Jan. 6, 1953 R. J. ROCKWELL 2,624,584

PHONOGRAPH

Filed Aug. 17, 1949

Fig. 1

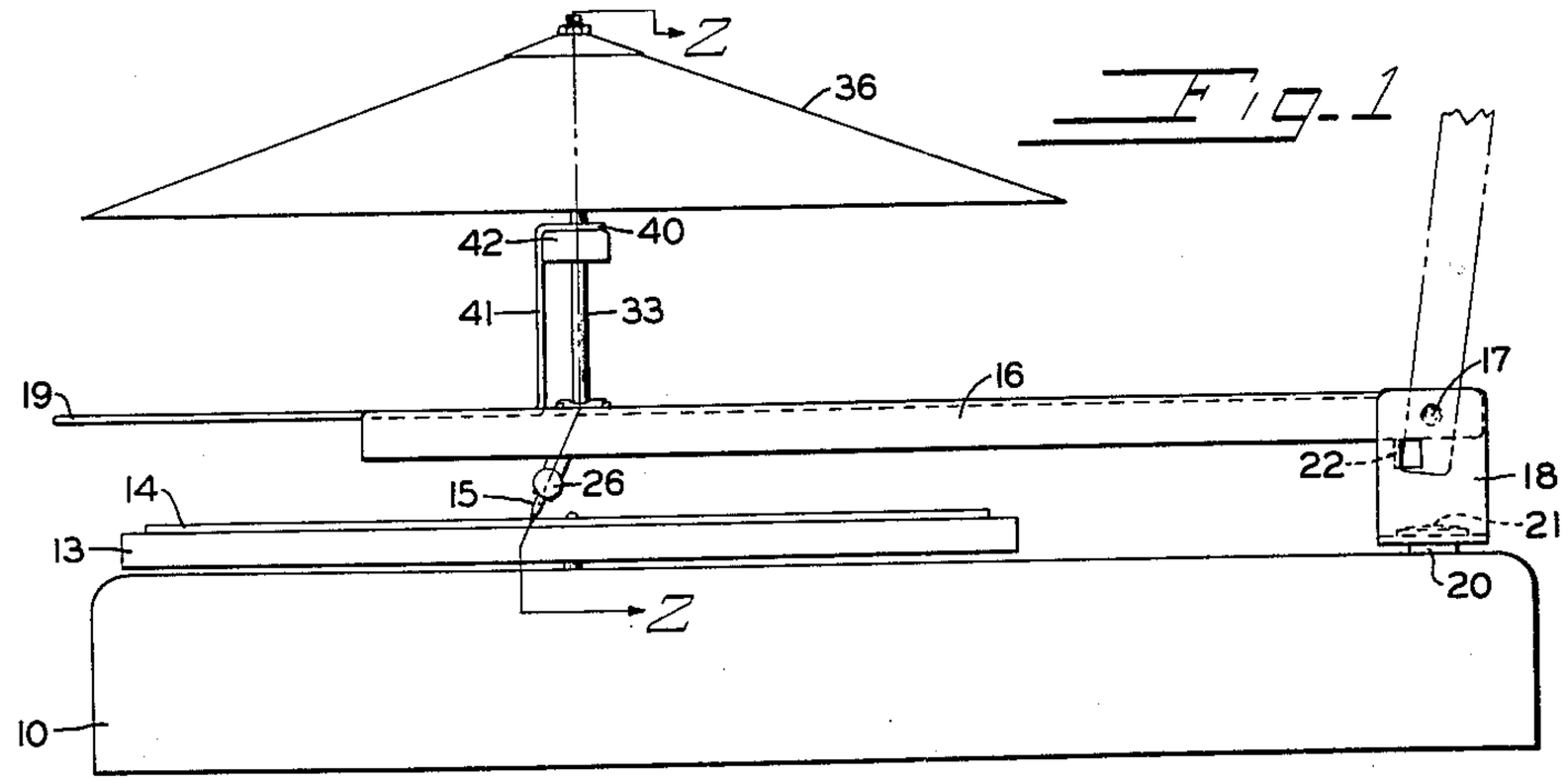


Fig. 2

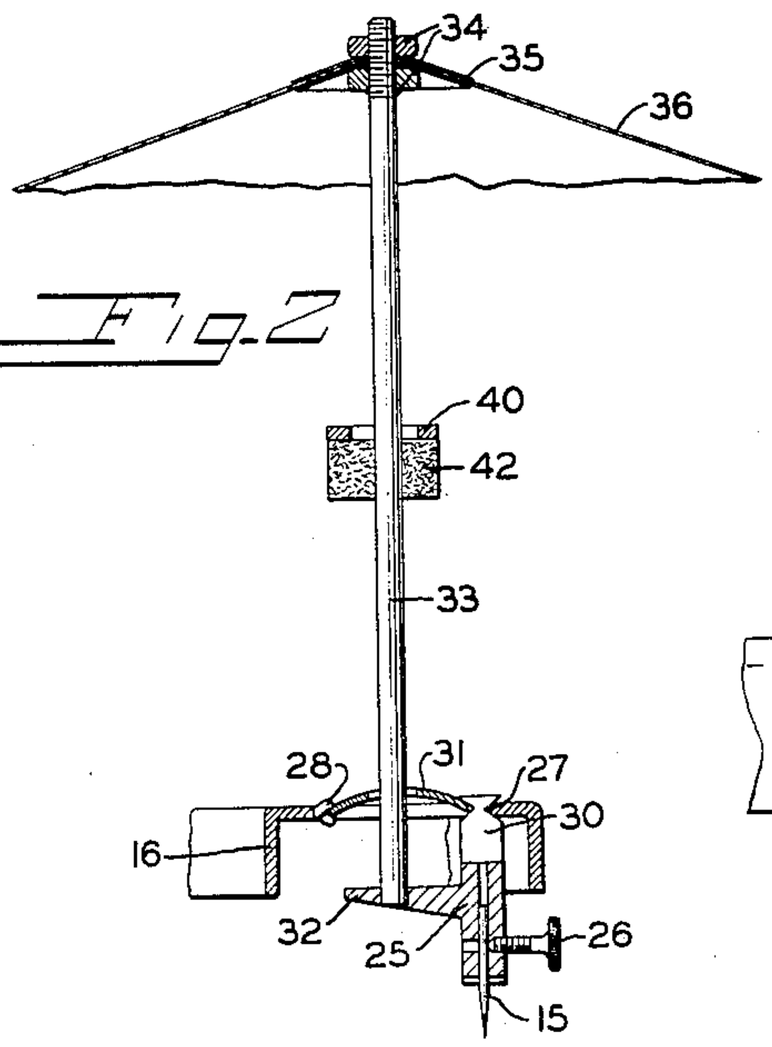


Fig. 3

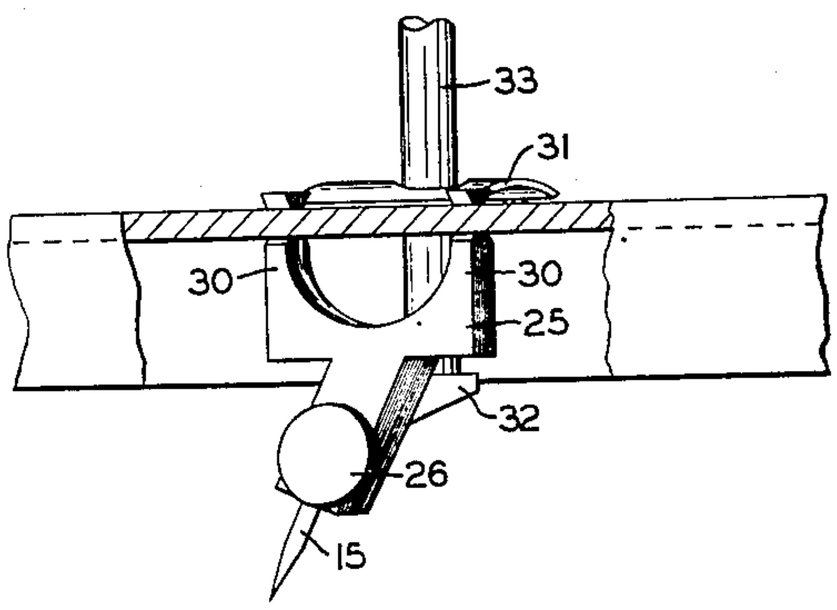
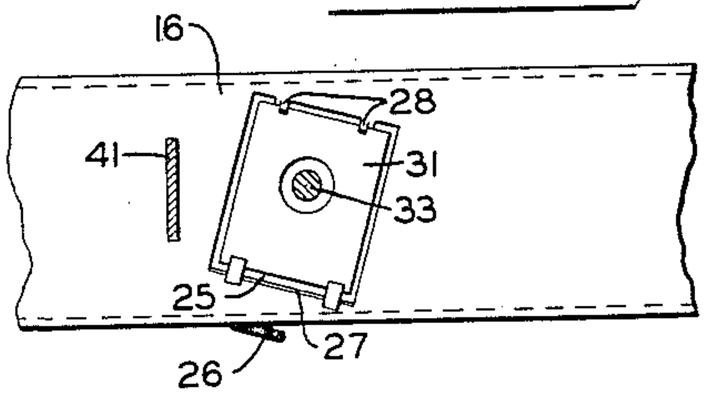


Fig. 4



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PHONOGRAPH

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7 Claims. (Cl. 274—16)

1

This invention relates to phonographs of the type having mechanical sound reproduction systems and more particularly, to an improvement in the sound reproduction apparatus for such instruments.

At the present time there are several different types of small, inexpensive phonographs on the market which are designed primarily for use in the playing of children's records, although they may, of course, also be used for playing other types of records if desired. These devices are generally of the type having a cabinet on which is mounted a turntable driven by a small electric motor. Also mounted on the cabinet is a tone arm to which is attached an acoustic reproducer or sound-box type of pick-up head in which the playing needle or stylus is mounted. The groove modulations picked up from the record by the stylus are conveyed to a small diaphragm mounted in the sound-box of the pick-up head. The motion of this diaphragm causes air vibrations to be produced in a hollow tone arm which is communicatively connected with a sound chamber provided in the cabinet of the instrument. The cabinet is provided with an opening, generally along one side thereof, which communicates with the sound chamber and from whence the sounds reproduced by the instrument are rendered audible to the listeners.

Phonographs of the aforementioned type are subject to several disadvantages such as poor fidelity, needle scratch, and heavy needle pressure which causes rapid wear of the sound grooves of the records.

Accordingly, it is an object of this invention to provide an improved sound reproducing apparatus for phonographs of the aforementioned category.

Another object of the invention is to provide a phonograph in which the entire sound reproduction system is mounted upon and above the outer end of the pick-up arm.

Another object of the invention is to provide a mechanically operated loud speaker apparatus for small phonographs in which the sound radiating cone is mounted directly above the record in order to provide a small and compact instrument.

Another object of the invention is to provide a sound reproducing apparatus for small, portable phonographs in which satisfactory reproduction may be obtained with a needle pressure of from one to two ounces.

Another object of the invention is to provide a sound reproduction apparatus for small, portable phonographs in which the frequency response is greatly superior to that of the conventional, sound-box types of reproducers.

2

Another object of the invention is to provide a sound reproduction apparatus for phonographs which consists of a pivoted pick-up arm, a pivoted needle holder mounted on the arm, a sound radiating cone, and a vertical drive rod connected between the needle holder and the cone.

Another object of the invention is to provide a resilient supporting element for stably supporting the drive rod of a mechanical type of sound reproduction mechanism for phonographs.

A further object is to provide a sound reproducing device of extreme simplicity which will produce eminently satisfactory performance and which can be manufactured with facility and at low cost.

With these and other objects in view, as will more fully appear from the following description, I shall now describe my invention in conjunction with the accompanying drawings in which:

Figure 1 is a side elevation of a phonograph embodying my invention.

Figure 2 is a cross-sectional view taken along the line 2—2 in Figure 1.

Figure 3 is a detail view of the pivoted element which receives and supports the phonograph needle.

Figure 4 is a fragmentary plan view of the pick-up arm.

In general, my improved sound reproduction apparatus comprises a small cabinet or base on which is mounted a turntable which is preferably driven by a small electric or spring motor located within the interior of the cabinet. Also supported on the cabinet is a pick-up arm which is mounted for pivotal movement in both a horizontal and a vertical plane so that the arm may be lifted from its position of rest and swung over the record mounted on the turntable after which it may be lowered so as to bring the needle or stylus into engagement with the sound track of the record. Similarly, after the record has been played, the pick-up arm and stylus may be lifted off of the record and swung over to one side so as to permit the record to be removed and another one to be placed on the turntable.

The needle or stylus is received within a motion converting member which is pivotally mounted on the pick-up arm for oscillatory movement about an axis lying approximately parallel to the longitudinal axis of the pick-up arm. Attached to this member is a vertically disposed drive rod which has affixed to its upper end a sound radiating cone which may be formed of

stiff paper, fiber, metal or plastic material as may be desired. The rod is supported in its upright position by a resilient element through which the rod passes and which element is affixed to a bracket formed on the pick-up arm or suitably attached thereto.

I have found that a sound reproduction apparatus of this type gives excellent results, the most noticeable improvement being in the extension and flattening of the frequency response and in the reduction of surface noise and high frequency chatter, which characterizes all of the sound-box types of reproducers with which I am familiar. Not only does my improved device result in a more natural and higher fidelity reproduction of the music or other intelligence impressed upon the record, but it also has the property of reducing the surface noise or "needle scratch" which is a contributing factor in the unpleasant reproduction obtained from other mechanical sound reproduction systems.

A further advantage of my device is that the pressure of the needle on the record may be made as small as one or two ounces, thereby greatly reducing the wear on the record and also reducing the surface noise caused by additive wear of the needle on the record. I am able to achieve this result due to the light weight of the pick-up arm and the mechanism mounted thereon so that better reproduction is obtained from the record and the life of the record is greatly increased. A further advantage of my device over the prior art devices resides in the fact that all of the sound reproducing mechanism is mounted on the tone arm above the cabinet and hence no provision need be made within the cabinet or base of the phonograph for transmitting the sound picked up off the record. Since relatively large acoustic volume need not be provided in the cabinet to serve in place of a horn type radiator, hence, the cabinet may be made smaller and more compact than in the case of phonographs of the latter type.

I will now proceed with the description of one illustrative embodiment of my invention, it being realized, of course, that various changes and alterations may be made in the specific features of construction of the device hereinafter described without departing from the principle or spirit of my invention.

In Figure 1 is shown a small phonograph in which the principles of the present invention are incorporated. As therein shown, the phonograph consists of a cabinet or base **10** on which is supported the driving motor and the phonograph turntable.

As shown in Figure 1 of the drawings a turntable **13** is arranged to be rotated in a well known manner by the motor, thereby causing a disc-type record **14** mounted on the turntable to be rotated beneath the needle. The needle follows the modulations, representative of sounds, which have been impressed on the upper surface of the sound record disc.

Cooperating with the sound track, which in this case is assumed to be of the lateral-cut type, is a stylus **15** which is mounted near the outer end of a pick-arm **16**. As shown in Figure 2, the pick-up arm is preferably formed in the shape of a channel so as to increase the rigidity and stiffness thereof and thereby enable relatively thin sheet stock to be used in fabricating the arm.

As shown in Figure 1, the right-hand or inner end of the pick-up arm **16** is pivotally mounted

at **17** on a bracket **18** so as to permit the arm to be raised or lowered by grasping a finger tab or handle **19** provided on the left-hand or outer end thereof. The bracket **18** is in the shape of a U and the arm **16** is received between the side arms thereof and pivotally attached thereto as mentioned above. This pivotal attachment, as indicated at **17** in Figure 1, is preferably achieved by forming inwardly extending extrusions or dimples in the bracket **18** which are adapted to engage in apertures or recesses provided in the sides of the arm **16**. The bracket **18** is preferably formed of resilient or springy material so that the extrusions on the arms thereof will spring into the recesses provided in the pick-up arm so as to hold the arm in position. The bracket **18** is in turn journaled on the cabinet **10** by means of a stud **20**, secured to the cabinet **10**, which stud is provided on its upper end with a tenon of reduced diameter which passes through an aperture in the bottom of the bracket, the bracket being retained thereon by means of a headed screw **21**. It will be understood that any suitable arrangement for universally mounting the arm **16** may be substituted for the elements **17**, **18**, **20** and **21**.

In order to insure that any vibrations transmitted to the pick-up arm **16** by the stylus **15** will not be transmitted to the cabinet **10**, which would act as a sounding board for the same and interfere with the proper reproduction of the record, the stud **20** is preferably insulated from the cabinet **10** by means of a block of rubber, felt or other resilient material so as to prevent this from occurring.

As further shown in Figures 1, each of the upstanding arms of the bracket **18** is provided with an inwardly extending ear **22**, the upper edge of which lies beneath the edge of the arm **16** and serves to support the arm in a substantially horizontal position when it is swung off to one side of the turntable **13**. The rear face of each of the lugs serves to engage the lower edge of the arm **16** when the same is moved slightly beyond the vertical position, as indicated in phantom outline in Figure 1, and will maintain the arm in this position so as to facilitate the replacement of the needle **15** or the placing of a new record on the turntable.

As mentioned earlier herein, the entire sound reproduction system of the phonograph is supported on the arm **16** and is entirely independent of the remainder of the phonograph assembly. The structure hereinafter to be described constitutes the sound reproduction apparatus of the device and, as the description proceeds, it will be observed that I have provided a very simple but effective apparatus for reproducing the intelligence impressed upon the record.

As shown in Figures 2 and 3, the stylus **15** is received within a bore provided within a member **25** which serves to convert the sidewise motion of the stylus into vertical motion. As shown in Figure 3 this bore is inclined at an angle of approximately 25 degrees to the vertical, when viewed from the side, so as to insure smooth tracking of the needle within the sound groove of the record.

The pick-up arm **16** is provided in the vicinity of the member **25** with a rectangular aperture in the upper face thereof, and one edge of the aperture is provided with a beveled knife edge **27**, while the opposite edge thereof is provided with a notch arrangement **28** as shown in Figure 2. As shown in Figure 4, this aperture is in-

clined slightly with respect to the axes of the arm 16 in order to reduce the tangential tracking error which occurs with short pick-up arms. The stylus receiving member 25 is provided with a pair of upwardly extending arms 30 which are provided near their upper extremities with a pair of notches, one set of said notches being adapted to cooperate with knife edge 27 and the other set being adapted to receive one edge of a spring clip 31. The clip 31 is distorted from a substantially flat condition to an arcuate shape, as shown in Figure 2, and is compressed between the notches in the arms 30 and the notch arrangement 28 provided along one edge of the aperture formed in the upper face of the pick-up arm 16. The member 25 is thereby held firmly in position on the pick-up arm but is free to rock to a limited degree about the knife edge 27.

As shown in Figure 2, the stylus receiving member 25 is provided with a laterally extending arm 32 which is apertured to receive the lower end of a drive rod 33. This rod may be brazed to the member 25 or otherwise securely attached thereto so as to insure the effective transmission of the vertical motion of the stylus 15 to the rod. At its upper end, the rod 33 is threaded so as to receive nuts 34 and conical washers 35 by means of which a sound radiating cone 36 is securely attached to, and maintained in position on, the upper end of the rod. The cone 36 may be formed of any relatively stiff but light material such as paper, relatively thin, pressed fiber board, etc. However, if desired, the cone may be molded of a thin pastic, or fibrous material, or it may be shaped from a light metal such as aluminum. Furthermore, while the cone is herein shown as being symmetrical in form, it may, if desired, be given an asymmetrical shape so as to more perfectly respond to the various frequencies transmitted thereto from the stylus. The size of the cone should be as large as possible consistent with the size of the cabinet so as to extend the lower frequency range of the sound reproduction apparatus.

The drive rod 33 should be made relatively small in diameter and should be of the proper length to support the cone at the desired height above the cabinet. For example, in the device herein shown and described, I have employed a one-eighth inch metal rod which is approximately three and one-half inches in length with very satisfactory results.

While the embodiment of the invention herein shown and described is designed for use with lateral-cut records, it will be obvious to anyone skilled in the art that it may be readily adapted for use with vertical-cut records by moving the stylus from its present location to a position directly beneath the lower end of the drive rod 33. By so doing, the vertical movements of the stylus will be transmitted directly to the rod and thence to the cone which will convert the motion into sound.

As shown in Figures 2 and 3, the rod 33 passes upwardly from the member 25 through an aperture provided in the spring clip 31 and then through an enlarged aperture provided in the horizontally disposed flange 40 of an upwardly extending bracket 41 formed on or otherwise attached to the arm 16. Secured to the flange 40 is a block 42 of felt or other resilient material through the center of which is passed the rod 33. The block 42 is located approximately midway along the length of the rod and serves to

support the rod and maintain it in an upright position.

Inasmuch as the pick-up arm 16 itself is light in weight, and since the weight of the member 25, the rod 33, and the cone 36 is in the neighborhood of but a few ounces, it is easily possible to maintain a stylus pressure on the record of one or two ounces. However, if desired, counterbalancing of the arm 16 by means of a spring or weight may be employed in the well known manner.

It is also desirable to design the member 25 so that it will serve not only as a motion connecting element but also as an impedance matching device. For this purpose, the lever arm of the stylus (i. e., the distance from the point of the stylus to the knife edge 27) is so proportioned with respect to the lever arm of the rod (i. e., the distance from the lower end of the rod to the knife edge 27) as to cause the sound radiating cone to be driven with the maximum power obtainable from the sound track on the record. This principle of mechanically matching the impedance of the stylus with that of the cone is shown though not described in U. S. Patent No. 1,897,399, issued February 14, 1933 to R. J. Rockwell et al. Accordingly, reference is hereby made to that patent for further information regarding this feature of the device.

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

1. A sound reproducing device for phonographs comprising a cabinet, a pick-up arm having one end thereof pivotally attached to said cabinet, a stylus receiving member, means for supporting said member on said arm for pivotal movement about an axis lying approximately parallel to the major axis of said arm, a sound generating cone located with its periphery disposed in a plane parallel to the plane of the record, and a vertically disposed rod having one end attached to said stylus receiving member, and the other end attached to said cone for supporting said cone in position and for transmitting motion from said stylus receiving member to said cone, said supporting means including a knife edge form of pivot and a spring clip disposed edgewise to the stylus receiving member for holding said member in place on the arm, said spring clip being apertured to receive said rod.

2. In a phonograph of the type including a pick-up arm, a sound diaphragm mounted on said arm, a stylus, and means including a rocker member for communicating the vibratory motion of said stylus to said diaphragm, an improved device for pivotally mounting the rocker member in direct contact with the pick-up arm, comprising: a knife edge formation on the pick-up arm, a complementary notch formation on the rocker for receiving the knife edge, and resilient means for biasing said notch formation against said knife edge, said means including another notch formation on the rocker and a spring clip disposed edgewise to and in contact with said other notch formation.

3. In a phonograph of the type including a pick-up arm, a sound diaphragm fixedly mounted on said arm, a stylus and a diaphragm actuator, the improvement which comprises, in combination, a T-shaped rocker member having a downwardly extending stylus receiving portion and an upwardly extending bifurcated portion and a laterally-extending actuator-engaging portion, and means for mounting said rocker member to ro-

tate about an axis generally parallel to said arm in response to vibratory motion of said stylus, thereby to move said actuator in translation, comprising: a knife edge formed on said arm, individual V-notches on one side of the bifurcations of said arm in receptive relationship to said knife edge, a bow spring, a notch formed on said arm in receptive relationship to one end of said bow spring and other individual V-notches on the other sides of said bifurcations in receptive relationship to the other end of said bow spring.

4. The improvement in accordance with claim 3 wherein said bow spring is centrally apertured and wherein said diaphragm actuator projects through the aperture.

5. The improvement in accordance with claim 4 wherein said diaphragm actuator is stabilized by embracing damping material mounted in fixed relationship to said pick-up arm.

6. A sound reproducing device for phonographs comprising a cabinet, a stylus, a pick-up arm having one end thereof pivotally attached to said cabinet, a T-shaped member for receiving the stylus and providing an impedance match to the cone, means for supporting said member on and in contact with said arm for pivotal movement about an axis lying approximately parallel to the major axis of said arm, said supporting means including a knife-edged form of pivot comprising notches on said stylus receiving member, and a spring clip apertured to receive said rod and disposed in engagement with one of said notches for holding the stylus receiving member in place on the arm, a sound generating cone located above said arm with its periphery disposed in a

plane parallel to the plane of the record, and a vertically disposed rod having one end attached to said stylus receiving member and the other end attached to said cone for supporting said cone in position and for transmitting motion from said stylus receiving member to said cone.

7. The invention as defined by claim 6 including an upwardly extending bracket attached to said arm adjacent to said rod, and a resilient supporting element attached to said bracket and in embrace with said rod.

RONALD J. ROCKWELL.

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