Nov. 2, 1965 J. F. WOOD 3,215,440

PHONOGRAPH CARTRIDGE

Filed Feb. 15, 1962 3 Sheets-Sheet 1

FIG. 1.

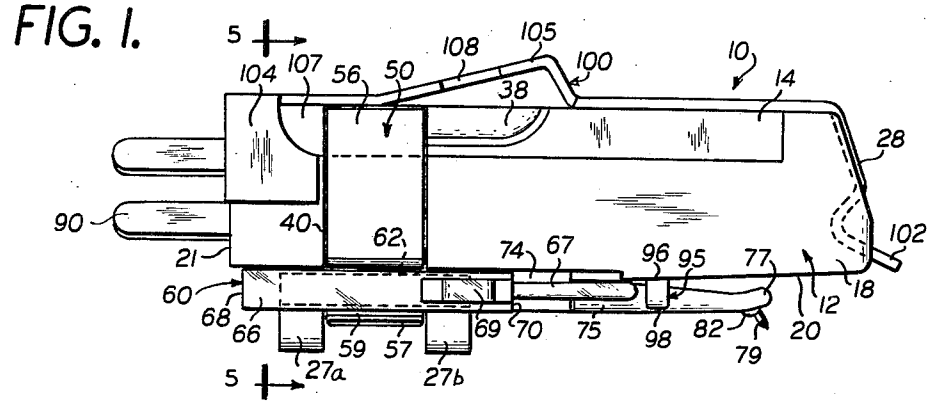


FIG. 2.

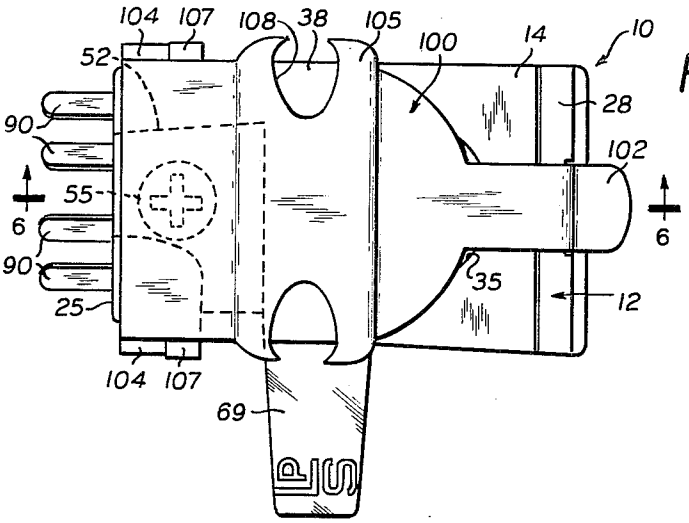
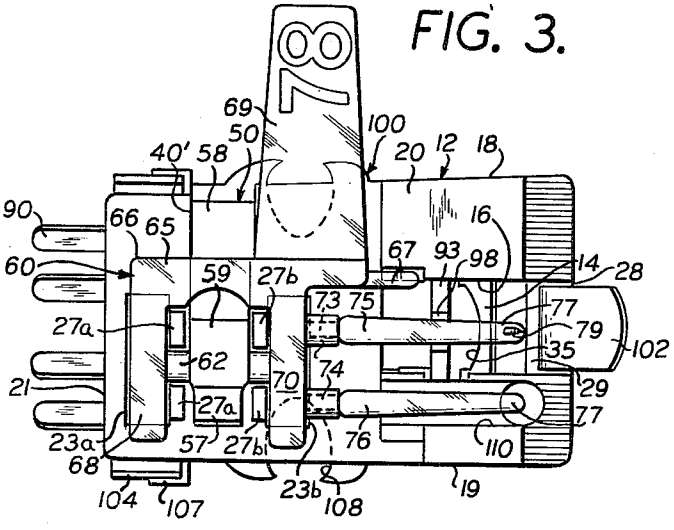


FIG. 3.



INVENTOR
JOHN F. WOOD

BY J. B. Burke

ATTORNEY.

Nov. 2, 1965 J. F. WOOD 3,215,440

PHONOGRAPH CARTRIDGE

Filed Feb. 15, 1962 3 Sheets-Sheet 2

FIG. 4.

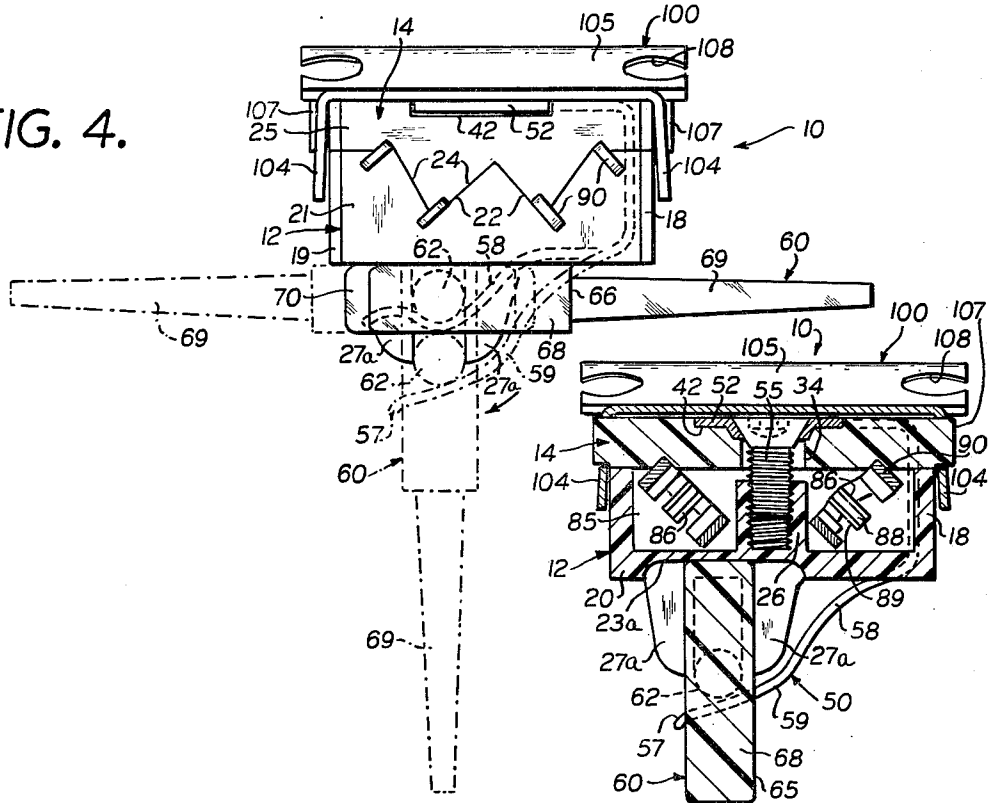
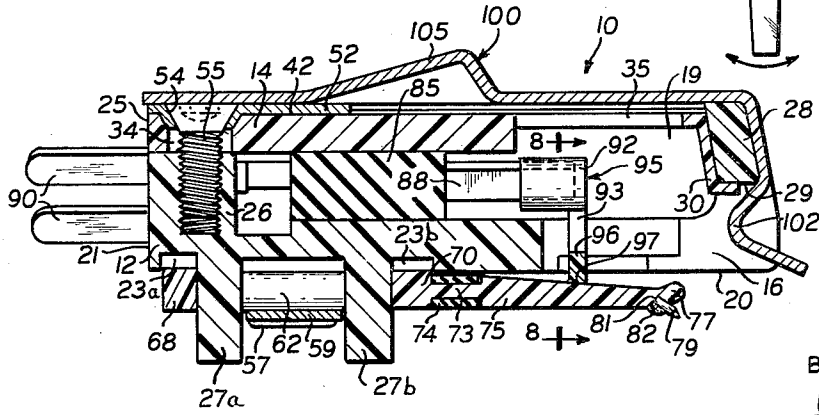


FIG. 5.

FIG. 6.



INVENTOR
JOHN F. WOOD
BY
J. B. Burke
ATTORNEY.

Nov. 2, 1965 J. F. WOOD 3,215,440

PHONOGRAPH CARTRIDGE

Filed Feb. 15, 1962 3 Sheets-Sheet 3

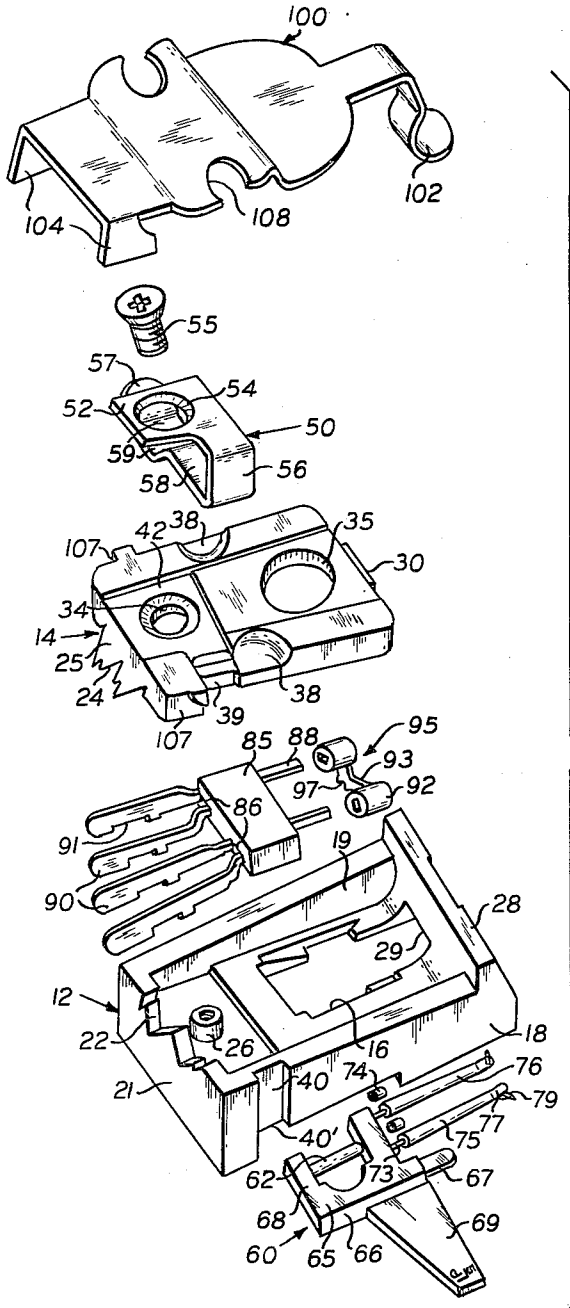


FIG. 7.

FIG. 8.

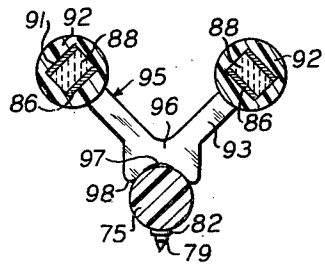
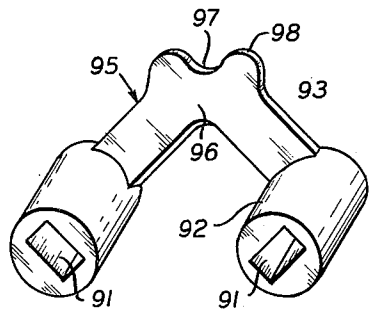


FIG. 9.



INVENTOR
JOHN F. WOOD
BY
J. B. Burke
ATTORNEY.

United States Patent Office 3,215,440 Patented Nov. 2, 1965

3,215,440

PHONOGRAPH CARTRIDGE

John F. Wood, San Juan, Puerto Rico, assignor to Euphonics Corporation, Rio Piedras, Puerto Rico, a corporation of Puerto Rico

Filed Feb. 15, 1962, Ser. No. 173,512
11 Claims. (Cl. 274—36)

This invention relates to the art of phonograph cartridges and particularly concerns an improved phonograph cartridge of the turnover type employing dual needles especially adapted for playing both monaural and binaural or stereophonic records, rotated at 33⅓, 45 or 78 revolutions per minute.

Phonograph cartridges of the type mentioned above have been known heretofore. A general characteristic of the prior turnover cartridges has been their relatively high cost of manufacture. Some prior cartridges have had rather complex structures making needle replacement difficult and often precluding changing of piezoelectric elements. Some prior cartridges have required internal wiring and soldering of connections.

The present invention has as a principal object provision of a turnover phonograph cartridge characterized by a simplified structure, which effects economies in manufacture and replacement of parts.

A further object is to provide a turnover phonograph cartridge employing a novel one-piece dual needle structure.

Another object is to provide a turnover phonograph cartridge having novel needle support and needle turning arrangement.

A further object is to provide a turnover phonograph cartridge in which an entire unitary assembly of needles is readily inserted in and removed from the cartridge without use of tools and without disassembling the cartridge.

A still further object is to provide a turnover phonograph cartridge in which a unitary assembly of needles is turnable about an axis disposed between the needles while the axis of rotation is translatable between guide elements depending from the cartridge.

Other objects are to provide a turnover type cartridge with a novel casing structure, casing support and needle holder, all contributing to a simplified economical assembly having improved electro-acoustic performance characteristics.

The invention will be best understood from the following detailed description taken together with the drawing, wherein:

FIG. 1 is a side elevational view of an assembled phonograph cartridge embodying the invention, shown on a magnified scale, with a needle turning handle shown in one stabilized position.

FIG. 2 is a top plan view of the assembled cartridge.

FIG. 3 is a bottom plan view of the cartridge.

FIG. 4 is a rear end elevational view of the cartridge.

FIG. 5 is a cross sectional view of the cartridge, with the needle turning handle shown in an intermediate position between two stabilized positions.

FIG. 6 is a central sectional view taken on line 6—6 of FIG. 2.

FIG. 7 is an exploded perspective view of parts of the cartridge.

FIG. 8 is a sectional view on a greatly enlarged scale through needle, piezoelectric elements and mechanical coupling member.

FIG. 9 is a perspective view on a greatly enlarged scale of the coupling member per se.

Referring to the drawing, there is shown in FIGS. 1–6, the assembled cartridge indicated by numeral **10**. The several parts of the cartridge are shown in FIG. 7. The cartridge **10** includes a case having a base **12** and cover **14**. The base and cover are both generally rectangular as viewed in plan with a slight taper from wider front end to narrower rear end. The base **12** has a generally rectangular opening **16** formed in the bottom **20** near its front end. The base has upstanding lateral side walls **18, 19**. The rear end wall **21** of the base is formed with notches **22** which interfit with corresponding notches **24** formed in the bottom edge of rear end wall **25** of the cover **14**. An internally threaded cylindrical boss **26** is located just inside the rear end wall **21** and is located centrally between lateral walls **18, 19**. The base has an upstanding front end wall **28**. The opening **16** extends through the front end wall **28** so that wall **28** has a lower exposed edge **29**. Spaced pairs of projections **27***a*, **27***b* are formed at the bottom of the base. Adjacent to the projections are grooves **23***a*, **23***b*.

The cover **14** is formed with depending foot **30** at its front end **32**. This foot engages underneath the lower edge **29** of wall **28** as best shown in FIG. 6, to stabilize the base on the cover. In addition the front end of the cover abuts the rear side of wall **28**, and the notches **24** at the rear end interfit with notches **22** in the rear wall **25** of the base. A countersunk hole **34** is formed at the rear end of the cover in registration with the threaded hole in boss **26**. A large round hole **35** is formed in the cover near its front end. Recesses **38** are formed in the lateral edges of the cover. A lateral recess **39** is formed in one side of the cover near its rear end. Another recess **40** is continued around to the bottom of the base and extends part way across the bottom of the base as shown at **40'** in FIG. 3. A rather large generally trapezoidal recess **42** is formed in the top of the cover. This recess communicates with recesses **39** and **40**.

A generally U-shaped spring **50** is provided as a spring biasing member for the dual needle structure and also serves as a closure for the case. The spring **50** has an upper generally trapezoidal plate **52** which fits into recess **42**. The plate has a countersunk hole **54** which fits into a countersunk cover portion at hole **34** and receives the head of screw **55**. The threaded shank of the screw passes through hole **34** and is secured in the threaded boss **26** to lock the base and cover together. The spring **50** has a bight portion **56** which fits into aligned recesses **39, 40**. The spring has a free arm **58** which terminates in an outwardly bent portion **59** and a free tip **57**. Arm **58** fits into recess **40'** at the underside of the base. The bent portion **59** underlaps crossbar **62** of the needle structure **60**.

The dual needle structure **60** is shown to best advantage in FIGS. 3 and 7. The needle structure **60** includes a rectangular U-shaped frame **65**. The frame is flat and has a straight bight **66** and two straight arms **68, 70**. The rear arm **68** is slightly shorter than the forward arm **70**. Crossbar **62** extends across the frame **65** between arms **68, 70** parallel to bight **66**. The needle structure includes an operating or turning handle **69** which extends outwardly from the bight in the plane of the frame **65**. A finger **67** extends forwardly from the frame in alignment with the bight **66** and parallel to crossbar **62**. The needle structure has two axially parallel tapered needles **75, 76**. The needles are axially spaced equally from the axis of crossbar **62** and extend parallel thereto in the plane of the frame **65**. The needles are attached to the forward edge of arm **70** by short cylindrical necks **73** of lesser diameter than the needles themselves. This neck structure imparts greater compliance or flexibility to the needles. Resilient, cylindrical collars **74** encircle the necks **73**. The collars serve to provide restoring and axial centering forces for the needles upon lateral deflection. The collars also serve to prevent or dampen vibrations of the needles due to mechanical resonance. The needles

terminate in tips 77 which are bent at obtuse angles to the axes of the needles in opposite directions. Styluses 79 are secured by cement 82 in recesses 81 in the tips 77.

The crossbar 62 extends longitudinally of the cartridge while the arms 68, 70 extend transversely thereof in stabilized positions of the needle structure. The crossbar normally seats on opposite ends between rear projections 27*a* and forward projections 27*b* depending from the bottom of the base. The arms 68, 70 overlay grooves 23*a*, 23*b* formed in the bottom of the base. Groove 23*a* is located just to the rear of the pair of projections 27*a*, while groove 23*b* is located just forward of the pair of projections 27*b*. The grooves 23*a*, 23*b* extend transversely of the underside of the base and both grooves have rounded or curved inner sides.

Between the side walls 18, 19 and on the bottom of the base is a rectangular resilient block 85. This block fits snugly in the cavity defined by the side walls and bottom of the base. In this block are two spaced rectangular holes 86 oriented 90° to each other and at angles of 45° to the side walls 18, 19. A pair of elongated ceramic piezoelectric elements 88 are inserted in the respective holes. These ceramic elements have metal electrodes 89 at opposite sides; see FIG. 5. A pair of metal contacts 90 is provided for each of elements 88. The pairs of contacts are tightly juxtaposed to the electrodes at the opposite sides of elements 88 in holes 86. The contacts have notches 91 which interfit with mating notches 22, 24 in the base and cover. The rear free ends of the contacts 90 extend rearwardly of the assembled cartridge for attachment of suitable circuit leads thereto.

The piezoelectric elements 88 extend forwardly of block 85. On the free ends of the elements 88 are engaged cylindrical nipples 92 formed at the end of a generally V-shaped mechanical coupling member or yoke 95; see FIGS. 6–9. The nipples have rectangular holes 91 axially oriented 90° apart. The apex 96 of the coupling member is formed with a notch 97 between rounded tips 98 at the apical end of member 95. The needle 75 or 76 fits into the notch 97 in operating position of the needle.

In order to mount the cartridge at the underside of a phonograph pickup arm, there is provided a spring bracket plate 100. This bracket has a forwardly extending bent tongue 102 which fits under edge 29 of wall 28. At the rear end of the bracket are two depending lateral wings 104 which engage under lateral projections 107 formed at the sides of the cover at the rear thereof. The bracket includes an upwardly inclined plate portion 105 provided with notches 108 for engaging heads of screws which will attach the bracket to the pickup arm. The recesses 38 formed in the cover of the cartridge are under notches 108 and will receive the heads of the mounting screws.

When the bracket 100 is secured to the underside of a pickup arm (not shown) the cartridge can be readily attached to the bracket by engaging the wings 104 under projections 107 and then snapping the tongue underneath the edge 29 of wall 28 of the base.

To assemble the several parts shown in FIG. 7, the assembly of block 85, elements 88 and contacts 90 will be inserted into the cavity provided therefor in the base with the contacts extending out of notches 22 and with elements 88 extending over the rectangular opening 16. The V-shaped coupling member can be mounted on the elements 88 prior to insertion into the base by engagement of nipples 92 on the free ends of the elements 88. The apex 96 of the coupling member will extend downwardly since the coupling member assumes an upright V-position in normal operation. Then the cover 14 will be placed on the base with hole 34 aligned with boss 26. Then spring 50 will be engaged around the base and cover with arm 58 extending between the projections 27*a*, 27*b*. The screw 55 may now be inserted through hole 54 in plate 52 and screwed into boss 26 to hold the base and cover together. Now the needle structure 60 can be inserted by manually holding handle 69 and pushing frame 65 laterally past the bent tip 57 of arm 58 while arm 58 deflects downwardly until the crossbar 62 engages in the bent arm portion 59 and snaps into place between projections 27*a*, 27*b*. It will be noted that the needles 75, 76 extend longitudinally of the cartridge. One needle (needle 75 in FIG. 3) will be centrally located with the stylus 79 in tip 77 extending forwardly and downwardly. The needle will fit into notch 97 in the apex 96 of coupling member 95. The notch 97 opens downwardly during operation and is held in the notch by pressure exerted between the phonograph record being played and the tone arm of the pickup to which the cartridge will be attached.

The other needle (needle 76 in FIG. 3) will be horizontally disposed and nested in a longitudinal groove 110 formed in the underside of the bottom 20 of the base near wall 19. The tip 77 of the other needle will be upwardly inclined with respect to groove 110 and the stylus carried by the tip will extend upwardly toward the inner side of the groove. In this position, the unused needle will be protected and out of the way while the stylus of the active needle engaged with the coupling member will be exposed to engage in the groove of the record being played.

Handle 69 is marked at opposite sides with indicia "78" and "LP–S." When the "78" is uppermost the needle structure is positioned for tracking records rotated at seventy-eight revolutions per minutes. When "LP–S" is uppermost the needle structure is positioned to track records rotated at slower speeds of 16, 33⅓ and 45 revolutions per minute. The needle in the active position is then also positioned to play records having binaurally or stereophonically cut grooves.

FIGS. 4 and 5 illustrate the novel turnover arrangement of the needle structure. The crossbar 62 moves vertically downward between the projections 27*a*, 27*b* as guide members while the handle is turned in an arc through a vertical plane from one horizontal position to the other. In the vertical intermediate position of the handle shown in FIG. 5, the free ends of arms 68, 70 are engaged in and are moving along the curved inner sides of grooves 23*a*, 23*b*. The arm 58 of spring 50 is biased outwardly pressing the underside of the crossbar. As the handle is raised to horizontal position the arm 58 rises to force the crossbar 62 to its most elevated position between the projections 27*a*, 27*b* while the ends of arms 68, 70 ride up out of grooves 23*a*, 23*b* and assume horizontal positions overlying the grooves. When the handle is initially moved downward to turn the needle structure, the active needle is moved directly vertically downward to disengage the needle from the downwardly directed notch 96 and apical tips 98 of the coupling member. Then as the needle clears the tips 98 the active needle turns downwardly away from the coupling member while the previously inactive needle is lifted out of groove 110 and moves laterally to a central position under notch 97. Then as the handle assumes a horizontal position the frame does likewise and the previously inactive needle engages the coupling member 95 in active playing position. The needle structure does not rotate on a fixed axis. Instead both needles are laterally offset from the axis of crossbar 62 and the axis of the crossbar is translatable vertically or down and up with respect to base 12 while the needles rotate around the vertically moving crossbar to change places between active and inactive positions.

The finger 67 of the frame serves to protect the needle 75 from damaging deflection if the operator's fingers gripping handle 69 should slip while turning the needle structure 60. Finger 67 also serves to stabilize the frame against rotation in its plane when in both horizontal positions of the needle structure, to supplement the stabilizing function of spring 50.

It should be noted that the needle structure 60, exclusive of the styluses, has a one-piece construction. The

structure is preferably molded of nylon or other tough, light plastic material. Both needles of the needle structure are integrally molded with the frame and handle. Thus when it is desired to change needles for replacement purposes, both needles are removed at once simultaneously. Disengagement of the needle structure is easily accomplished by manually grasping handle **69** and pulling the frame downwardly to clear crossbar **62** from projections **27***a*, **27***b* while spring arm **58** bends downwardly, and then by pulling the frame laterally to disengage the frame **65** from spring arm **58**. The frame snaps out of engagement with the deflected spring arm. Replacement of the needle structure is just as readily accomplished. The frame **54** is pushed laterally past the bent tip **57** on the end of arm **58** and the crossbar **62** slips into the concave part of bent portion **59**. The arm **58** deflects downwardly while the needle structure is pushed laterally and the needle structure snaps into place as the arm **58** engages under cross bar **62**.

The coupling member or yoke **95** is also molded of tough, light plastic material such as nylon. During turnover of the needle structure and during insertion of the needle structure into the cartridge, the needle engaging the coupling member slides over the rounded tips **98** and funnels into the wide V-shaped notch **96**. The needle also slides over the rounded tips of the coupling member as the needle is lifted out during turnover and also during removal of the needle structure from the cartridge.

The cartridge described above is readily assembled and disassembled. It is made of simple parts easily and economically fabricated by known mass production metal and plastic working machinery. It provides improved electro-acoustic performance characteristics. The turnover of the needle structure is more easily accomplished than in prior cartridges where the case turns with the needle. Here only the needle structure turns. The needle structure is not attached to other parts of the cartridge but is only held slidably and rotatably thereon by spring tension so that the needle structure is easily slipped in and out of the cartridge.

While only a single embodiment of the invention has been described, it will be understood that this has been done only by way of example and that the described structure is subject to many modifications without departing from the scope of the invention as defined in the appended claims. The invention is to be construed as coextensive with the broadest of the following claims, and with each of the claims.

What is claimed and sought to be protected by Letters Patent of the United States is:

1. In a phonograph cartridge, including a casing, a pair of piezoelectric elements mounted in said casing, said elements having elongated bodies, means engaging one end of each element and supporting the elements in spaced parallel relationship, and a generally V-shaped coupling member having a pair of legs engaged at ends thereof with other ends of said elements; a needle structure comprising a frame rotatable 180° on an axis parallel to said casing between two stabilized positions on the casing, said frame having two needles integral therewith, a different one of said needles engaging the apical end of said coupling member in each of said positions of said frame.

2. As an article of manufacture, a needle structure for a phonograph cartridge having a casing with spaced pairs of projections at one side thereof, piezoelectric elements in the casing, spring means for holding said structure on the casing and coupling means on said elements for applying driving forces thereto, said needle structure comprising a flat rectangular U-shaped frame having two straight parallel arms and a bight perpendicular to and joining the arms in the plane of the frame, a crossbar extending parallel to said bight and joined at opposite ends to said arms for engaging rotatably and slidably between said projections on the casing and between said spring means and said one side of the casing so that the frame normally abuts the casing, a handle extending outwardly from said bight in the plane of the frame for turning the frame to two different positions on the casing while being retained by said spring means, and two axially parallel needle elements joined at one end thereof with one of said arms and extending outwardly therefrom in the plane of said frame for alternately engaging said coupling means in said two positions respectively of the frame.

3. A needle structure according to claim **2**, further comprising a stylus carried at the free other end of each needle element, the styluses on the respective needle elements pointing in opposite directions with respect to the plane of the frame, so that a different one of the styluses extends outwardly of the casing and is exposed for tracking grooves in a phonograph record in each of said two positions of the frame on the casing.

4. A needle structure according to claim **2**, wherein each of said needle elements has a neck of reduced diameter to increase compliance of the needle elements, and a resilient collar on the neck of each needle element to provide a restoring and centering force for each needle element upon lateral deflection thereof.

5. A needle structure according to claim **2**, further comprising a stylus carried at the free other end of each needle element, the styluses on the respective needle elements pointing in opposite directions with respect to the plane of the frame, so that a different one of the styluses extends outwardly of the casing and is exposed for tracking grooves in a phonograph record in each of said two positions of the frame on the casing, each of the needle elements having a neck of reduced diameter, and a resilient collar on the neck of each needle element to provide restoring and axial centering forces for each needle element upon lateral deflection thereof and to prevent mechanical resonant vibrations of each needle element.

6. A needle structure according to claim **2**, wherein each of said needle elements has a neck of reduced diameter to increase compliance of the needle elements.

7. A needle structure according to claim **2**, further comprising a stylus carried at the free end of each needle element, the styluses on the respective needles pointing in opposite direction with respect to the plane of the frame, and resilient means at the one end of the needles to provide restoring and axial centering forces for each needle element upon lateral deflection thereof and to prevent mechanical resonant vibrations of each needle element.

8. A needle structure according to claim **2**, further comprising resilient means at the one end of the needles to provide restoring and axial centering forces for each needle element upon lateral deflection thereof and to prevent mechanical resonant vibrations of each needle element.

9. In a phonograph cartridge including a casing having a separable base and cover for supporting a needle carrying structure, means for rotatably mounting said needle carrying structure on the base, comprising a generally U-shaped spring member having two arms joined by a bight and embracing the base and cover respectively, means for removably securing one of said arms to the base and for securing the base and cover detachably together, the other one of said arms being flexible and shaped to engage said needle carrying structure and bias the same rotatably on said base, said other arm having a free end to permit the needle structure to be snapped off and on the base while the spring member remains on the base and cover.

10. In a phonograph cartridge including a casing for rotatably supporting a needle carrying frame structure with a crossbar extending across said frame structure, means for mounting said frame structure rotatably on the casing, comprising a generally U-shaped spring member having two arms embracing opposite sides of said casing, spaced pairs of projections extending outwardly of one side of the casing for receiving said crossbar between the projections and for guiding movements thereof during rotation of said frame structure, said one side of the casing

having grooves adjacent to said projections for underlying portions of said frame structure for guiding movement of said frame structure during rotation thereof on the casing while said crossbar slides and rotates between said projections, one arm of said spring member being flexible to engage said crossbar and bias said frame structure toward the casing, said one arm of the spring member having a free end to permit the needle structure to be placed on the casing in a single lateral movement thereof in one direction and to be removed from the casing in a single lateral movement thereof in an opposite direction while said one arm of the spring member flexes to permit the lateral and rotational movements of said frame structure.

11. In a phonograph cartridge including a casing for rotatably supporting a needle carrying frame structure with a crossbar extending across said frame structure, means for mounting said frame structure rotatably on the casing, comprising a spring member having two arms embracing opposite sides of said casing, spaced pairs of projections extending outwardly of one side of the casing for receiving said crossbar and for guiding movements thereof during rotation of said frame structure through 180° on the casing, one of said arms being flexible to engage said crossbar and to bias said frame structure toward the casing, said one arm having a free end to permit said needle carrying frame structure to be placed on the casing in a single lateral movement thereof in one direction and to be removed from the casing in a single lateral movement thereof in an opposite direction while said one arm of the spring member flexes to permit rotational movement of said frame structure and lateral movements of said frame structure.

References Cited by the Examiner

UNITED STATES PATENTS

2,849,239	8/58	Dieter et al.	274—37
2,881,005	4/59	Michalko et al.	274—37
2,939,716	6/60	Bauer et al.	274—37
3,146,319	8/64	Stanton	274—37

FOREIGN PATENTS

231,831	1/61	Australia.

NORTON ANSHER, *Primary Examiner.*

BERNARD KONICK, *Examiner.*