

Feb. 17, 1942.

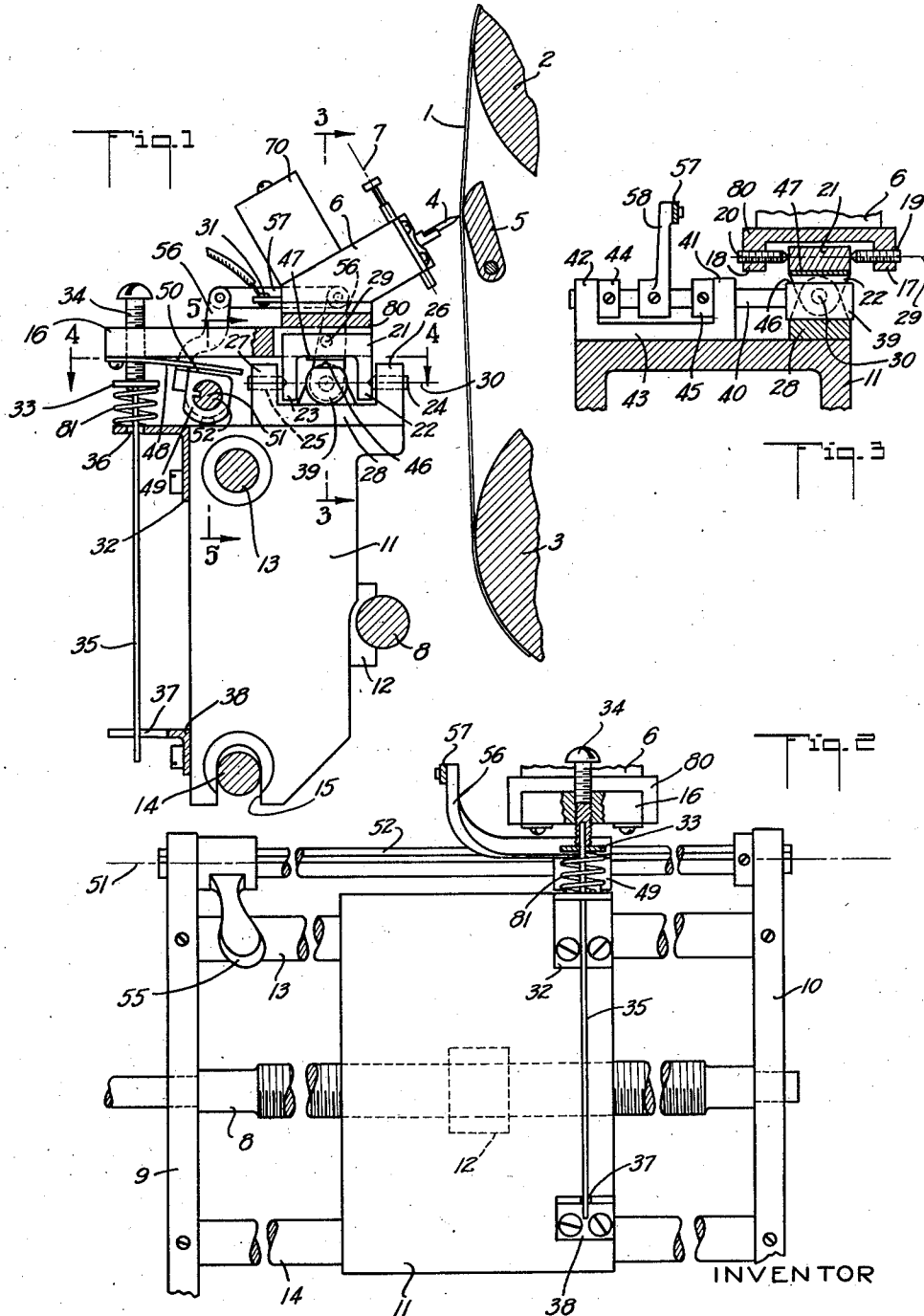
S. YERKOVICH

2,273,391

APPARATUS FOR REPRODUCING AND RECORDING SOUND

Filed June 19, 1939

2 Sheets-Sheet 1



INVENTOR

Simon Yerkovich
BY John Flam
ATTORNEY

Feb. 17, 1942.

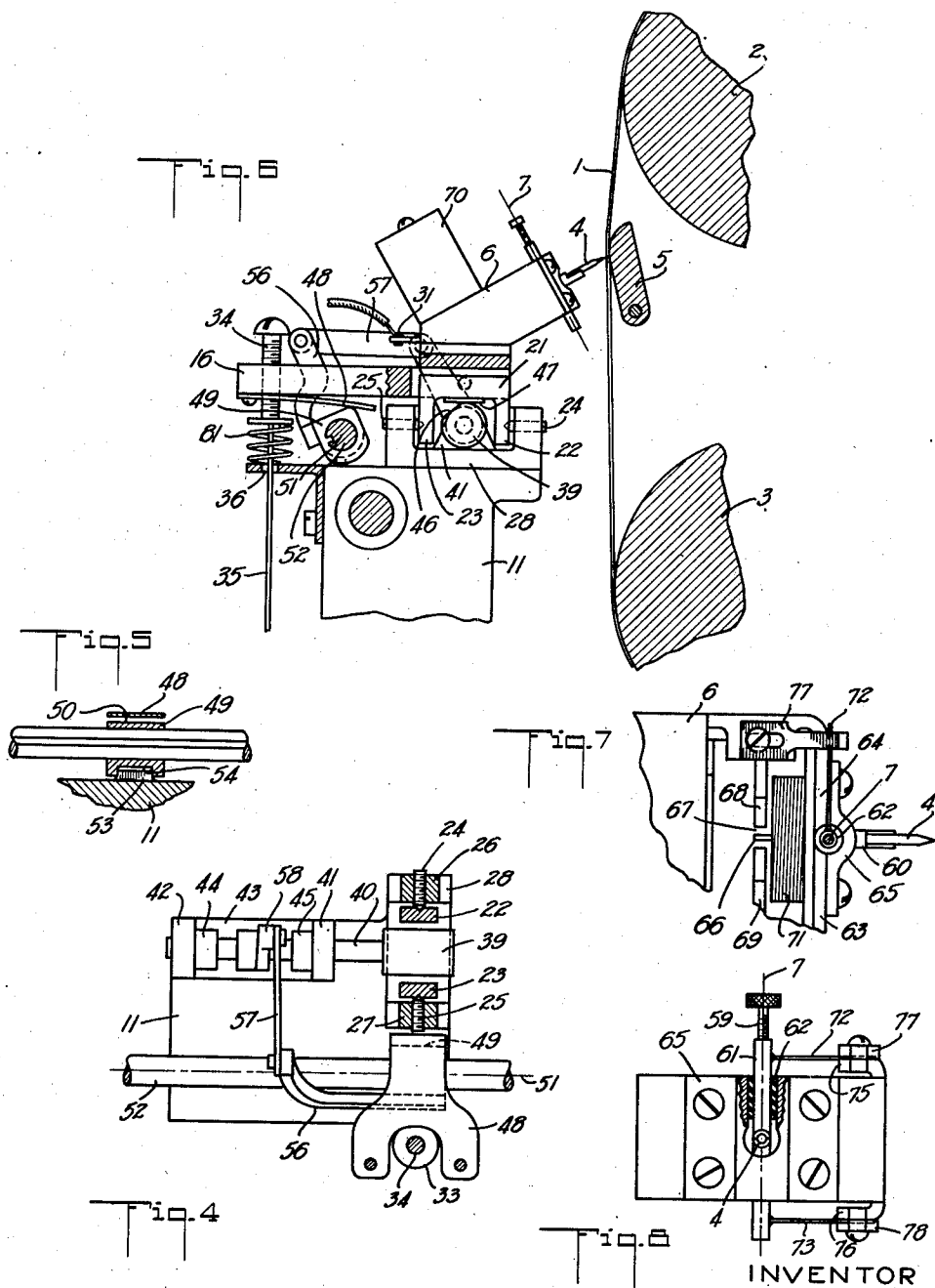
S. YERKOVICH

2,273,391

APPARATUS FOR REPRODUCING AND RECORDING SOUND

Filed June 19, 1939

2 Sheets-Sheet 2



INVENTOR
BY *Simon Yerkovich*
John Flam
ATTORNEY

UNITED STATES PATENT OFFICE

2,273,391

APPARATUS FOR REPRODUCING AND
RECORDING SOUND

Simon Yerkovich, Los Angeles, Calif., assignor to
United Acoustigraph Corporation, Los Angeles,
Calif., a corporation of Nevada

Application June 19, 1939, Serial No. 279,849

11 Claims. (Cl. 274—1)

This invention relates to sound recording and reproducing apparatus, and more particularly to apparatus that incorporates a stylus in contact with a record or a record blank.

In such apparatus, the blank for receiving the sound record may be in the form of a thin endless flexible loop or band, upon which the vibrating stylus impresses or cuts the undulations that correspond to the sound. In reproducing, the stylus point is permitted to follow the record grooves freely, and such movement causes corresponding current variations in a translating circuit. In both recording and reproducing, the stylus must be advanced in a direction transverse to the motion of the record or the blank. This may conveniently be accomplished by a lead screw, engaging a carriage upon which the stylus and its associated mechanism is mounted.

It is one of the objects of this invention to make it possible to use the same stylus and carriage for recording as well as for reproduction. For this purpose, the stylus is provided with a blunt point such as a sapphire point, which impresses the record undulations in a blank without cutting it, and which can readily follow the record grooves for reproduction, without undue wear.

It is necessary, for the purposes of recording, that the stylus point form the record grooves as the carriage advances, and that the stylus be so mounted as to make it possible to exert an adequate pressure on the blank by the stylus point. Yet when it is desired to reproduce the record, the stylus must be left quite unrestrained so as to enable it effectively to follow the previously formed undulations. It is therefore another object of this invention to provide a mechanism such that these differing requirements for recording and reproducing may be obtained at will, as by a convenient adjustment or control.

One of the important features of the recording and reproducing stylus structure is that the stylus can be vibrated to cause considerable pressure for recording, and the stylus yet is maintained against appreciable movement under the forces acting on the stylus that are useful for producing the record; and yet, when the stylus is used for reproduction purposes, it is sufficiently yielding to permit the stylus to follow the record grooves and undulations. The structure by the aid of which this is accomplished is described and claimed in a copending application, entitled "Recording and reproducing head," Serial No. 279,847, filed on June 13, 1939, by Bernard F. McNamee. In conjunction with such a stylus struc-

ture, the apparatus embodying the present invention is effective to control the operation of the stylus for both recording and reproduction purposes.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a view, partly in longitudinal section, of an apparatus incorporating the invention and shown as in use for reproducing;

Fig. 2 is a side view of the apparatus illustrated in Fig. 1.

Figs. 3, 4 and 5 are sectional views taken respectively along the planes 3—3, 4—4 and 5—5 of Fig. 1;

Fig. 6 is a fragmentary view similar to Fig. 1, illustrating the apparatus in use for recording;

Fig. 7 is a top plan view of the mounting structure of the stylus utilized in connection with the invention, and

Fig. 8 is a front view partly broken away of the stylus mounting.

In the present instance, the record member 1 is shown as a thin, flexible loop adapted to be disposed over the rollers 2 and 3 appropriately mounted and arranged to move the record member past a vibratory stylus 4. In the recording, as well as in the reproducing position, the tip of the stylus, which may be formed of some gem point, such as sapphire, may be placed against the record member 1 opposite an anvil member 5 (Figs. 1 and 6) disposed back of the record member 1 and capable of being turned to the active position illustrated in these figures.

The stylus 4 is incorporated generally in a stylus structure or head structure 6 described in detail in the aforementioned application filed in the name of Bernard F. McNamee. In general it may be stated for the present that this stylus structure provides for the vibration of the stylus 4 about an axis 7, causing the stylus to make a lateral record, or to be vibrated about the axis 7 by playing in a groove carrying such a lateral record.

In reproducing the sound, the stylus structure

6 is intended to be moved at a substantially uniform rate in a direction transverse of the exposed surface of the record member 1. This is ordinarily accomplished by the aid of a carriage structure 11 advanced for example as by a threaded lead screw 8 (Figs. 1 and 2). This lead screw may be appropriately supported for rotation as in the side members 9 and 10 of a stationary frame. It may be rotated by any appropriate source of motion such as a small electric motor (not shown). The carriage structure 11 (Figs. 1, 2 and 3) is arranged to be moved by the lead screw 8 as by the aid of a half nut 12 fastened to carriage 11. The sides of the carriage 11 are provided with appropriate apertures for the passage of a stationary guide rod 13 appropriately supported by the frame members 9 and 10. A lower guide rod 14 of similar structure to guide rod 13 is engaged within the slots 15 in the lower portion of the carriage 11. The rods 13 and 14 thus restrain the carriage 11 from any movement other than in a direction parallel with the axes of the guide rods 13 and 14.

It is essential when the stylus 4 is used for reproduction that it be quite free to follow the record groove and its lateral undulations. For this purpose it is desirable so to mount the stylus 4 as to permit it to move in a direction transverse to the record surface. At the same time the stylus 4 should be so mounted that it is caused to vibrate about its own axis 7 through the minute amplitudes corresponding to the undulations in the sides of the record groove. A force must also be provided for urging the stylus point into the groove. By the aid of the present mounting illustrated in Figs. 1, 2, 3 and 4, these requirements are adequately provided for.

Thus the stylus structure 6 is shown as mounted on top of a supporting member 80 having a rearwardly extending portion 16, as well as downwardly directed arms 17 and 18. These arms 17 and 18 are shown as provided with headless conical pointed pivot screws 19 and 20, by the aid of which the supporting member 80 is pivotally mounted on an axis parallel to the surface of the record member 1. For this purpose the pivot screws 19 and 20 engage a block 21 extending upwardly between the arms 17 and 18. This block 21 is provided with downwardly directed arms 22 and 23. These arms provide a pivot for the structure 6 about an axis transverse to the surface 1. For this purpose there are shown a pair of headless conical pivot screws 24 and 25 threaded respectively through the arms 26 and 27 of a bracket 28. This bracket 28 is appropriately supported on top of the carriage 11.

Without further provisions, it is seen that the structure 6 has freedom of motion about a pivot 29 parallel to the record surface 1, as well as about a pivot 30 transverse to the record surface 1. Accordingly, as the carriage 11 is advanced by the lead screw 8, the structure 6 can accommodate itself to the vagaries of the groove in the record member 1. At the same time the inertia of the parts is such that the minute undulations in the walls of the groove cause the stylus 4 to be vibrated about its own axis 7, and thereby affect an appropriate pickup circuit. One of the terminals for this circuit is indicated at 31 in Fig. 1.

A light resilient force is provided for keeping the stylus 4 in contact with the groove. At the same time a light, resilient force is also provided tending to keep the structure 6 centralized about

the transverse axis 30. The manner in which this is accomplished will now be described.

Thus the arm or extension 16 formed on the support 80 is subjected to the upward pressure of a compression spring 81 (Figs. 1 and 2). The lower end of this compression spring rests upon an angle bracket 32 fastened to the left hand edge of carriage 11. The upper end of the compression spring 81 carries a disk 33 disposed immediately below the bottom of an adjusting screw 34 passing through the extension 16. The spring 81 thus urges the extension 16 upwardly, and thereby the structure 6 about the axis 29 parallel to the surface of the record.

To provide the centralizing resilient force about the axis 30, use is made of a bar spring 35. This bar spring 35, as shown most clearly in Fig. 2, extends axially of the screw 34 and may be fixed therein. It extends downwardly through the disk 33 and through the spring 81, which surrounds the bar spring 35. The bracket 32 is provided with a large clearance aperture 36 to permit passage of the bar spring therethrough, irrespective of the angular position of the support 80 about its axis 29. The free or lower end of the bar spring is accommodated in a slot 37 formed in a bracket 38 attached adjacent the lower edge of the carriage 11. The slot 37 extends in a direction parallel to the transverse axis 30. By engagement of the lower end of the bar spring 35 with one or the other wall of the slot 37, this bar spring 35 is flexed by the force exerted upon it whenever the structure 6 is urged away from a central position with respect to the axis 30. The force of the bar spring tends to keep the structure 6 in a vertical position, but readily permits the structure nevertheless to depart slightly from this vertical position as required by the restraint imposed upon the stylus 4 by the walls of the record groove.

These light resilient forces provided by the springs 81 and 35, while essential for purposes of reproduction, should be altered during the process of recording with the same stylus 4. For recording purposes, for example, a much greater force should be exerted, urging the stylus 4 toward the recording surface; and the structure 6 must be restrained from any motion whatever about the axis 30. In this way, sufficient forces may be caused to be exerted upon the stylus 4 for obtaining a requisite pressure not only to form the record groove, but also its lateral undulations.

A simple mechanism is provided for ensuring that during the process of recording these restraints and forces be properly proportioned.

Thus for example the restraint against motion about the axis 30 is accomplished in the present instance by providing a cam member 39 (Figs. 1, 3, 4 and 6). This cam member is shown as extending beneath the block 21 and as supported on a rotary shaft 40, journaled in arms 41 and 42 provided on the support 43. This support 43, as shown most clearly in Figs. 3 and 4, is supported upon the top surface of the carriage 11. The shaft 40 is restrained against axial movement as by the collars 44 and 45.

The cam 39 is of general circular configuration; but at its top surface it has a flattened portion 46. In the position of Figs. 1 and 3, this flattened top portion 46 is substantially parallel with the lower surface 47 of the block 21. It therefore is out of the path of movement of the block 21, as block 21 pivots about the axis 30. However, in the position of Fig. 6, cam 39 has

been rotated so that the circular surface of the cam now engages the bottom surface or pad 47 of the block 21. Accordingly due to the engagement of the cylindrical surface of the cam 39 with the surface 47, rotation about axis 30 is prevented.

Provisions are made also, for the period of recording, to supplement the resilient force of the spring 81. For this purpose the lower end of the extension 16 carries a flat spring 48 (Figs. 1, 4 and 6). The free end of the flat spring in the reproducing position of Fig. 1 is left inoperative. However, the free end of the spring may be engaged by a corner of a block 49 (Figs. 1, 5 and 6) so as to impose a pressure upon this free end and supplement the pressure of the spring 81. In the reproducing position, as shown most clearly in Fig. 5, the flat upper surface 50 of the block 49 clears the lower end of the spring 48. One corner, however, may be moved into contact with the flat spring upon rotation of the block 49 about an axis 51 of a shaft 52. This shaft 52, as shown most clearly in Fig. 2, is rotatably supported in the frame members 9 and 10. The block 49 is splined to the shaft 52. It is arranged to be carried along with the carriage 11, as by the aid of the projection 53, which engages the arcuate slot 54 in the bottom of the block 49 (Fig. 5). This projection 53 is shown as integral with the top of the carriage 11.

The shaft 52 is provided at its left hand end with a manipulating lever or handle 55 (Fig. 2). By the aid of this handle 55 the angular motion of the block 49 may be controlled. Preferably, however, the manipulation of handle 55 is also rendered effective to rotate the cam shaft 40 for restraining rotation about axis 40. For this purpose the block 49, as shown most clearly in Figs. 1, 4 and 6, is provided with an upwardly extending arm 56. The free end of this arm is pivotally joined to a link 57. The other end of link 57 is pivoted to an arm 58 (Fig. 2) fastened to the shaft 40. Accordingly when the spline shaft 52 is rotated by handle 55, not only is the block 49 rotated, but a rocking motion is also imparted to the cam shaft 40.

The adaptability of the stylus 4 for both recording and for reproduction is provided for by the aid of the structure disclosed in the aforementioned prior application filed in the name of Bernard F. McNamee. In Figs. 7 and 8 the essential elements of the stylus mounting are indicated. Thus the stylus 4 is shown as accommodated in a saddle extension 60 of an armature, which is made integral with a tubular support 61. This tubular support 61 is threaded at its upper end for engagement of a thumb screw 59 by the aid of which the stylus 4 may be clamped within this saddle 60. The tubular member 61 is journaled in resilient sleeves 62 at the top and bottom of the supporting arms 63 and 64. These supporting arms provide sloping surfaces for the accommodation of the sleeves 62. These sleeves are clamped against the sloping surfaces by a cap 65 attached to the members 63 and 64. The armature which is made of magnetic material, is provided with a polar extension 66. This polar extension is accommodated in an air gap 67 between the opposed pole pieces 68 and 69 of a permanent magnet 70 (Figs. 1 and 6). The coil 71 surrounds the armature. Current impulses may be induced in this coil during the reproducing period, as is well understood. For recording purposes current impulses are passed to coil 71 for vibrating the armature and the stylus 4. All this

has been detailed in the prior application hereinbefore referred to.

In order to restrain lateral movement of the support 61 parallel to the record surface during the recording operation, while yet permitting the stylus 4 to be vibrated during reproducing operation, use is made of a pair of bar springs 72 and 73. These bar springs extend in a direction lateral to the axis 7 and generally parallel to the record surface 1. One end of each of the springs 72 and 73 is joined permanently to the tubular support 61. The other end is adjustably clamped to the bosses 75 and 76 respectively, as by the aid of the clamping members 77 and 78. By appropriate adjustment of the springs 72 and 73 in the clamping members 77 and 78, the stylus 4 and its tubular support 61 can be accurately centered with respect to the air gap 67. A strong restraint is placed by these two springs 72 and 73 against motion of the stylus axis in a direction parallel to the surface of the record. No material restraint, however, is imposed to motion in a direction transverse to the surface of the record. The flexible sleeves 62 provide a resilient force acting against the vibratory forces imposed upon the armature.

What is claimed is:

1. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, said structure including a stylus adapted to vibrate about an axis, a carriage movable parallel with said surface, means mounting the structure on said carriage so that the structure may have freedom of motion toward and from the surface, as well as freedom of motion in a direction transverse to the surface with respect to the carriage, means resiliently urging said structure toward said surface, and means for restraining said structure against said transverse motion, as well as for increasing the resilient force acting to urge said structure toward said surface, said means including a pair of simultaneously operable rotatable members on the carriage.

2. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, a pivotal supporting means for the structure on an axis parallel to said surface, another pivotal support for the said supporting means on an axis transverse to the axis of the supporting means, a resilient means acting on the said supporting means for urging said structure toward said surface, and means for imposing an additional resilient force on said supporting means including a spring interposed between the carriage and the supporting means controlled by a rotatable member, as well as means for restraining movement of the structure about said transverse axis, comprising a rotatable cam member on the carriage.

3. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, and a mounting for the structure, comprising a carriage movable parallel with said surface, a supporting means for said structure, means mounting said supporting means on said carriage including a pivot mounting said supporting means on an axis parallel to said surface, as well as a pivot mounting said supporting means on an axis transverse to said surface, a spring urging the supporting means toward the surface, and means acting to centralize the struc-

ture about the said transverse axis with respect to the carriage, comprising a bar spring interposed between the carriage and the mounting means.

4. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, and a mounting for the structure, comprising a carriage movable parallel with said surface, a supporting means for said structure, means mounting said supporting means on said carriage including a pivot mounting said supporting means on an axis parallel to said surface, as well as a pivot mounting said supporting means on an axis transverse to said surface, a coil spring urging the supporting means toward the surface, and a bar spring arranged between the supporting means and the carriage, and exerting a centralizing force on the structure with respect to the transverse axis.

5. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, and a mounting for the structure, comprising a carriage movable parallel with said surface, a supporting means for said structure, means mounting said supporting means on said carriage including a pivot mounting said supporting means on an axis parallel to said surface, as well as a pivot mounting said supporting means on an axis transverse to said surface, a spring urging the supporting means toward the surface, spring means arranged between the supporting means and the carriage to centralize the structure about the said transverse axis, and means for restraining movement of the structure mounting against movement about said transverse axis, comprising a rotatable cam member interposed between the carriage and a surface of the mounting means.

6. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, and a mounting for the structure, comprising a supporting means for said structure, a pivot mounting for said supporting means, on an axis parallel to said surface, means resiliently urging said supporting means about said axis toward said surface, a flat spring attached at one end to the supporting means, and means including a rotatable block for optionally engaging the free end of the flat spring, to increase the resilient force acting on the supporting means.

7. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, a mounting means for said structure on axes respectively parallel and transverse to the surface, a spring operating on the mounting means and urging the structure about the parallel axis and toward said surface, a flat spring having one end attached to the mounting means, means optionally engaging the free end of the flat spring for increasing the force urging the structure toward the surface, and means operating optionally to restrain the structure about the transverse axis, comprising a rotatable cam member interposed between the carriage and a surface of the mounting means.

8. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, a mounting means for said structure on axes respectively parallel and transverse to the surface, a spring operating on the mounting means and urging the structure about the parallel axis and toward said surface, a flat spring having one end attached to the mounting means, means optionally engaging the free end of the flat spring for increasing the force urging the structure toward the surface, means operating optionally to restrain the structure about the transverse axis, and a connection between the flat spring engaging means and said restraining means for simultaneously operating both of said means.

9. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, a carriage movable parallel with said surface, means for mounting said structure on said carriage for movement about an axis transverse to said surface, and means for centralizing said structure about said axis, comprising an elongated bar spring fixed at one end to said structure, and means forming a slot on the carriage extending in a direction parallel to the axis and into which the other end of said bar spring enters.

10. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, a carriage movable parallel with said surface, means supporting said structure on said carriage including means pivotally mounting the structure on an axis parallel to said surface, as well as about an axis transverse to said surface, a bar spring carried by the means mounting the structure about the parallel axis, means carried by the carriage forming a slot extending parallel to the transverse axis for accommodating the free end of the bar spring, and a compression spring surrounding the opposite end of the bar spring for urging the structure toward the surface about the parallel axis.

11. In a device of the character described, a stylus structure adapted for recording and for reproducing impulses in connection with a surface of a record member, a carriage movable parallel with said surface, means supporting said structure on said carriage including means pivotally mounting the structure on an axis parallel to said surface, as well as about an axis transverse to said surface, a bar spring carried by the means mounting the structure about the parallel axis, means carried by the carriage forming a slot extending parallel to the transverse axis for accommodating the free end of the bar spring, a compression spring surrounding the opposite end of the bar spring for urging the structure toward the surface about the parallel axis, and means for restraining movement of the structure about the transverse axis with respect to the carriage as well as for increasing the resilient force urging said structure toward said surface, said means including a pair of simultaneously operable rotatable members on the carriage.

SIMON YERKOVICH.