last mentioned shaft operable to exert a brake action on the second shaft in accordance with the radial position of the needle with respect to the turntable.

2. In a device for driving the turntable of a sound reproducing and recording device by a constant speed motor wherein the speed of rotation is dependent upon the radial travel of a needle over the turntable so as to provide constant linear speed for recording and reproduction, a differential gear driven by the motor, a shaft driven by the differential gear, a turntable spindle coupled to said shaft, means exerting a constant braking action on said spindle, another shaft driven by the differential gear, and means associated with said last mentioned shaft operable to exert a braking action on the second shaft in accordance with the radial position of the needle with respect to the turntable.

3. In a device for driving the turntable of a sound recording and reproducing device by a constant speed motor wherein the speed of rotation is dependent on the radial travel of a needle over the turntable so as to provide constant linear speed for recording and reproduction, a differential gear driven by the motor, a shaft driven by the differential gear, a turntable spindle coupled to said shaft, another shaft driven by the differential gear, a disc carried by the last mentioned shaft, brake means moved by the radial travel of the needle frictionally engaging said disc to exert a braking action thereon in accordance with the radial position of a needle with respect to the turntable.

4. In a device for driving the turntable of a sound recording and reproducing device by a constant speed motor wherein the speed of rotation is dependent on the radial travel of a needle over the turntable so as to provide constant linear speed for recording and reproduction, a differential gear driven by the motor, a shaft driven by the differential gear, a turntable spindle coupled to said shaft, another shaft driven by the differential gear, a disc carried by the last mentioned shaft having a curved face, means frictionally engaging said curved face, and means for moving said first mentioned means radially with respect to said disc in accordance with the radial travel of the needle with respect to the turntable.

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