Sept. 20, 1949. W. K. RIEBER 2,482,212

COMBINED RECORDING AND REPRODUCING DEVICE

Filed Dec. 22, 1945 2 Sheets-Sheet 1

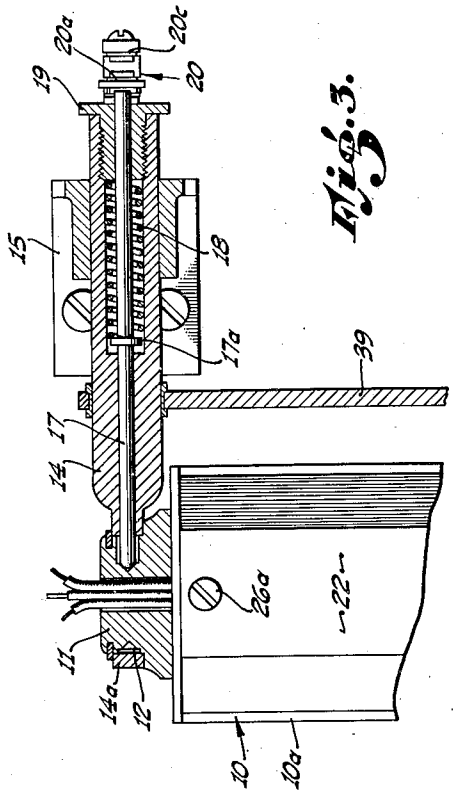

Fig. 3.

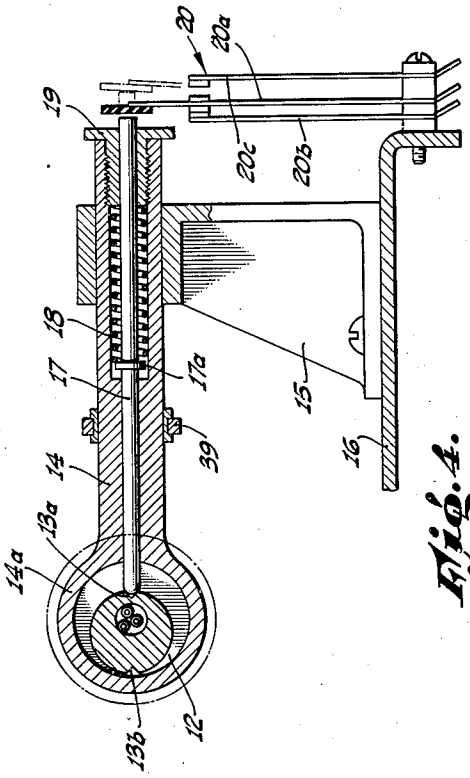

Fig. 4.

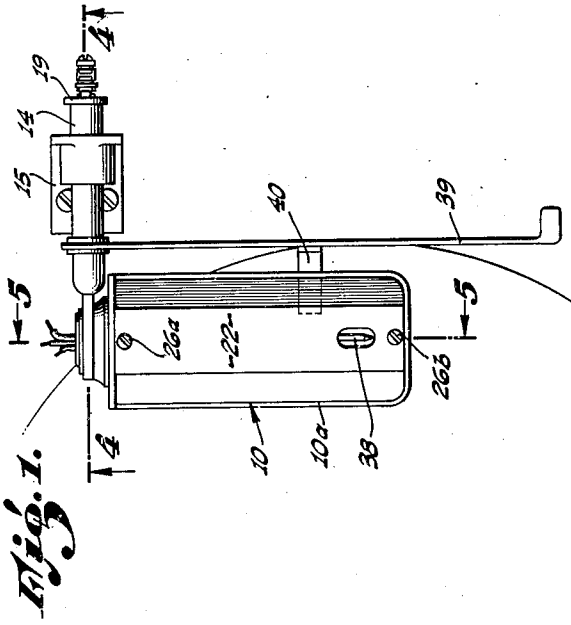

Fig. 1.

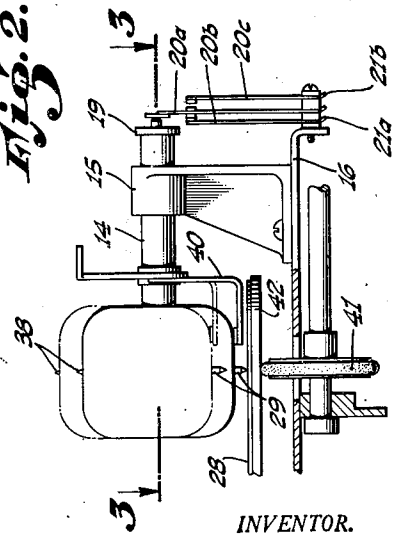

Fig. 2.

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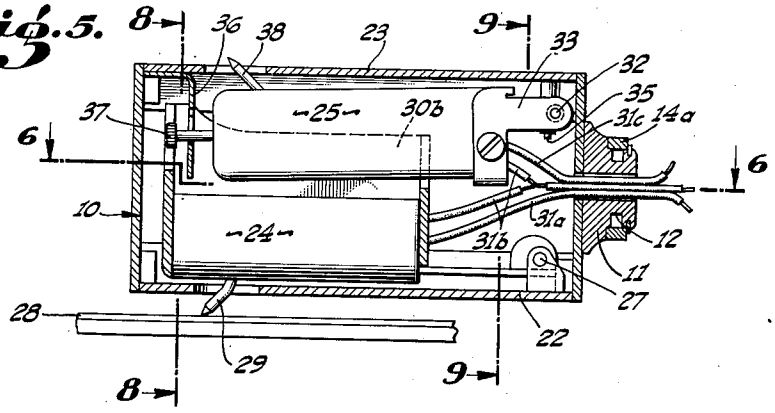
Fig. 5.



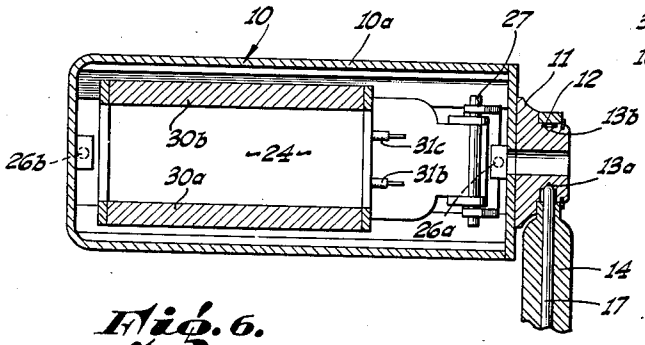


Fig. 6.

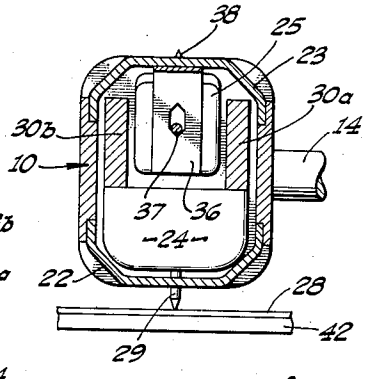


Fig. 8.

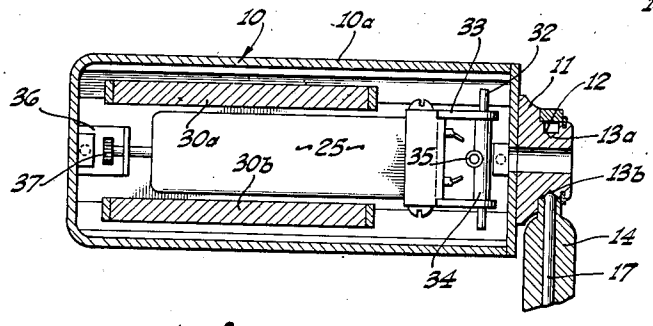


Fig. 7.

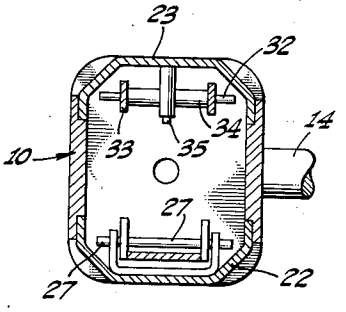


Fig. 9.

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UNITED STATES PATENT OFFICE

2,482,212

COMBINED RECORDING AND REPRODUCING DEVICE

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Application December 22, 1945, Serial No. 636,871

6 Claims. (Cl. 179—100.41)

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My invention relates generally to apparatus for producing, and/or transcribing from, sound records, and more particularly to devices of this class wherein the same mechanism is to be selectively employed for either purpose.

In phonographic devices of the class described the sound record is frequently produced by embossing or engraving an undulating groove in a moving record medium. The record medium may take the shape of a cylinder or loop, in which case the groove is produced in a helical path in the surface thereof; or the shape of the record may be that of a flat disc, in which case the sound groove follows a spiral path. The sound producing undulations in the groove are produced by forming it with a vibrating stylus, and the sound record is subsequently reproduced by tracking the groove with a stylus carried in a transducer or tone-head responsive to mechanical vibrations thereof produced by the undulations of the groove.

It is well known in the art that many transducer means are reversible; that is, capable of converting electrical pulsations into mechanical vibrations or, vice versa, converting mechanical vibrations into electrical pulsations. Reversible devices of this nature, however, do not secure optimum efficiency of energy transfer if they are adapted for both purposes, the most efficient transducers being those that are designed specifically for only one of the above-mentioned functions; i. e., recording or transcribing. Transducers adapted for recording will sometimes be referred to herein as electro-mechanical transducers and those adapted for transcription as mechanico-electrical transducers or tone-heads.

In recording devices employing either a cylinder or disc type record the helical or spiral path is produced by a combination of rotary motion of the record and relative rectilinear motion of the stylus with respect to the record.

It is desirable for several reasons to produce the record groove by a process of embossing; that is, one in which no material is removed by the stylus but wherein the groove is pressed into the recording medium. One of the principal advantages of this method of producing the sound groove is that no shavings are produced thereby. Another advantage of embossing is that the quality of recorded sound is less apt to be influenced by the pressure with which the stylus is engaged with the record than is the case with engraving. Due to the shallowness of the groove produced by embossing, however, it is necessary when transcribing records produced by this method to provide auxiliary translating means for the transcribing tone-head (transducer) and stylus carried thereby, the shallowness of the groove being such that insufficient lateral thrust is developed to move the transcribing stylus across the record in the manner of tone arms on conventional disc phonographs.

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A major object of the present invention is to provide mounting means suitable for use in recording-transcribing equipment of the class described, for carrying two transducers, one adapted for efficient operation in recording and one adapted for such operation in transcribing, the mounting being such that the two transducers may be selectively positioned to engage a moving record for the purpose of either recording or transcribing a sound record.

It is another object of the invention to provide a mounting means as described above which is adapted to be moved in translation across a moving record either to produce or track a spiral or helical groove therein.

It is a common practice in recording-transcribing machines employing electronic amplifying means, to use the same amplifier for both functions, the amplifier being connected to amplify the electrical out-put of a microphone or similar sound pick-up and to deliver such amplified out-put to a recording transducer; or during transcription, being connected to amplify the electrical out-put of a transcribing tone-head and deliver power to ear-phones, a loud speaker or the like. It is an additional object of my invention, therefore, to provide an amplifier switching means for the above-stated purpose which is coordinated with operation of the transducer mounting means whereby the selective positioning of the desired transducer automatically effects the desired connections to and from the amplifier.

It is a still further object and advantage of my invention to provide selective transducer mounting means having no reciprocating or sliding parts therein and where all mechanical parts are of a rotating nature and hence economical to manufacture and easy to service.

It is an additional object of my invention to provide in the mounting means for the transcribing tone-head a small amount of horizontal and vertical leniency to thereby enable proper tracking of the sound groove regardless of minor deviations thereof, varying thicknesses of record material, and/or varying lengths of transcribing styli.

Still another object of my invention is to pro-

vide transducer mounting means adapted to mount commercially available transducers of conventional design and wherein said transducers may be readily replaced.

While the stated objects and advantages are achieved by use of my invention in many types of recording and transcribing equipment, it is particularly suitable for use with that class of apparatus known as the constant groove speed class wherein a record bearing turn-table is driven by a relatively movable drive wheel engaged with the face thereof, the radial position of the drive wheel with respect to the turn-table being constantly changed during the recording or transcribing process in order to maintain the linear velocity of the groove past the stylus constant throughout the record. In the particular apparatus embodying the presently illustrated version of my invention, the turn-table is rotatably mounted in a carriage which in turn is adapted to move in translation. A lead screw and lead nut are geared to the turn-table spindle in a manner whereby rotation of the turntable effects simultaneous translation thereof. Such an arrangement is disclosed in my co-pending application, Serial No. 603,961, filed July 9, 1945, and entitled Sound translating device.

Briefly described, the mounting constructed according to my invention takes the form of a turret rotatable through 180°, two transducers being mounted therein one above the other in such manner that the 180° rotation above-mentioned brings the desired stylus into proper position to engage the moving record. A cam is provided on a supporting shaft of the turret which serves to operate, through suitable linkage, an amplifier change-over switch.

For a more complete and detailed description of one embodiment of my invention, reference should now be had to the attached drawings, in which:

Fig. 1 is a partial plan view of a dual transducer mounting adapted for use in a constant groove speed, disc type, recorder-transcriber;

Fig. 2 is a partially sectioned, front elevational view of the apparatus shown in Fig. 1 including a record and portions of the recorder-transcriber in which the mounting is employed;

Fig. 3 is an enlarged and partially sectioned plan view of part of the apparatus shown in Fig. 1, taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged, sectioned, front elevational view taken on the line 4—4 in Fig. 1;

Fig. 5 is an enlarged, sectioned, side elevational view taken on the line 5—5 in Fig. 1;

Fig. 6 is a sectional plan view taken on the line 6—6 of Fig. 5 and with the transducer in position for recording;

Fig. 7 is a sectional plan view similar to Fig. 6 but with the device in position for transcribing;

Fig. 8 is a partially sectioned front elevational view taken on the line 8—8 in Fig. 5; and

Fig. 9 is a partially sectioned front elevational view taken on the line 9—9 in Fig. 6.

Referring now to the drawings, the numeral 10 indicates generally a turret, adapted to receive and mount for pivotal motion therein, a pair of transducers, one for recording and one for transcribing. The turret 10 comprises an open box shaped frame 10*a*, a rearwardly projecting hollow hub 11 mounted to the rear wall of the frame and coaxial with the longitudinal axis of the turret, and a pair of mounting plates 22 and 23 held in the open faces of the box frame 10*a*. The hub 11 is adapted to rotatably support the turret 10 in a journal bearing 14*a* and has formed in the bearing surface an eccentric cam surface 12 with two diametrically opposed detent holes 13*a* and 13*b*. The journal bearing 14*a* is formed in the end of a pivot shaft 14 which is, in turn, journally supported to permit vertical swinging motion of the turret frame 10, in an upwardly projecting pillow block 15 fixedly mounted to a suitable portion of the recording apparatus, as for example the chassis portion 16 indicated in Figs. 2 and 4. Thus the turret 10 is adapted for two modes of motion; rotation about its own axis and vertical swinging motion about the axis of the shaft 14. The pivot shaft 14 has a concentric hole therethrough carrying therein a cam operated plunger 17 which is thrust against the cam surface 12 by a compression spring 18 anchored at one end against an enlarged portion of plunger 17*a* and reacting against a threaded plug 19 screwed into an enlarged internally threaded portion of the hole through pivot shaft 14. The detent holes 13*a* and 13*b* in the cam surface 12 are selectively engaged by plunger 17 thus providing two indexed positions of the hub 11 and hence the turret 10 carried thereby. The plunger serves an additional purpose of operating an amplifier change-over switch 20 through the action of the cam 12.

Thus it will be seen that with the turret 10 in the recording position, as best seen in Fig. 4, the plunger is in its retracted position, thus allowing the movable center blade 20*a* of the change-over switch 20 to close against the left-hand stationary blade 20*b* as best seen in Figs. 2 and 4. When the turret 10 is manually rotated to a position diametrically opposite that shown in Fig. 4 the plunger 17 is then extended, forcing the movable blade 20*a* of the switch 20 against the right-hand stationary blade 20*c*, a position shown by phantom lines in Fig. 4. Suitable electrical connections are made to the blades of switch 20 through leads 21*a* and 21*b* to effect the required changes in an amplifier, suitable relay means being interposed if necessary. The method of making such amplifier connections is well known in the art and hence is not shown herein.

The two mounting plates 22 and 23 carry the recording transducer 24 and tone-head 25 respectively, and are each held in the turret frame 10 by two screws 26*a* and 26*b*. The recording transducer 24 is mounted to the lower mounting plate 22 in the position shown in Fig. 5, a suitable hinge pin 14 being provided at its rearward end to permit vertical swinging motion of the transducer within the turret 10 and above a moving record 28. An embossing stylus 29 is carried by the recording transducer 24 and projects downwardly through a suitable aperture in the plate 22 into position to engage the record 28. Vertical swinging motion of the transducer about the pin 14 adapts it and the stylus 29 to follow any irregularities in record thickness and provides latitude for such various lengths of embossing stylus 29 as may be used. Suitable weights 30*a* and 30*b* are mounted in spaced relationship on the recording transducer 24 whereby to effect pressure engagement of the recording stylus 29 and record 28 thereby causing the stylus to penetrate into the record and produce a groove due to motion thereof. Suitable electrical leads 31*a* and 31*b* are connected to recording transducer 24 and led through hollow hub 11 to suitable connector means (not shown) whereby to selectively connect recording transducer 24 to the out-put of an amplifier, such selective connection being made through the operation of change-over switch 20. Electrical pulsations delivered to recording trans-

ducer 24 cause lateral vibration of the recording stylus 29 carried thereby, and hence produce undulations in the sound groove.

The transcribing tone-head 25 is mounted to its mounting plate 23 by a pivot pin 32 engaging journal bearings in a bracket 33 attached to the rear end thereof, similar electrical leads 31b and 31c being connected thereto for connection to the amplifier. The tone bead lies between the weights 30a and 30b and lies either directly above or directly below the recording transcriber depending on the position into which the turret 10 has been rotated. In addition to vertical swinging motion as provided for in the recording transducer mounting, the transcribing tone-head mounting has slight horizontal leniency provided through the operation of a universal bearing member or Cardan support 34 which is adapted to receive both the horizontal pivot pin 32 and a vertical pivot pin 35 fixedly mounted in the mounting plate 22. In order to limit swinging motion of the transcribing tone-head 25, a bracket 36 is mounted to the inside of the forward end of the mounting plate 23. A knurled screw 37 which serves as a set screw for retaining a transcribing stylus 38 in the tone-head 25, also projects through an aperture in the bracket 36, thus serving the additional purpose of limiting the horizontal and vertical swinging motions of the tone-head 25. The upper and lower ends of the aperture in the bracket 36 are V-shaped thus to centrally position the tone-head 25 within its limits of swinging motion whenever it is in either of its vertically limited positions. As in the case of the recording stylus, the transcribing stylus 38 projects through an aperture in plate 22 into position to engage the record 28 when the turret 10 is rotated to a suitable position.

The rotary operation of the turret 10, it will be seen, serves merely to selectively position the desired stylus so that it may then be lowered onto the record 28. When the desired stylus is in position, the entire turret 10 and hence the transducers mounted therein is swung downwardly engaging the operative stylus with the record, this operation being performed by means of an operating lever 39 pivotally mounted on the pivot shaft member 14. Fixed to the side of the lever 39 is an L-shaped bracket 40 which projects to the left, as seen in Fig. 2, and under the turret 10, thus to support the turret above the record as indicated by the phantom line in Fig. 2 or to lower it to a position of record engagement as shown by the solid outline. Detent means may be provided operating on control lever 39 to retain it in either of the positions shown in Fig. 2.

The journal mounting 15 of pivot shaft 14 permits the turret 10 to be swung upwardly and away from the L-shaped bracket 40, thus permitting the rotary motion of the turret necessary to position the styli.

It will be seen from an examination of Fig. 2 that the operative stylus is positioned to engage the record disc 28 at a point immediately above a drive wheel 41 frictionally engaged with the under surface of a record supporting turn-table 42. In the presently illustrated embodiment, the relative rectilinear motion of the stylus and record disc requisite to produce a spiral groove is accomplished by moving the turn-table 42 laterally as viewed in Fig. 2. By reason of the above-described friction drive operation, the linear velocity of the sound groove past the operative stylus is constant throughout the record,

being substantially equal to the constant peripheral velocity of the drive wheel 41.

In order now to produce a sound record, the turret frame 10 is grasped by its forward end, rocked back around the axis of the pivot shaft member 14 and then rotated about its own longitudinal axis to bring the recording transducer 24 into an operative position, this position being indicated in Figs. 5, 6, and 8. The rotation of the turret 10 operates through plunger 17 to move the switch 20 into the position shown by the solid outline in Fig. 4. The turret 10, recording transducer 24, and the stylus 29 held thereby are then lowered by means of the control lever 39 and the L bracket 40 to engage the recording stylus 29 with a record 28 placed on and rotated by the turn-table 42. The recording process may now continue to the limit of rectilinear travel of the turn-table 42 or until a desired amount of material has been recorded.

In order to transcribe a sound record produced as described, the turret 10 is rocked back on the axis of the pivot shaft 14 on its axis rotated to bring the transcribing stylus 38 into record engaging position. The record is manually returned to its starting position, and the turret 10 lowered as before to bring the transcribing stylus 38 into engagement with the record 28. The rotation of the turret 10 operates through the action of the cam surface 12 and the plunger 17, to move the switch 20 into a position shown by the phantom line in Fig. 4, in which position the amplifier is connected as required for the operation of transcribing.

The centering action of the limiting bracket 36 operating on the tone-head 25 is such that, as the transcribing stylus 38 meets the record, the tone-head 25 is centrally located within its limits of horizontal leniency, thus permitting horizontal swinging action in order that the stylus 38 may follow such minor deviations either to the left or to the right as may occur in the sound groove. The transcribing then continues to the completion of the desired portion of the record.

It will be noted from an examination of Fig. 5 that when the turret 10 is in the recording position as shown therein, the tone-head 25 is uppermost and hence drops downwardly into the turret 10, this motion being limited by the limiting bracket 36 and being such as to substantially retract the transcribing stylus 38 through the aperture in the mounting plate 22. A similar action takes place when the turret is in the opposite position as shown in Fig. 7, the retracting motion of the recording transducer 24 being limited by its striking the top of the limiting bracket 36.

Rotation limiting means (not shown) may be provided to prevent continued rotation of the turret 10 in the same direction, thus to prevent twisting off of the electrical leads 31 at point where they pass through the hub 11.

Replacement of either the recording transducer 24 or the tone-head 25 is a relatively simple operation requiring only the removal of two screws 26a and 26b which retain the mounting plates 22 and 23 in the turret frame 10a. With the mounting plate removed, the transducer 24 or tone-head 25 mounted thereon is readily accessible either for replacement or for servicing.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred

embodiment of my invention, and that I do not mean to limit myself to the details of construction or design herein shown, other than as defined in the appended claims.

I claim:

1. In photographic apparatus of the class described for selectively producing or transcribing sound records including a moving, sound-receiving record and an amplifier, switching means and selective transducer means comprising, in combination: an electro-mechanical transducer, responsive to said amplifier and having recording stylus means therein; a mechanico-electrical transducer having transcribing stylus therein responsive to said record; a rotatable turret mounting said transducer for independent swinging motion with respect thereto; indexing means to lock said turret in either of two rotational positions whereby said transducers are selectively positioned to engage by said swinging motion thereof, said record; limiting means mounted in said turret and operatively associated with said mechanico-electrical transducer whereby to limit swinging motion of the same, said limiting means being further adapted by a V-shaped portion therein to engage and hold said mechanico-electrical transducer in a horizontally centralized position when the same is out of engagement with said record; and switching means mechanically connected to be operated by rotation of said turret and electrically connected between said transducers and amplifier to selectively effect operative connection of said amplifier with such transducer as is positioned to engage said record.

2. In apparatus for selectively producing or transcribing sound records, the combination of: a record carrying turn-table mounted for simultaneous rotation and translation in a horizontal plane; a disc shaped sound receiving record carried by said turn-table for rotation therewith; a drive wheel mounted for rotation in a relatively fixed location and frictionally engaged with a surface of said turn-table whereby to effect rotation thereof; lead means operatively connected to said turn-table whereby rotation thereof effects simultaneous translation thereof relative to said drive wheel; an electro-mechanical transducer responsive to electrical pulsations and having recording stylus means therein; a mechanico-electrical transducer having transcribing stylus means therein responsive to said record whereby to produce electrical pulsations; mounting means rotatably mounted above said record adapted to pivotally mount said transducers for swinging motion therein; indexing means for said mounting means whereby to selectively position either of said transducers to operatively engage by said swinging motion thereof said record at a point immediately adjacent said drive wheel; amplifier means adapted to selectively provide electrical pulsations for said electro-mechanical transducer or to be responsive to electrical pulsations produced by said mechanico-electrical transducer; and switch means operatively associated with said rotatable mounting means and electrically connected between said transducer and amplifier whereby to selectively effect connection of said amplifier either to said electro-mechanical transducer or to said mechanico-electrical transducer.

3. In photographic apparatus for selectively producing or transcribing sound records, selective transducer means comprising, in combination: an electro-mechanical transducer; a mechanico-electrical transducer; rotatable mounting means to mount said transducers; horizontal pivot means between said electro-mechanical transducer and said mounting means adapted to permit vertical swinging of said electro-mechanical transducer but to prevent lateral swinging thereof; vertical and horizontal pivot means between said mechanico-electrical transducer and said mounting means adapted to permit both vertical and lateral swinging of said mechanico-electrical transducer; centering means in said mounting means adapted to center said mechanico-electrical transducer between the limits of said lateral swinging thereof when said mechanico-electrical transducer is not operatively engaged with a record; and means to selectively position said transducers for operative engagement with a record.

4. In phonographic apparatus of the class described for selectively producing or transcribing sound records including a moving, sound-receiving record and an amplifier, switching means, and selective transducer means comprising, in combination; an electro-mechanical transducer, responsive to said amplifier and having recording stylus means therein; a mechanico-electrical transducer having transcribing stylus means therein responsive to said record; rotatable turret means mounting said transducers for independent swinging motion, said turret means being further adapted to constrain said swinging motion of said electro-mechanical transducer to a vertical direction and to constrain said swinging motion of said mechanico-electrical transducer to a vertical and lateral direction; indexing means to lock said turret means in either of two rotational positions whereby said transducers are selectively positioned to engage by said swinging motion thereof, said record; centering means for said mechanico-electrical transducer adapted to center the same within said lateral swinging motion thereof when disengaged from said record; and switching means responsive to rotation of said turret means whereby to selectively effect operative connection of said amplifier with such transducer as is positioned to engage said record.

5. In phonographic apparatus for selectively producing or transcribing sound records, selective transducer means comprising in combination: an electro-mechanical transducer; a mechanico-electrical transducer; a record engaging stylus in each of said transducers; rotatable mounting means to mount said transducers; horizontally aligned pivot means connected between said electro-mechanical transducer and said mounting means to support said electro-mechanical transducer for vertical swinging movement thereof with respect to said mounting means; vertically and horizontally aligned pivot means connected between said mechanico-electrical transducer and said mounting means to support said mechanico-electrical transducer for both vertical and lateral swinging movement with respect to said mounting means; a centering member fixed in said mounting means and adapted to engage and center said mechanico-electrical transducer between the limits of said lateral movement thereof when said mechanico-electrical transducer is not operatively engaged with a record; and a universal support for said mounting means, said universal support including a first bearing aligned to permit rotation of said mounting means selectively to operatively position one or the other of said transducers with the stylus thereof extending downwardly, and a second bearing aligned to permit vertical movement of

said mounting means to selectively lower or raise the then operatively positioned transducer into or out of record engaging position.

6. In phonographic apparatus of the class described for selectively producing or transcribing sound records including a moving sound receiving record and amplifier, switching and selective transducer means comprising in combination: an electro-mechanical transducer electrically connectable to said amplifier and having a recording stylus therein; a mechanico-electrical transducer having a transcribing stylus therein engageable with said record; a rotatable turret mounting said transducers for independent swinging motion therein, said turret being further adapted by aligned pivot bearings therein to constrain said swinging motion of said electro-mechanical transducer to a vertical direction and by a Cardan support to constrain said swinging motion of said mechanico-electrical transducer to a vertical and lateral direction; indexing means to lock said turret in either of two rotational positions whereby said transducers are selectively positioned to engage a record therebeneath when said turret is lowered; means including a support bearing to raise and lower said turret; a centering member fixed in said turret at a point spaced from said Cardan support, said centering member being positioned and adapted to engage said mechanico-electrical transducer when said turret is lifted, and move said transcribing stylus to a horizontally centralized position; and switching means including an electrical circuit having a switch therein operatively associated with, and actuated by rotation of said turret whereby to selectively effect operative electrical connection of said circuit with such transducer as is then positioned to engage said record.

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