

May 9, 1950

E. O. THOMPSON

2,506,692

MOUNTING UNIT FOR PHONOGRAPH TONE-ARMS

Filed Oct. 11, 1947

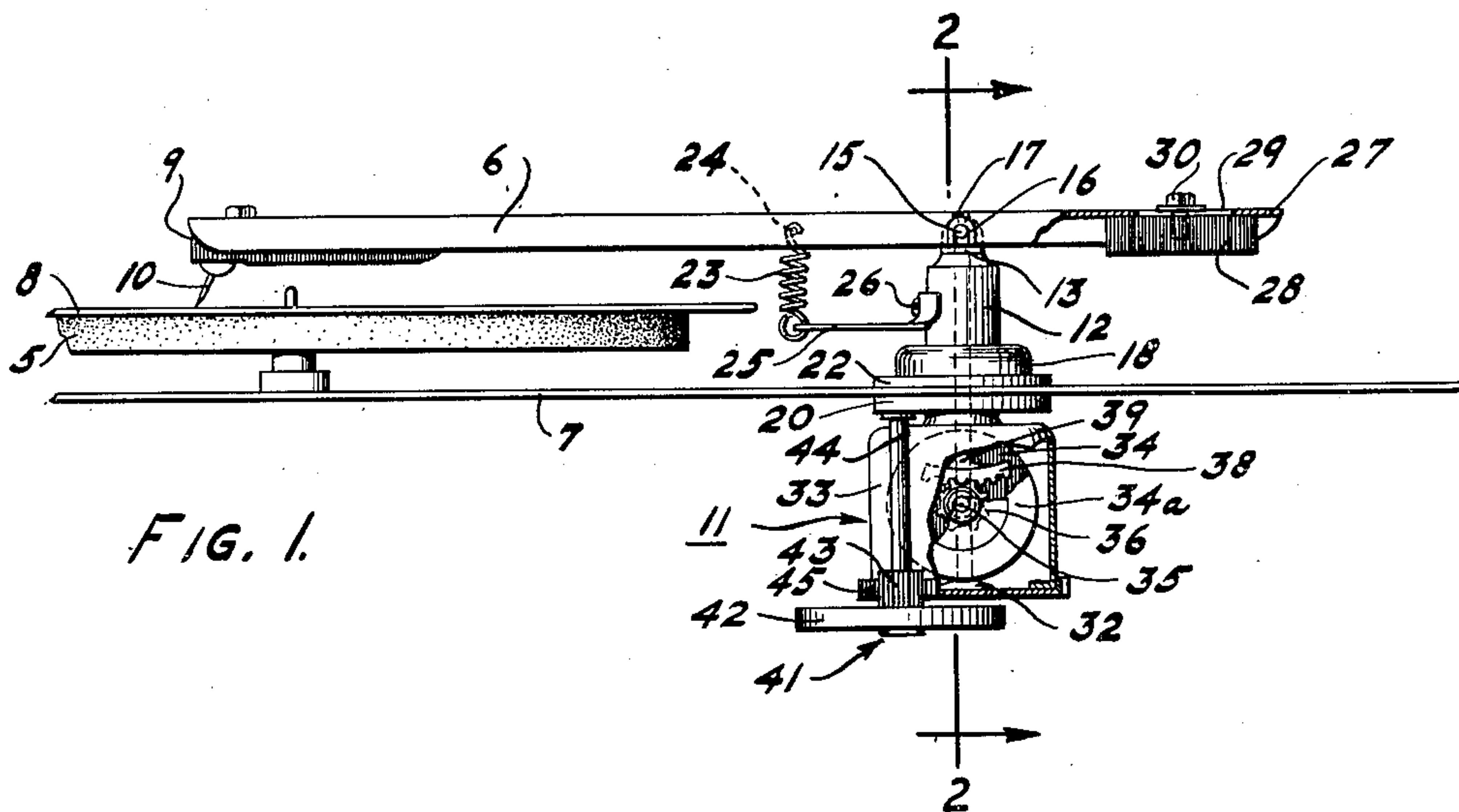


FIG. 1.

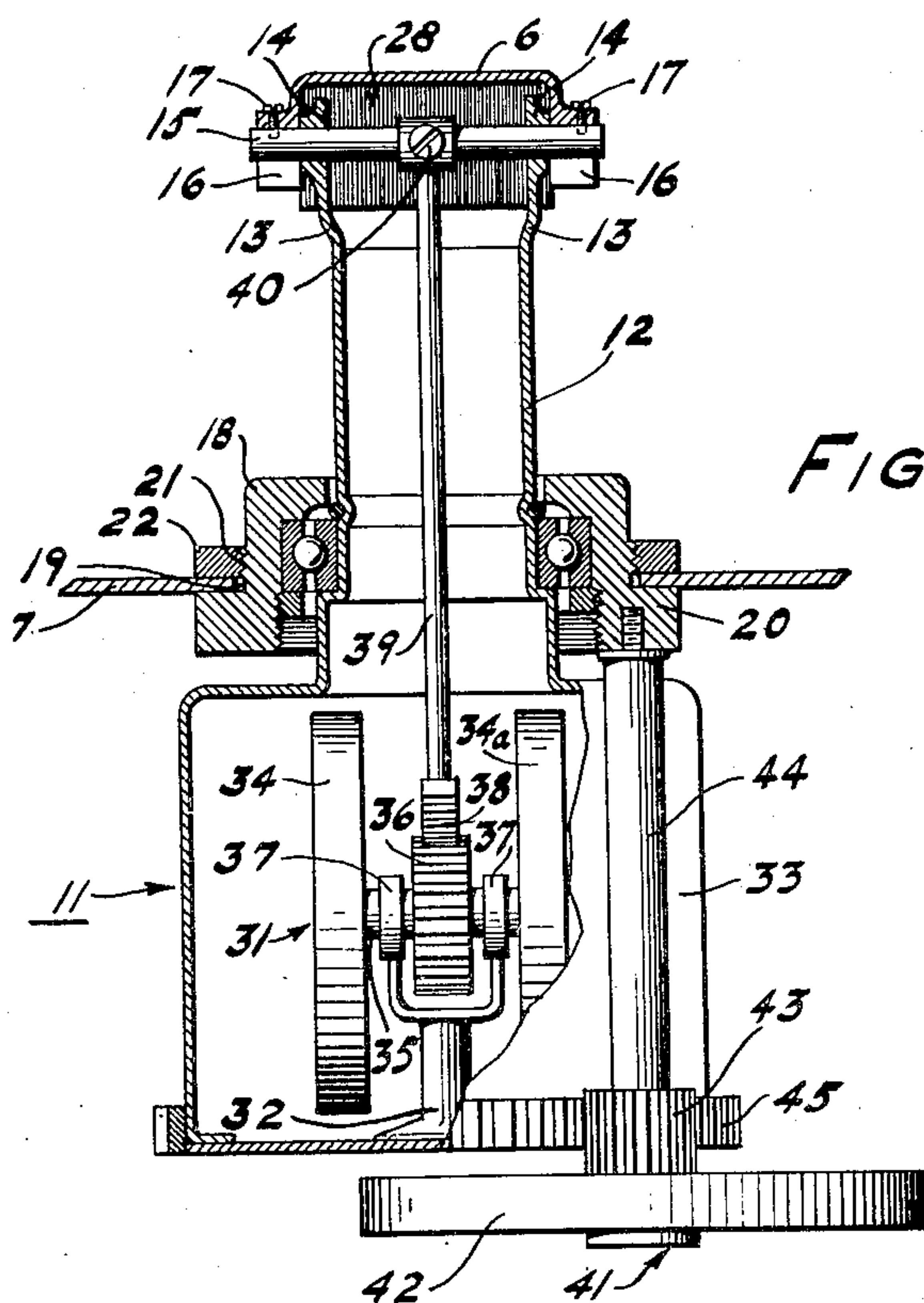


FIG. 2.

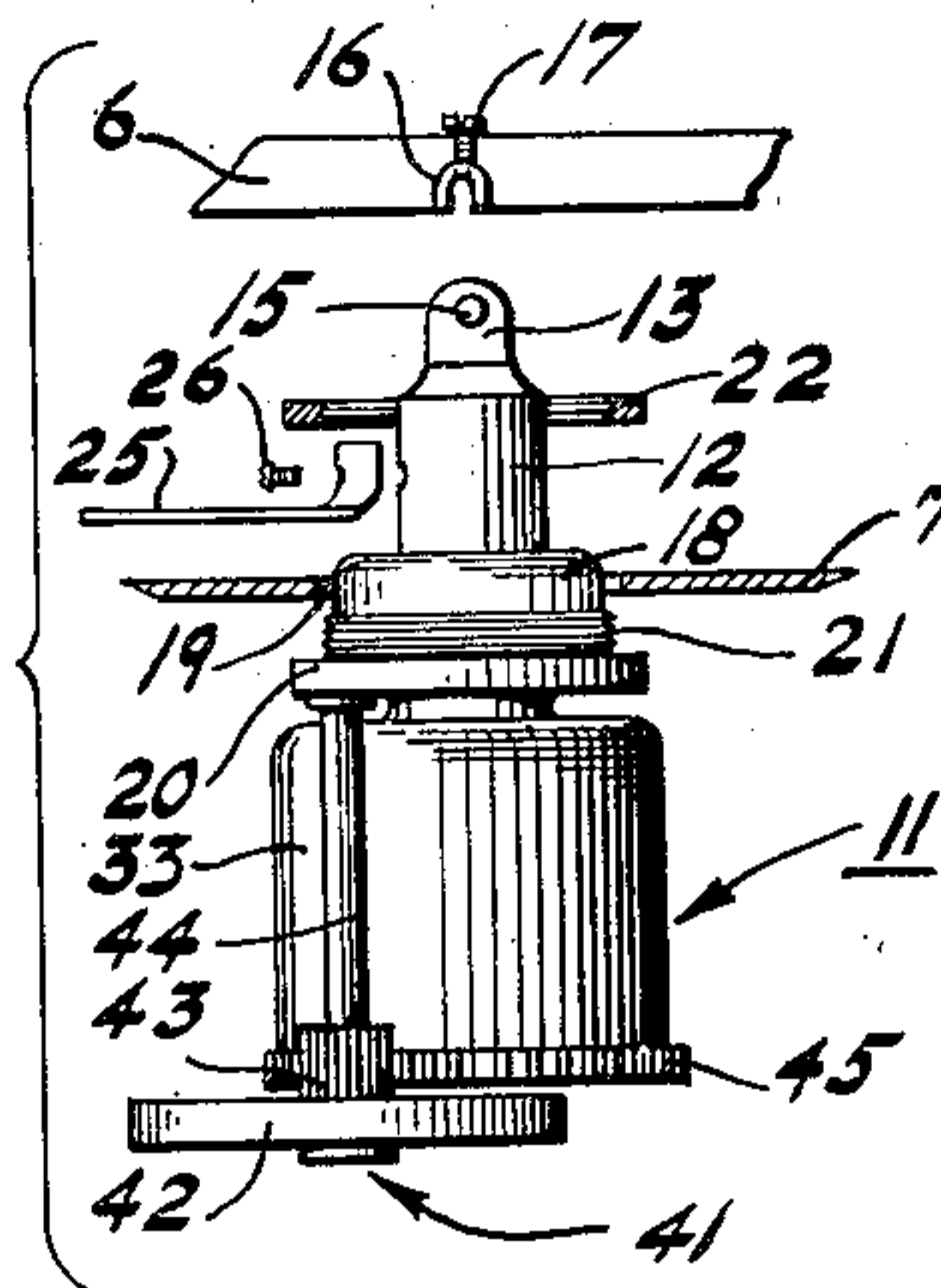


FIG. 3.

INVENTOR.
ELMER O. THOMPSON
BY
Brown, Lenk & Synnestvedt
AGENTS

UNITED STATES PATENT OFFICE

2,506,692

MOUNTING UNIT FOR PHONOGRAPH
TONE-ARMSElmer O. Thompson, Grasmere, N. Y., assignor to
Philco Corporation, Philadelphia, Pa., a corpo-
ration of Pennsylvania

Application October 11, 1947, Serial No. 779,339

4 Claims. (Cl. 274—23)

1

The present invention relates to phonograph apparatus and, particularly, to phonograph apparatus of the type having a pivotally mounted tone-arm adapted for playing engagement with a record supported on a turntable. Specifically, the invention has to do with improvements in the mounting of the tone-arm.

In phonograph apparatus of the type above mentioned, the tone-arm which carries the pick-up, is customarily mounted to swing freely in a direction transverse to the record supporting surface of the turntable, so that the pick-up needle can be brought in and out of engagement with the playing surface of the record, and so that the tone-arm will be free to move with undulations of the record. The tone-arm is also mounted to swing in a direction paralleling said surface of the turntable, so that the tone-arm can be moved out of the playing field to allow changing of records, and so that the pick-up needle will be free to track the record groove. Because the tone-arm is free to pivot in the two above mentioned directions, sudden translatory or rotatory movements of the phonograph result in undue displacements of the tone-arm and cause the pick-up needle to jump off or slide across the record. For these reasons, ordinary phonographs are adapted to play properly only when in a stable and substantially level position. They are not suited to play while in transportation, and are particularly incapable of adequately playing in driven vehicles, such as automobiles, which are subject to shocks, jars, and vibrations due to abrupt stopping and starting, traveling up and down hills and over bumps, and changing direction from a straight line path into a curve or turn.

It is, therefore, the primary object of this invention to provide a phonograph which is adapted to play in any position and which can play properly in transportation, particularly, in moving vehicles. To that end, the invention employs a tone-arm mounting which allows the tone-arm to be pivotally moved about two perpendicularly related axes but which effectively prevents accidental displacement of the tone-arm about said axes and, thus, insures positive retention of the pick-up needle in the record groove, even when the phonograph is subjected to severe jolts.

Another object of the invention is to provide a tone-arm mounting which makes the above mentioned advantages possible, and which has a simplified construction capable of being readily associated with other existing parts of the phonograph without necessitating material changes

2

therein. This object of the invention is obtained by means of a unitary structure which is adapted to provide for normal swinging movements of the tone-arm but which functions to counteract any tendency of the tone-arm to move abnormally under influence of shocks, jolts, jars or unusual severe movements of the phonograph.

Still another and more specific object of the invention resides in the provision of a tone-arm mounting arrangement which makes it possible to balance the tone-arm both statically and dynamically so that the pick-up needle will not slide across nor leave the surface of the record during the playing thereof, even should the phonograph be subjected to unusual shaking or swinging motions in any direction. For that purpose, the invention provides a tone-arm supporting unit in which counterbalancing and counterrotating means, having moments of inertia dynamically balancing those of the tone-arm assembly, are so coupled to said assembly that said moments of inertia oppose undesired movements of the tone-arm assembly.

These and other objects of the invention, and the manner in which they are obtained, will be fully understood from the following description based on the accompanying drawing which illustrates a preferred embodiment of the invention, and in which:

Figure 1 is a side elevational view showing a tone-arm mounting constructed in accordance with the invention, certain parts being broken away for clarity of illustration;

Figure 2 is an enlarged elevational-sectional view looking in the general direction of arrows 2—2 of Figure 1; and

Figure 3 is an exploded view of certain parts of the arrangement as shown in Figure 1, and illustrates the mode of assembling the tone-arm mounting unit with the phonograph base plate and tone-arm.

With more particular reference to the drawing, Figure 1 shows a turntable 5 and a tone-arm 6. The turntable is conveniently mounted on a base plate 7, and is adapted to be rotated in the usual manner by means of a suitable motor (not shown). The turntable is further adapted to support a record, as is indicated at 8, and to rotate the record in relation to the tone-arm 6. The tone-arm carries a pick-up 9 which is provided with a needle 10 disposed for engagement with the customary spiral modulated groove of the record. As shown, tone-arm 6 is supported to swing about two perpendicularly related axes. Swinging movement of the tone-arm about one of said axes

3

allows for movement of said tone-arm in a direction transverse to the plane of the turntable, in order that the pick-up needle may be brought in or out of engagement with the record, and in order that the tone-arm may accommodate itself to undulations of the record. Swinging movement of the tone-arm about the other of said axes allows for movement of said tone-arm in a direction generally parallel to the plane of the turntable, in order that said tone-arm may be moved out of and into the playing field, and in order that the pick-up needle may follow the record groove, unobstructedly.

In accordance with the invention and as illustrated in the drawing, the tone-arm support comprises a mounting unit which is designated, in its entirety, by the reference numeral 11, and which is constructed and arranged to provide for movement of the tone-arm in the two above named directions. For that purpose, unit 11 includes a generally cylindrical supporting member or standard 12 which, as more clearly shown in Figure 2, has ears 13 adapted to provide diametrically opposed bearings 14. These bearings may be of any suitable construction, and are adapted to receive a rotatable shaft or pivot 15. As can best be seen in said Figure 2, the sides of the tone-arm 6 are provided with bifurcated trunnions 16 which are adapted to engage pivot 15 and to be rigidly connected thereto, as by means of suitable locking elements 17. Thus, the tone-arm can be swung at right angle to the longitudinal axis of the main supporting member 12. The member 12 is arranged for rotation, about its longitudinal axis, on the base plate 7. This is conveniently accomplished by providing a ball-bearing connection which, as more clearly shown in Figure 2, is mounted on member 12 and has a part 18 adapted to be fixedly secured to the base plate. For that purpose, the member 12, together with its ball-bearing connection, is received in an opening 19 in the base plate, and the part 18 of the ball-bearing connection has a lip 20 disposed to bear on the one side of the base plate. The part 18 further has a threaded portion 21 in engagement with a nut 22 adapted for bearing engagement with the other side of the base plate. In this manner, the tone-arm is free to rotate with member 12 about the longitudinal axis of the latter. As illustrated in Figure 1, a coil spring 23, which has one of its ends attached to a connection 24 on the tone-arm, and which has its other end attached to a bracket 25 secured, as by means of fastening element 26, on a rotatable member 12, serves to maintain the pick-up needle in proper tracking engagement with the record groove.

As hereinbefore stated, the tone-arm, according to the present invention, is adapted to be perfectly balanced statically and dynamically about both of its axes of rotation so as not to be deleteriously affected by shocks or vibrations to which the phonograph may be subjected. For that purpose, and as particularly shown in Figure 1, the tone-arm is provided with an end portion 27 which projects beyond the pivot 15, and a counterbalancing weight 28 is attached to this extended portion. The mass of weight 28 and of the extended portion 27 on one side of the pivotal axes is such that it accurately balances the mass of the pick-up and of the tone-arm portion on the other side of said axes. Because of this construction, it will be understood that, in effect, the tone-arm assembly is pivoted for rotation at its center of gravity so that the tone-arm, when at

4

rest, is perfectly balanced. In order to allow for critical adjustment in balancing the tone-arm, the weight 28 is adjustably mounted on the tone-arm portion 27. This is conveniently accomplished by providing said portion with a slot 29, and by providing the weight with a suitable releasable locking element 30 passing through said slot. After loosening element 30, the weight may be slidably adjusted until perfect balance is secured, and then the weight may be retained in adjusted position by tightening said element.

Because the tone-arm is perfectly balanced in the manner above described, translatory movements of the phonograph in directions transverse to either the rotatable member 12 or to the rotatable pivot 15, will not deleteriously affect the inertia of the tone-arm. Accordingly, the tone-arm, if moving under influence of the radial leading force developed by the spiral groove of the record, will tend to continue its normal movement, although the phonograph may be subjected to severe jolting in directions transverse to the pivotal axes of the tone-arm.

However, the inertia of the balanced tone-arm would be deleteriously affected by unusual rotatory movements of the phonograph in directions corresponding to the axes of the tone-arm. Such rotatory movements tend to develop torque forces which, in turn, tend to produce abnormal rotational displacements of the tone-arm, with the result that the pick-up needle tends to slide over or to leave the surface of the record. In order to overcome these conditions, the invention provides the unit 11 with counterbalancing and counterrotating means which tend to counteract the effects of such rotatory movements of the phonograph.

For the purpose of counteracting the effect of those rotatory movements which tend to cause abnormal displacement of the tone-arm about the axis of rotation at pivot 15, a mass, indicated generally at 31 (Figures 1 and 2) and mounted to rotate at its center of gravity on a support 32, is so connected with said pivot as to rotate in a direction opposite to the direction in which said pivot tends to rotate under influence of such rotatory movements of the phonograph. In the embodiment illustrated in the drawing, the rotatable mass and its support are housed in an enlarged portion 33 of the tone-arm supporting member 12. The mass, as shown, consists of a pair of balanced flywheels 34 and 34a, a shaft 35 interconnecting the flywheels at their centers, and a gear 36 fixed to the shaft. The support 32 includes suitable bearings 37 (Figure 2) which are disposed to engage the shaft 30 so as to support said shaft with its gear and flywheels in perfectly balanced condition. The gear 36 engages a gear segment 38 provided in one end of an arm 39, the other end of which is rigidly secured, as indicated at 40 in Figure 2, to the pivot 15 of the tone-arm, in such a manner that said arm 39 extends from said pivot and into the cylindrical supporting member 12. The flywheel-shaft-and-gear assembly which constitutes the rotatable mass 31, is such that its moment of inertia about shaft 35, exactly dynamically balances the moment of inertia of the tone-arm assembly about pivot 15 and including the arm 39 and gear segment 38. Thus, the mass 31 opposes the tendency of the tone-arm to rotate about the axis of pivot 15, when shocks or vibrations tend to impart rotatory movements to the phonograph, in directions corresponding to the axis of rotational pivot 15.

For the purpose of counteracting the effect of those rotatory movements which tend to

5

cause abnormal displacement of the tone-arm about the axis of rotational supporting body 12, another mass, indicated generally at 41, is mounted to rotate at its center of gravity and is so connected with said body as to rotate in a direction opposite to the direction in which said body tends to rotate under influence of such rotatory movements of the phonograph. In the arrangement shown, the rotatable mass 41 consists of a balanced flywheel 42 and a pinion 43 rigidly connected with said flywheel. The flywheel-and-pinion assembly is rotatably suspended on a stud 44 suitably attached to the lip 20 of part 18 of the ball-bearing connection, which part is fixedly secured to base plate 7. The pinion 43 engages a gear-toothed element 45 provided on the circumferential surface of enlarged portion 35 of the tone-arm supporting member 12. The flywheel-and-pinion assembly constituting the rotatable mass 41 is such that its moment of inertia, about stud 44 exactly dynamically balances the moment of inertia of the complete tone-arm assembly, about the vertical axis of member 12, including the mass 31, connecting arm 39 and segment 38. Thus the mass 41 opposes the tendency of the tone-arm to rotate with supporting member 12 about the longitudinal axis of the latter, when shocks or vibrations tend to impart rotatory movements to the phonograph in directions corresponding to said axis of the rotational member 12.

In associating the tone-arm mounting unit 11 with the phonograph, the tone-arm supporting member 12 of said unit is introduced, as represented in Figure 3, through opening 19 of base plate 7, and is guided in said opening until lip 20 of ball-bearing connection part 18 comes in contact with the confronting side of said base plate. The nut 22 is then engaged with threaded portion 21 of said part 18, and is tightened until the unit becomes securely clamped on the base plate. Bracket 25 is then secured to member 12 by means of fastening element 26. The tone-arm 6 may then be rigidly connected with said member by engaging bifurcated trunnions 16 with pivot 15 and by tightening the fixing elements 17 on said pivot which, in order to insure positive connection, may be provided with suitable depressions disposed to receive the end of said elements 17, as shown in Figure 2. When mounted, the tone-arm is accurately balanced on its support by adjusting weight 28, if this is found necessary. Spring 23 (Figure 1) which is adapted to supply the required needle pressure on the record, is then connected to the tone-arm 6 and bracket 25.

From the foregoing description, it will be appreciated that the present invention provides a simple yet dependable arrangement whereby the tone-arm of a phonograph is capable of free normal movement during the playing of a record, but is effectively checked against undesired movements, in all directions. Moreover, from the preceding description it will be appreciated that the invention makes it possible to provide a mounting unit for a phonograph tone-arm, which unit functions to insure proper playing of a record regardless of the position of the phonograph or of any swinging or shaking motion to which the phonograph may be subjected. Particularly, the provision of a tone-arm mounting unit as herein described, has the advantage that it can be readily used to replace the usual tone-arm support pro-

6

vided on phonographs, especially because such a unit can be mounted without the exercise of exceptional skill.

I claim:

1. A unit for mounting a phonograph tone-arm to rotate about two perpendicularly related axes, said unit comprising a tone-arm supporting member, means arranged on the supporting member to mount the same for rotation about one of said axes, a flywheel structure supported by said means to rotate in a plane transverse to said one axis and connected with said member for rotation counter to the rotation of the latter, a tone-arm engaging element mounted on said member for rotation therewith about said one axis and for rotation relative to said member about the other of said axes, and a second flywheel structure supported by said member to rotate in a plane transverse to said other axis and connected with said element for rotation counter to the rotation of the latter.

2. A unit as set forth in claim 1, in which the supporting member is hollow, the first-mentioned flywheel structure is supported exteriorly of said member by the stated means, and the second-mentioned flywheel structure is supported interiorly of and by said member.

3. A tone-arm mounting unit comprising a generally cylindrical member, support means arranged on said member to mount the same for rotation about its longitudinal axis, a flywheel structure supported by said means to rotate about an axis substantially paralleling the mentioned rotational axis of said member, a connection between said member and flywheel structure to rotate the latter counter to the rotation of said member, a rotatable shaft provided on said member and extending in a plane transverse to the rotational axis of said member and adapted for connection with a tone-arm, said shaft being arranged for rotation with said member and for rotational movement with respect thereto about an axis extending substantially at right angles to the rotational axis of said member, a second flywheel structure housed and supported within said member to rotate about an axis substantially paralleling said shaft, and a connection between said shaft and second flywheel structure to rotate the latter counter to the rotation of said shaft.

4. A tone-arm mounting unit as set forth in claim 3, in which the first-mentioned connection includes a pinion attached to the first-mentioned flywheel, and a toothed wheel affixed to the generally cylindrical member and in mesh with said pinion; and the second-mentioned connection includes a gear as part of the second flywheel structure, and an arm secured to the rotatable shaft and having a toothed rack in mesh with said gear.

ELMER O. THOMPSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,033,729	Montfort	Mar. 10, 1936
2,263,979	Bruno	Nov. 25, 1941
2,331,122	Jones	Oct. 5, 1943