Nov. 19, 1940. R. DALLY 2,222,552

TONE ARM

Original Filed June 27, 1938 2 Sheets-Sheet 1

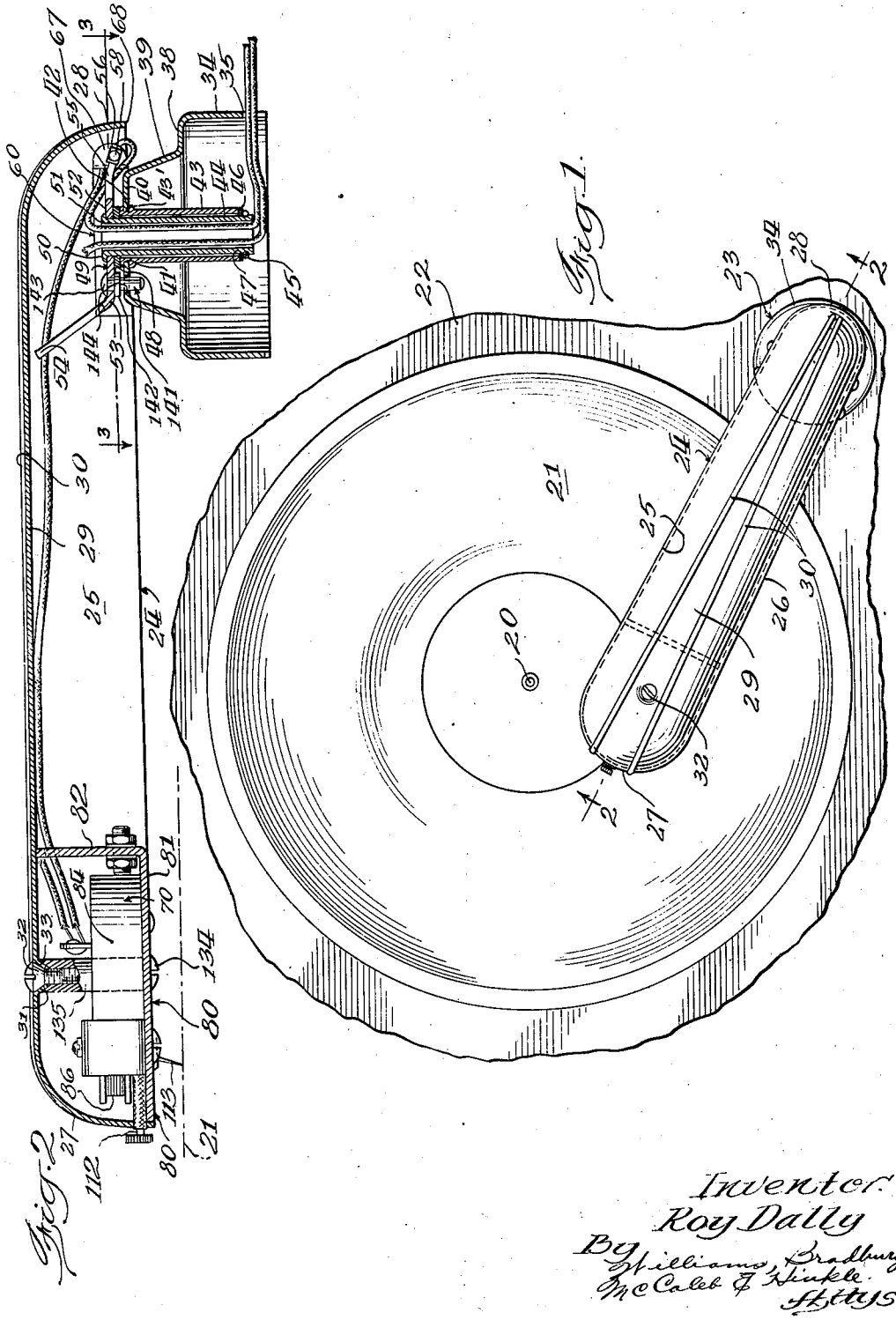


Fig. 1.

Fig. 2.

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Fig. 5.

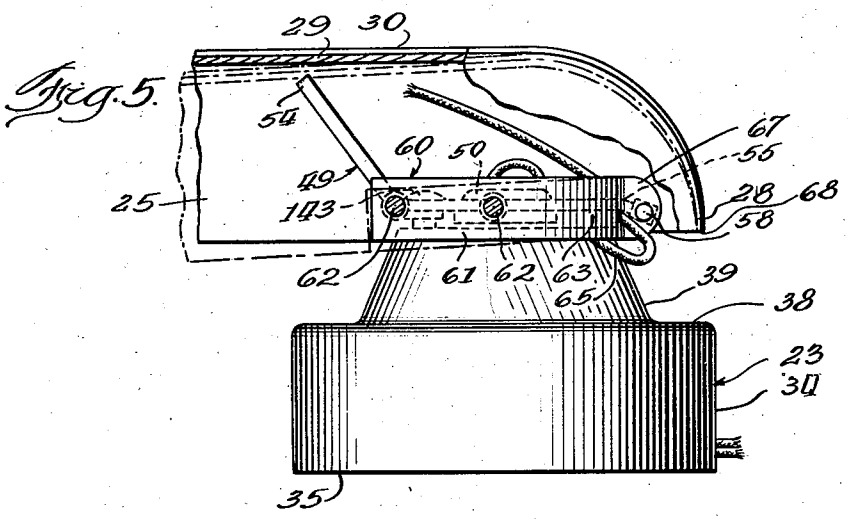


Fig. 3.

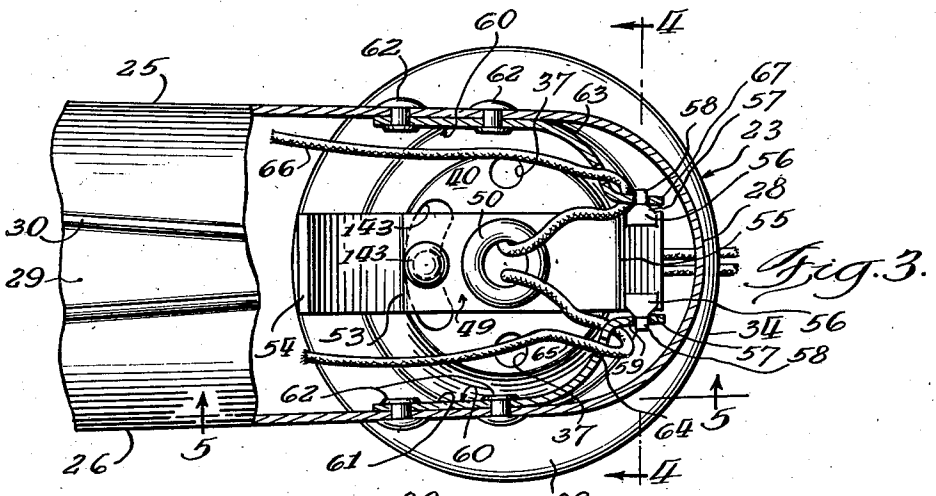
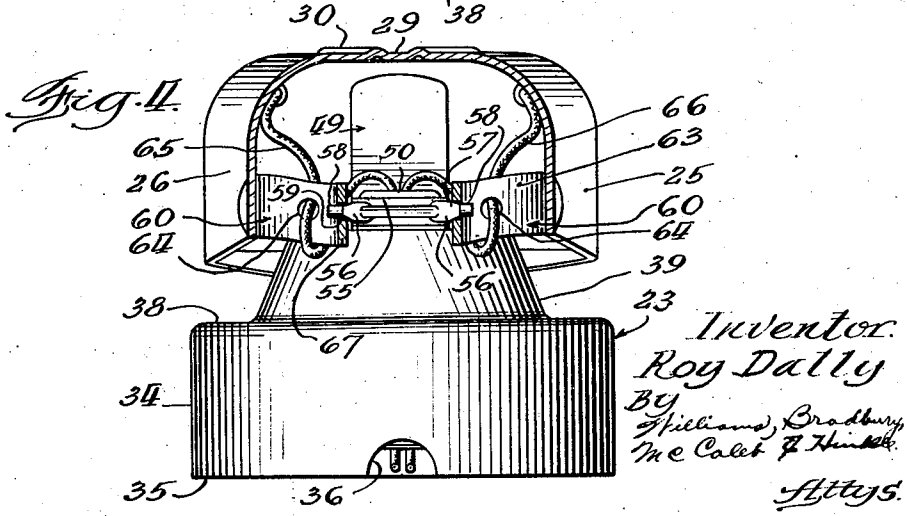


Fig. 4.



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2,222,552

UNITED STATES PATENT OFFICE

2,222,552

TONE ARM

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Original application June 27, 1938, Serial No. 216,027, now Patent No. 2,197,967, dated April 23, 1940. Divided and this application December 22, 1939, Serial No. 310,491

5 Claims. (Cl. 274—23)

The present invention relates to tone arms, and is particularly concerned with improved constructions of the tone arm and the supporting arrangements whereby the tone arm is secured to a fixed support for engagement with a record on a turntable.

One of the objects of the invention is the provision of an improved tone arm adapted to be used for sound reproduction apparatus of high fidelity, which is adapted to be used with conventional phonographs, and to give the best reproduction and minimum record wear, and to eliminate undesirable frequency responses.

Another object of the invention is the provision of an improved tone arm which is provided with stop means for preventing the arm and needle from striking the motor board.

Another object of the invention is the provision of an improved light tone arm structure, having a minimum amount of friction and inertia about a vertical axis, and adapted to facilitate high fidelity reproduction.

Another object of the invention is the provision of an improved tone arm pivotal support by means of which the tone arm may be so mounted that it can be lifted up, when installed on the phonograph, to such a position that the bottom of the pickup can be inspected and the needle can be most conveniently inserted.

Another object of the invention is the provision of an improved tone arm support having a resilient connection between the tone arm and the support so that the tone arm can be removed at any time by merely springing apart the bearing springs which are carried by one of these parts.

The present application is a division of my prior application, Serial No. 216,027, filed June 27, 1938, now Patent No. 2,197,967, granted April 23, 1940.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings:

Fig. 1 is a fragmentary top plan view of a phonograph showing the turntable and tone arm constructed according to the invention, when the tone arm is equipped with a magnetic pickup;

Fig. 2 is a full sized vertical sectional view through the tone arm and its support, taken along the plane of the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view, taken on the plane of the line 3—3 of Fig. 2, showing the structure of the bearings for the tone arm;

Fig. 4 is a fragmentary sectional view, taken on the plane of the line 4—4 of Fig. 3, looking in the direction of the arrows;

Fig. 5 is a fragmentary sectional view, taken on the plane of the line 5—5 of Fig. 3.

Referring to Fig. 1, 20 indicates the shaft for the turntable of an electric phonograph, preferably of the type that is driven by an electric motor and provided with an amplifier, whereby the signals which are picked up from the record 21 on the turntable may be suitably amplified and transmitted to a loud speaker.

The turntable is rotatably mounted on the support 22, which may also carry the base 23 of a tone arm 24. The tone arm is shown in full size in Fig. 2 and in vertical section. The tone arm is preferably formed of light metal, such as aluminum or an aluminum alloy, and by a stamping operation, by means of which the tone arm may be formed all in one piece of metal.

The tone arm comprises a relatively long and wide metal shell, having comparatively flat side walls 25, 26, cylindrical end walls 27 and 28, all of these walls being integrally joined to the top 29 by curved portions. The top is provided with a pair of integral pressed ribs 30, extending from one end to the other end, and diverging for the purpose of ornamentation and reinforcement.

The tone arm preferably tapers from the right to the left in Fig. 1, being smaller at the end which is pivotally supported on the base 23 and larger at the end which carries the pickup, so that the pickup may be disposed at a suitable angle to secure substantially perfect tracking.

The upper wall 29 of the tone arm is provided with an aperture 31 for receiving the screw bolt 32, which is adapted to secure the pickup in place. The aperture 31 may be provided with a pressed formation fitting the tapered lower side of the pressed formation 33.

The tone arm 24 is mounted upon the base 23 for pivotal movement in a horizontal plane and in a vertical plane, and the present construction is particularly adapted to save space and permit the movement of the tone arm to such a position that the lower side of the pickup can be inspected when the needle is being put in the pickup.

The base 23 may comprise a stamped metal member, preferably constructed of steel, and of substantially cup shape, having an open lower end formed by a cylindrical wall 34, the lower

edge 35 of which is all in the same plane, except for the groove 36, so that the edge 35 may engage the support 22 to which it is secured by a plurality of screws located in the apertures 37.

The cylindrical wall 34 is integrally joined to an annular radially extending flange 38, which is joined to a frusto-conical wall 39 having a flat top 40. The flat top 40 is provided with a centrally located aperture 41. The aperture 41 is adapted to receive the reduced cylindrical portion 42 of a steel tube 43, having an annular shoulder 43' engaging the lower side of the top 40.

The tube 43 is riveted over above the top 40 so that it is fixedly secured in the aperture 41 and adapted to serve as a bearing for the tone arm trunnion.

The tone arm trunnion may consist of a brass tube 44 adapted to be rotatably mounted in the steel tube 43, and the brass tube 44 is provided at its lower end with a spring washer 45 engaging the end of the bearing 43.

The spring washer 45 is in turn engaged by a split steel spring wire 46, which is engaged in a groove 47 located in the periphery of that portion of the brass tube 44 which projects beyond the end of the bearing 43. At its upper end the brass trunnion 44 is formed with an integral radially projecting flange 48, which is adapted to engage below the tone arm supporting member 49.

The extreme end of the trunnion 44 is riveted over as at 50 above the member 49, which comprises a galvanized steel strip of relatively stiff steel or iron, having an aperture 51. Thus the tone arm supporting member 49 is fixedly riveted to the trunnion 44, and the member 49 is adapted to be pivotally mounted for rotation on a vertical axis.

The radial flange 48 serves as a thrust bearing, engaging the upper end of the bearing 43, and the spring washer 45 serves as a lower thrust bearing, engaging the lower end of the bearing 43. The spring washer 45 is in turn engaged by the split steel wire ring 46, which springs into its groove 47 and holds the parts in assembled relation.

The tone arm supporting member 49 has a central flat body 52 which extends at right angles to the bearing 44, but its forward end is bent up diagonally at 53, so that the end 54 is located in close proximity to the lower side of the top 29 of the tone arm. As shown in Fig. 5, when the tone arm has no needle in it, and it pivots downwardly, the end 54 serves as a stop member for preventing the tone arm from actually engaging a record, the stopping position being shown in dotted lines in Fig. 5.

The opposite end of the tone arm supporting member 49 is bent downwardly slightly at 55 and, as shown in Fig. 3, has laterally projecting bearing lugs 56 oppositely located at each side of that end.

The bearing lugs 56 are suitably upset so that they are provided with substantially frusto-conical formations 57, terminating in cylindrical trunnions 58 adapted to be received in the apertures 59, which are formed in the bearing brackets 60.

The cylindrical trunnions 58 are a substantial fit in the apertures 59 of the bearing brackets, thereby assuring the bearing engagement between the brackets and the supporting member 49, but the bearing brackets 60 are resilient, and they press tightly and resiliently against the frusto-conical surfaces 57 so as to take up all rattling and play; and in the event of any wear on the bearings 59 or trunnions 58, this will be taken up by the resilient engagement of the bearing brackets with the frusto-conical surfaces 57. This action is better shown in an enlarged figure (Fig. 3), in which engagement of the frusto-conical surfaces with the bearing brackets is exaggerated purposely.

The bearing brackets 60 are identical in construction, but are oppositely disposed, and therefore only one need be described in detail.

Each bearing bracket may be constructed of a steel strip having a flat body 61, which flatly engages the inner wall 25 or 26, to which these bodies are riveted by rivets 62. The bearing strips are curved inwardly at 63, and the offset or shoulder is provided with an aperture 64, which serves to support the insulated conductors 65, 66, which connect the pickup in the circuit.

The bearing brackets are also provided with the two parallel end portions 67, which have the apertures 59, and serve as bearings.

By virtue of the length and resiliency of these bearing brackets, the parallel end portions 67 press tightly against the frusto-conical part 57 on the tone arm supporting member 49. Thus the tone arm is supported for pivotal movement on a horizontal axis, which is the axis of the trunnions 58.

The resilient arms or bearing brackets 63 may also be pressed apart to clear the ends of the trunnions 58 so that the tone arm may be detached from its supporting base.

The rearwardly extending portion 55 of the tone arm supporting member 49 carries the pivotal points 58 back sufficiently beyond the base 34 so that the end wall 28 does not engage the base 23 until the tone arm is pivoted upward to such a position that it is practically vertically disposed. The relation of parts may be such that the tone arm may be lifted to a position slightly past the vertical so that the lower edge at the point 68 may serve as a stop surface engaging the frusto-conical flange 39 to hold the tone arm past its dead center in substantially vertical position.

In this position the pickup may be inspected and the needle may be very conveniently inserted, since the aperture for the needle is readily visible. It is not necessary to try to find the aperture merely by feeling around, as in many of the devices of the prior art, which are so constructed that the tone arm cannot be lifted to a point where the needle aperture is visible. The base and tone arm are so arranged that suitable provision is made for the conductors, 65, 66, which may pass in through to the slot 36, up through the bearing tube 44, through the apertures 64, and along the inside of the tone arm to the pickup unit 70.

In order to provide stop means for limiting the rotation or movement of the tone arm 24 about a vertical axis, the tone arm supporting member 49 is provided with a depending pin 141, which is riveted to the member 49 by means of an integral annular flange 142 and a head 143. The pin 141 projects through an arcuate slot 144 in the top wall 40 of the base 23, the slot being better shown in Fig. 3. Thus the engagement of the pin 141 with the ends of the slot 144 determines the amount of movement of the tone arm. This prevents the tone arm from moving over far enough to hit the turntable shaft 20 or so far in the opposite direction that

it may swing beyond the top limits of the cabinet.

The present tone arm may be equipped with a pickup of the crystal type, as disclosed in said prior application, the crystal pickup unit being arranged at a suitable angle so as to secure approximately perfect tracking; or it may be equipped with a pickup 70 of the magnetic type, as shown by way of example in Fig. 2.

The pickup in either case is housed inside the tone arm by means of a sheet metal member 80, which encloses the bottom of the tone arm, and is flush with the lower edges of its side walls and an upwardly extending flange 82, which encloses the end of the pickup chamber. Each pickup has a suitable needle chuck for supporting the needle 113, which is held by a needle screw 112. The pickup unit is secured in place by being fastened to the plate 80, which in turn is secured to a spacer 135, which is fastened to the plate 80 by the screw bolt 134, and to the tone arm by the screw bolt 32.

The magnet of the magnetic pickup is indicated at 84, and the coils at 86.

The operation of the present tone arm and its support will be apparent from the foregoing description of its parts. When there is a needle in the chuck and the tone arm is disposed at one side of the turntable and record, the stop may prevent the needle from engaging the top of the phonograph housing.

The tone arms permit lifting of the pickup end to such a height that the needle aperture is clearly visible and so that the needle may be very easily inserted, thereby saving much time and trouble in the insertion of needles. The pickup unit and tone arm may be made very light so as to reduce the vertical inertia and thereby reduce the wear on records due to the weight placed on the needle in the devices of the prior art.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a tone arm supporting structure, the combination of a cup-shaped base member having a substantially flat upper end provided with a centrally located aperture, said aperture having a tubular member secured therein and extending downwardly into the cup, a tone arm supporting member having a tubular bearing member adapted to be rotatably mounted in said first-mentioned tubular member, said tubular bearing member having a transversely extending bracket secured to its upper end and having a thrust bearing carried by its lower end, said bracket being provided with a laterally projecting arm having a pair of transversely extending trunnions, and a tone arm having a pair of resiliently mounted bearing brackets, each bracket having a bearing aperture for engaging one of said trunnions, said bearing brackets having their ends manually movable so that they may be spread to remove the tone arm from its support.

2. In a tone arm supporting structure, the combination of a cup-shaped base member having a substantially flat upper end provided with a centrally located aperture, said aperture having a tubular member secured therein and extending downwardly into the cup, a tone arm supporting member having a tubular bearing member adapted to be rotatably mounted in said first-mentioned tubular member, said tubular bearing member having a transversely extending bracket secured to its upper end and having a thrust bearing carried by its lower end, said bracket being provided with a laterally projecting arm having a pair of transversely extending trunnions, and a tone arm having a pair of resiliently mounted bearing brackets, each bracket having a bearing aperture for engaging one of said trunnions, said bearings being located adjacent one end of said tone arm in relation to said cup-shaped supporting member so that the end of the tone arm may act as a stop surface for engaging said cup-shaped member to hold the tone arm in predetermined position.

3. In a tone arm supporting structure, the combination of a cup-shaped base member having a substantially flat upper end provided with a centrally located aperture, said aperture having a tubular member secured therein and extending downwardly into the cup, a tone arm supporting member having a tubular bearing member adapted to be rotatably mounted in said first-mentioned tubular member, said tubular bearing member having a transversely extending bracket secured to its upper end and having a thrust bearing carried by its lower end, said bracket being provided with a laterally projecting arm having a pair of transversely extending trunnions, and a tone arm having a pair of resiliently mounted bearing brackets, each bracket having a bearing aperture for engaging one of said trunnions, said laterally extending arm locating said trunnions laterally of the top of said cup-shaped member whereby the tone arm may be lifted to make its lower side visible for convenient insertion of a needle.

4. In a tone arm, the combination of a cup-shaped base member having a substantially flat upper end provided with a centrally located aperture, with a tubular member secured in said aperture and extending downwardly into said cup, a tone arm supporting shaft comprising a tubular metal member adapted to be rotatably supported in said first-mentioned tubular member, said shaft having a transversely extending bracket secured to its upper end and having a thrust bearing at its lower end, said bracket having a forwardly extending arm acting as a stop for supporting the tone arm, and having an upwardly turned end, and said bracket having a rearwardly extending arm provided with a pair of laterally extending trunnions and a tone arm comprising a channeled member, said channeled member being mounted with its open end downward and having at one end a pair of rearwardly extending bearing brackets of resilient metal, said bearing brackets being secured longitudinally of said tone arm and having inwardly bent and oppositely disposed portions provided with apertures forming bearings for said trunnions located adjacent the rear wall of said tone arm.

5. In a tone arm, the combination of a cup-shaped base member having a substantially flat upper end provided with a centrally located aperture, with a tubular member secured in said aperture and extending downwardly into said cup, a tone arm supporting shaft comprising a tubular metal member adapted to be rotatably

supported in said first-mentioned tubular member, said shaft having a transversely extending bracket secured to its upper end and having a thrust bearing at its lower end, said bracket having a forwardly extending arm acting as a stop for supporting the tone arm, and having an upwardly turned end, and said bracket having a rearwardly extending arm provided with a pair of laterally extending trunnions and a tone arm comprising a channeled member, said channeled member being mounted with its open end downward and having at one end a pair of rearwardly extending bearing brackets of resilient metal, said bearing brackets being secured longitudinally of said tone arm and having inwardly bent and oppositely disposed portions provided with apertures forming bearings for said trunnions located adjacent the rear wall of said tone arm, said trunnions being provided with cylindrical portions for engagement in said apertures of said bearing brackets, and with frusto-conical portions engaging the inner surfaces of said bearing brackets, and adapted to take up wear without rattling.

ROY DALLY.