July 16, 1929. R. S. WEIR 1,721,362

PHONOGRAPH ARM

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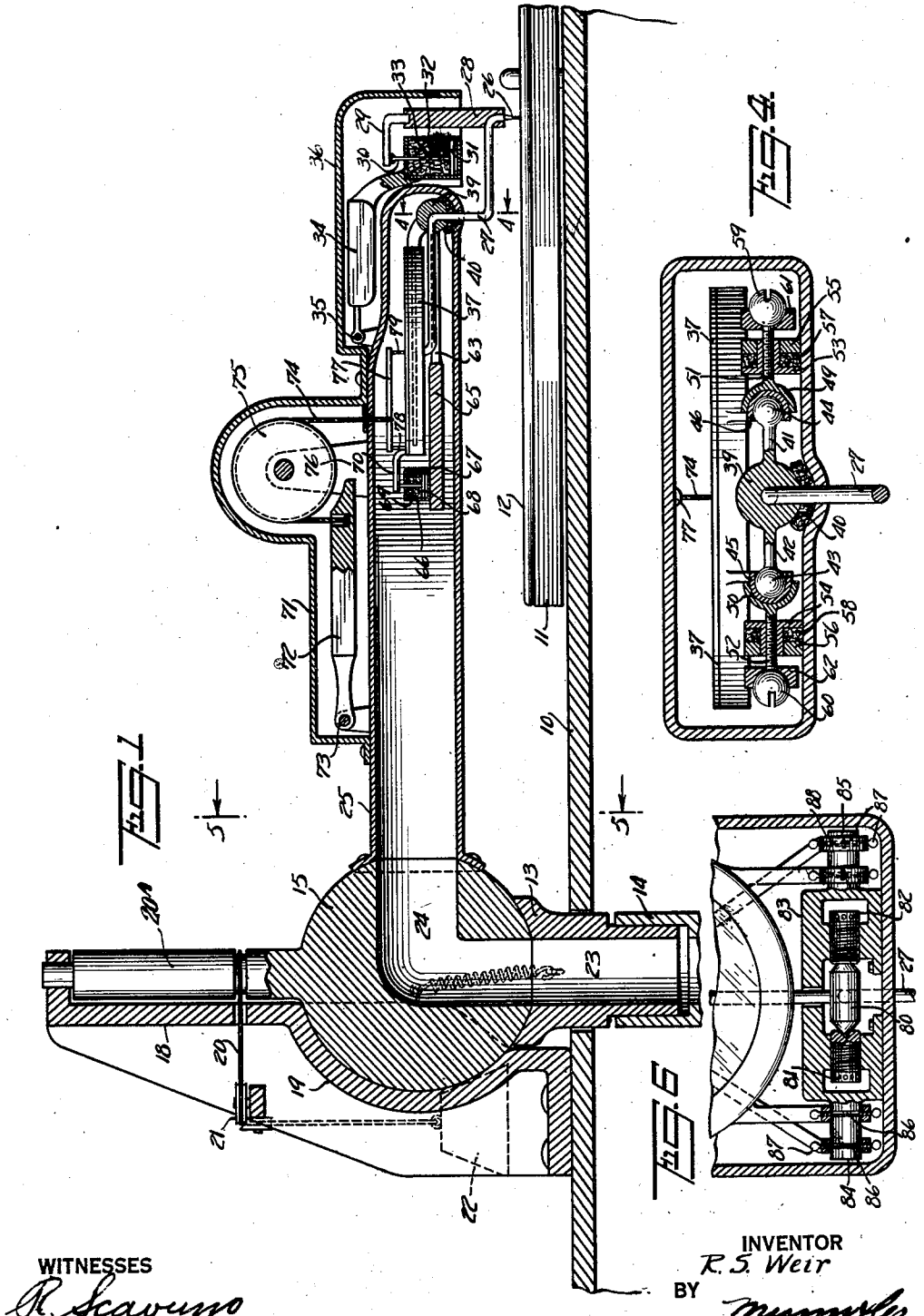

WITNESSES

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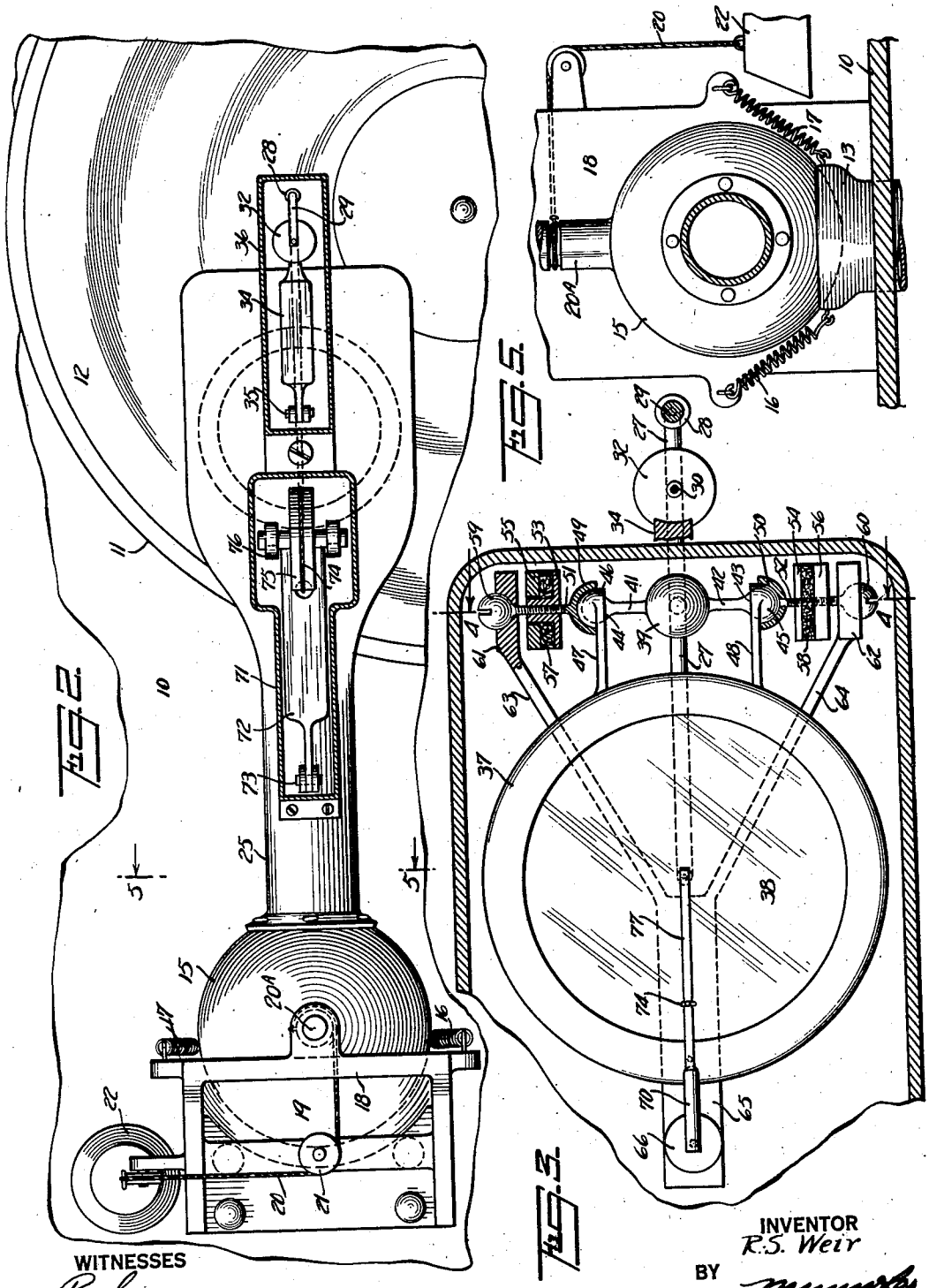

FIG. 2.

FIG. 3.

FIG. 4.

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UNITED STATES PATENT OFFICE.

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PHONOGRAPH ARM.

Application filed June 5, 1928. Serial No. 283,068.

This invention concerns a phonograph, and has particular reference to the construction and assembly of the tone arm and the connection of the sound box and needle thereto.

It is the object of the invention to suspend a sound box and needle assembly within a tone arm in such manner that the maximum output of the needle vibrations will be transmitted into sound waves and incur minimum loss by absorption in the mechanical parts of the apparatus.

It is also an object to suspend a sound box and needle unit so freely that they may be said to float and have most efficient and free frictionless production of vibration.

A further object is to mount the tone arm so that little friction is involved in its gradual turning as the needle moves over the record, and in fact, it is part of the invention to provide means whereby the tone arm assists the needle in its travel in the sound grooves.

As a further object, I intend to so cushion or damp the parts and their supports, that no vibrations pass except direct from the needle to the diaphragm.

To this end, the invention comprises a tone arm mounted on a swivel joint which is provided with means to bias the arm laterally in a given direction so as to assist the needle in its groove travel. The joint is provided with a flexibly connected throat held resiliently thereagainst to continue the sound passage, but permit free movement between the parts.

The sound box and needle support are mounted on a pivot which is cushioned against vertical and lateral vibrations so that none of the vibratory energy of the needle is lost. Furthermore, the sound box and needle unit is balanced on each side of the pivots by means such as weights so that it is not positively or rigidly connected to the tone arm, and consequently floats therein in a very sensitively dynamic state, whereby a maximum of sound is produced without loss of vibrations through inert parts of the mechanism.

A preferred embodiment of the invention is shown in the drawings, of which—

Fig. 1 is a vertical longitudinal section through the tone arm and sound box assembly.

Fig. 2 is a plan view thereof, showing certain casings broken away.

Fig. 3 is an enlarged plan view of the sound box mounted with the enclosing casing cut away.

Fig. 4 is a section on the line 4—4 of Fig. 3.

Fig. 5 is a section on the line 5—5 of Fig. 2.

Fig. 6 is a plan view partly in section of a modified form of pivot bearing for the sound box and its associated mechanism.

The preferred form as shown in the drawings, is mounted on a platform 10 on which a turntable 11 is mounted to receive a record 12. A throat 13 projects through the platform 10 and connects loosely with the end 14 of a horn mechanism (not shown). This throat is held resiliently against a ball shaped swivel joint member 15 by means of springs 16 and 17 fastened to an upright plate 18 mounted on the platform 10. This plate 18 has a curved socket 19 against which the rear face of the ball swivel member 15 bears. A shaft 20A extends upwardly from the member 15 and is journalled in the plate 18 at the top. A cable 20 passes through the plate 18 and is wrapped around the shaft 20A. Back of the plate 18, it passes over pulleys 21 and extends downwardly to support a weight 22. The effect of this weight is to tend to turn the member 15 in a given lateral direction. The throat 13 and the member 15 are provided with passages 23 and 24 which form continuations of the passage in a tone arm 25 attached longitudinally to the member 15. This tone arm extends outwardly over the record 12, with which a needle 26 is adapted to contact. Preferably this needle is the usual diamond point type. The needle is supported or forms part of a needle arm 27 held near its outer end in a plate 28. This plate has a lateral extension 29 at the top, from which depends a link 30 connected to a damper plate 31 in the bottom of casing 32. Above the damper plate 31 within the casing 32 is disposed a mass of flexible material, such as packing 33.

The casing 32 is supported at one end of a weighted arm 34 pivoted at 35 on the tone arm. Over this mechanism extends a cover 36. The weight of plate 28 tends to hold the needle firmly in the groove on the

record. This is further accentuated by the weighted arm 34 pressing down on damper plate 31 through the packing or cushion 33. However, the vibrations of the needle by reason of the packing will not pass to the weighted arm 34.

Within the tone arm 25, a sound box 37 is pivotally mounted. This sound box has a diaphragm 38 to the under side of which the needle arm 27 is centrally connected. Intermediate its ends, this needle arm passes through a ball pivot member 39 which rests on a flexible cushion 40 disposed between it and the adjacent surface of the tone arm. This pivot member has laterally extending arms 41 and 42 provided with ball shaped ends 43 and 44 resting in curved sockets 45 and 46 on the ends of arms 47 and 48 extending from the sound box. These sockets 45 and 46 in turn are received by curved sockets 49 and 50 on threaded stems 51 and 52 threaded into sliding plates 53 and 54 mounted on fixed plates 55 and 56 supported from the tone arm with layers of flexible packing 57 and 58 therebetween. The outer ends of the threaded stems 51 and 52 have curved balls 59 and 60 with which engage the ends 61 and 62 of arms 63 and 64 extending from a weighted plate 65 disposed beneath, but not in contact with the sound box 37. On the outer end of this weighted arm 65 is a casing 66 containing flexible packing 67 and a damper plate 68. This plate is connected by a link 69 to an arm 70 extending from the sound box.

Mounted on top of the tone arm is a cover 71 beneath which is a weighted arm 72 pivoted on the tone arm at 73 and connected to a flexible cable 74 passing over a pulley 75 on pedestals 76 mounted on a tone arm. The cable 74 passes through an aperture in the tone arm and is connected to a bar 77 about one-third the distance from one end thereof. This bar is connected by suitable links such as cords 78 and 79; cord 79 being connected to the center of the diaphragm 38 at the top, and the cord 78 connected to the sound box 37.

In the modification shown in Fig. 6, the needle arm 27 is supported on a conical ended pivot member 80 seated in adjustable bearings 81 and 82 disposed in a plate 83 mounted on the tone arm. The opposite end of this plate is provided with extending shafts 84 and 85 having grooves such as 86 therein to receive set screws such as 87 on ring-shaped collars 88 formed on the ends respectively of arms 47, 48, 63 and 64 above mentioned. These arms can rotate around the shafts, but will not have any lateral movement with respect thereto.

This type of construction and assembly will permit a free vertical movement of the sound box, its diaphragm and the needle arm, but any lateral movement therewith, will be prevented. Furthermore, by reason of the opposed weights connected to the sound box and needle arm unit on opposite sides of the main pivot, the assembly is in a state of delicate dynamic balance to be responsible in a maximum degree to the vibrations set up in the needle. By reason of the flexible cushion or packing disposed at the points above mentioned, these vibrations are not allowed to be transmitted to other parts of the mechanism, and consequently a maximum of volume is achieved and a pure tone results.

The effect of weight 72 is to pull up on the sound box, whereas the effect of weight 65 is to pull down on the sound box. These weights are so balanced that very little stress is set up in the packing 67. Similarly, the weight of the sound box on one side of the pivot member 39 is balanced by the effect of the weight 34 and the plate 28 on the needle 26. Consequently, the sound box and the needle are delicately supported, the sound box substantially floating with the tone arm.

I claim:

1. In a phonograph, a tone arm, a sound box pivotally supported therein out of contact therewith, a needle arm extending from the tone arm to contact with a record and connected to said sound box, and means for cushioning the support of said sound box and needle arm against vertical and lateral vibrations.

2. In a phonograph, a tone arm, a sound box pivotally supported therein out of contact therewith, a cushion for said pivot to dampen vertical and lateral vibrations, a needle arm extending in the opposite direction from said tone arm and connected to said sound box, and a weighted element connected to the sound box, a weighted element connected to the needle arm, and cushioning means between said weighted elements, the sound box and the needle arm.

3. In a phonograph, a tone arm, a sound box pivotally supported therein out of contact therewith, cushioning means for said pivot against vertical and lateral vibrations thereof, a weighted element connected to said sound box tending to exert an upward force thereon, a second weighted element connected to said sound box and tending to exert a downward force thereon, and cushioning means between the sound box and one of said weighted elements.

4. In a phonograph, a tone arm, a sound box pivotally supported therein out of contact therewith, cushioning means for said pivot against vertical and lateral vibrations thereof, a weighted element connected to said sound box tending to exert an upward force thereon, a second weighted element connected to said sound box and tending to exert

a downward force thereon, cushioning means between the sound box and one of said weighted elements, a needle arm extending from the sound box in the opposite direction from the pivot, said needle arm connected to the sound box, a weighted element associated with the needle arm, and cushioning means between the needle arm and said weighted element.

5. In a phonograph, a tone arm, a sound box pivotally supportd therein out of contact therewith, cushioning means for said pivot against vertical and lateral vibrations, a needle arm connected to the sound box and extending from the tone arm in the opposite direction from the pivot, and weighted elements connected to the sound box and the needle arm to maintain them in a state of sensitive dynamic balance.

6. In a phonograph, a tone arm, a sound box pivotally supported therein out of contact therewith, cushioning means for said pivot against vertical and lateral vibrations, a needle arm connected to the sound box and extending from the tone arm in the opposite direction from the pivot, weighted elements connected to the sound box and the needle arm to maintain them in a state of sensitive dynamic balance, and cushioning means disposed between said weighted elements, the sound box and the needle arm.

ROBERT S. WEIR.