Feb. 14, 1933. R. J. ROCKWELL ET AL 1,897,399

CONSTRUCTION OF LOUD SPEAKER MOTORS

Filed Dec. 31, 1930 2 Sheets-Sheet 1

Fig. 1.

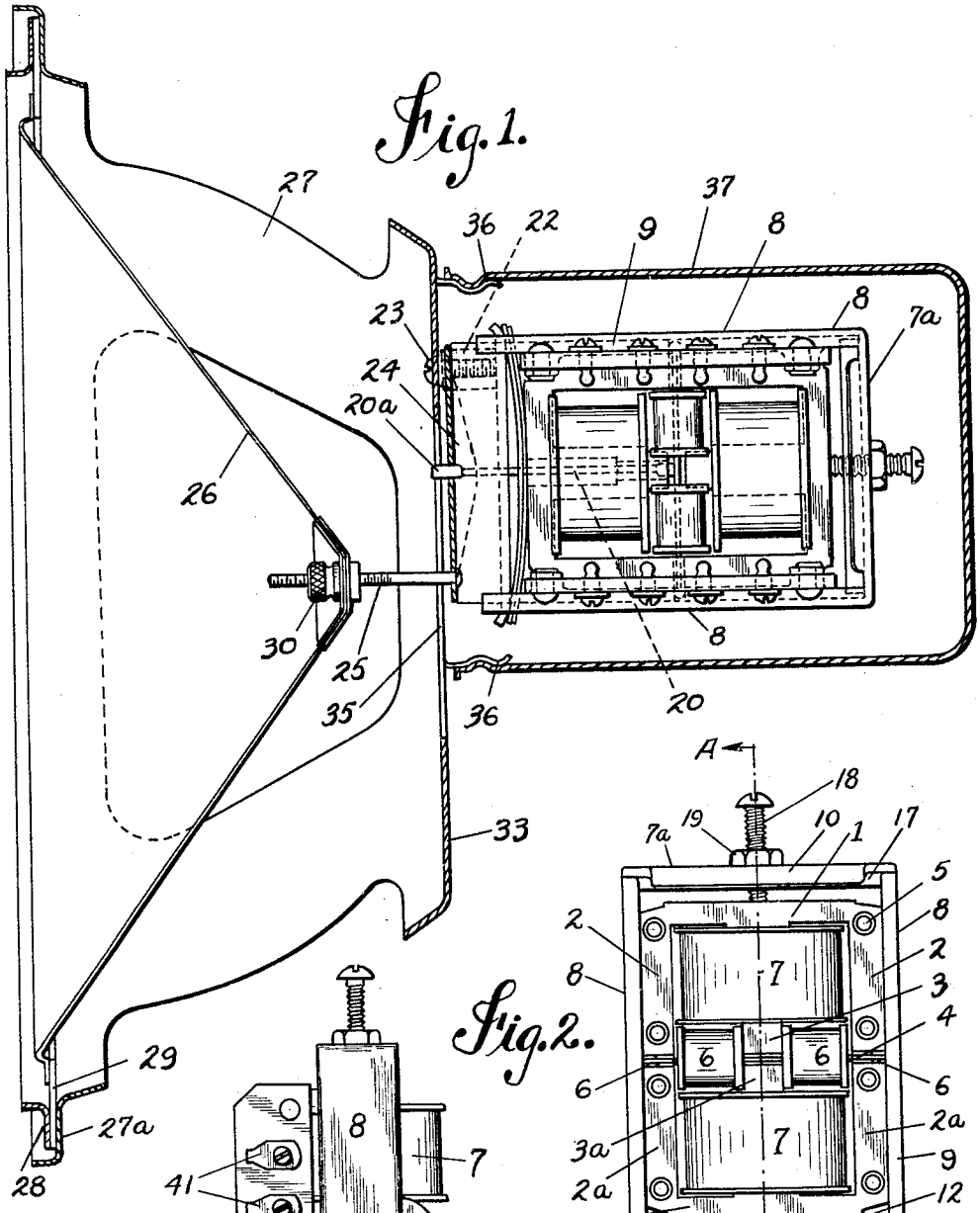
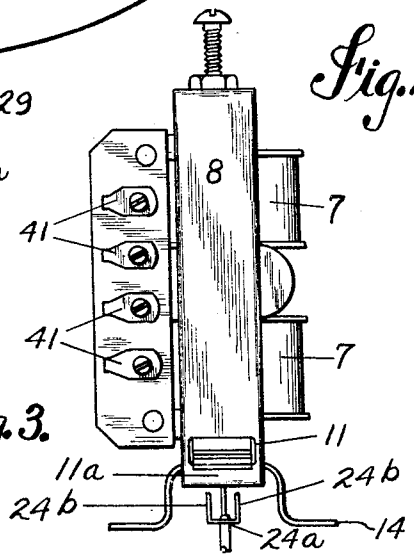


Fig. 2.

Fig. 3.



INVENTORS
Ronald J. Rockwell
Austin F. Parkhurst
BY Allen & Allen
ATTORNEYS

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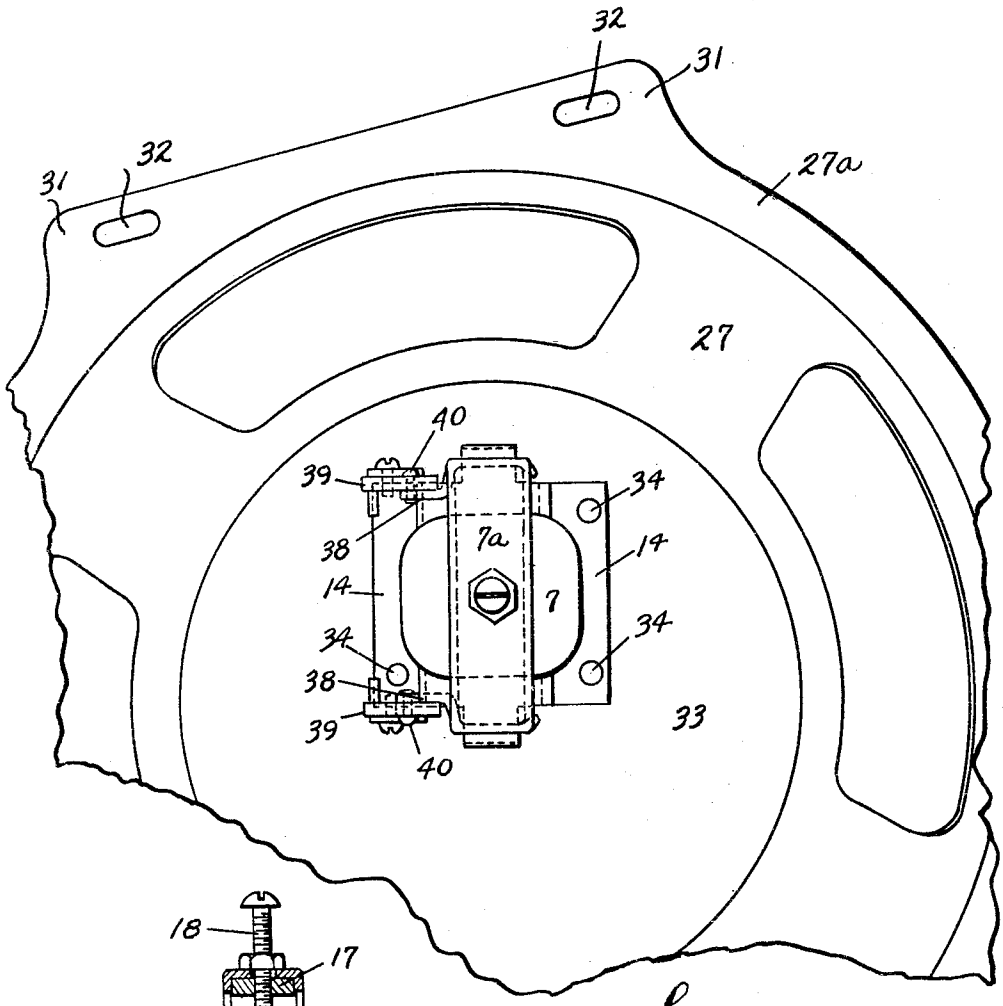

Fig. 4.

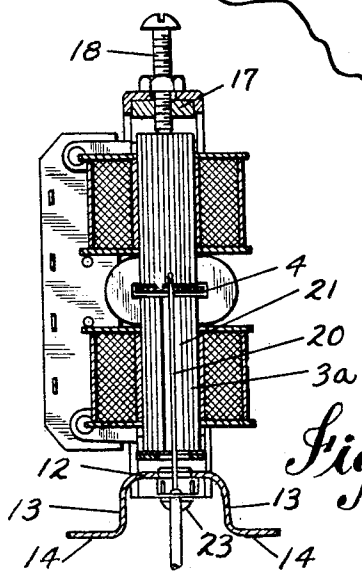

Fig. 5.

INVENTORS
Ronald J. Rockwell
BY Austin F. Parkhurst
Allen & Allen
ATTORNEYS

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UNITED STATES PATENT OFFICE

RONALD J. ROCKWELL AND AUSTIN F. PARKHURST, OF CINCINNATI, OHIO, ASSIGNORS TO THE CROSLEY RADIO CORPORATION, OF CINCINNATI, OHIO, A CORPORATION OF OHIO

CONSTRUCTION OF LOUD SPEAKER MOTORS

Application filed December 31, 1930. Serial No. 505,880.

The primary object of our invention comprises specific improvements in the construction of loud speaker motors whereby provision of a new type is made for the adjustment of a motor and the centering of the armature, whereby the construction of a motor is made less expensive, and whereby the motor may be more accurately matched to the particular driven vibratile device which is to reproduce the sound.

This and other objects of our invention, which will be set forth hereinafter or will be apparent to one skilled in the art when reading these specifications, we accomplish by that certain construction and arrangement of parts of which we shall now describe a preferred embodiment, reference being had to the drawings which form a part hereof.

Figure 1 is a cross sectional view of a loud speaker showing the motor in elevation on the terminal side, the motor housing, the cone housing and the cone in section.

Figure 2 is a side elevation of our motor from the opposite side.

Figure 3 is an end elevation thereof.

Figure 4 is a partial plan view of our motor in place upon the cone housing.

Figure 5 is a sectional view through our motor.

In the specific embodiment of our invention the type of motor shown is one having E shaped field core sections in opposed relationship with an armature mounted between them. It will be understood that the broader aspects of our invention are not limited to a motor of this type but in the exemplary embodiment chosen, we shall describe it in connection with this type of motor, the essential novelty in our device being set forth in the appended claims.

In Figure 2, we have shown a pair of E shaped core sections 1 and 1*a*, having outer yoke pieces 2 and 2*a*, and central legs 3 and 3*a*, forming pole pieces between which an armature of the flat or strip type 4 is mounted. The core sections are preferably formed of laminations of soft iron which may be held together by rivets 5. A pair of voice coils 6 surround the armature 4 on either side of the pole pieces 3 and 3*a*, and a pair of field coils 7 surround the said pole pieces. Loud speakers of this general construction have heretofore been made and no further or more particularized description of the elements just mentioned is thought to be necessary. In our invention, however, we achieve improvements in the assembly of the parts aforementioned which not only result in a more economical construction, but also an improvement in operation. Heretofore it has been the practice to mount the armature 4 in spacing blocks of rubber or other resilient material, which, although good speakers could be made in this way, nevertheless gave some trouble in construction and in operation, largely due to variations in materials initially or in changes in materials after a lapse of time. The armature in speakers of this type has hitherto been supposed to be self-centering, or adjustment was of a less effective type. Centering devices have been attached to the drive rod, but these devices tended to affect reproduction.

One of the objects of our present invention is to provide a fixed gap between the poles 3 and 3*a* in which the armature is located and then to provide means for centering the armature in this gap or of correcting the centering of the armature therein. We provide a metallic mounting on the ends of our armature, which mounting also serves rigidly as means for spacing the poles. We may do this by locating on either side of our armature 4 between the said armature and the legs 2 and 2*a*, small blocks of metal or pieces of sheet metal indicated in Figure 2 at 6. Or we may gain the same result by taking a small piece of sheet metal and lapping it over the ends of our armature so that it assumes a U shape and lies between the armature and the legs 2 and 2*a* respectively. In constructing our motor after the assembly of the laminations which make up the cores 1 and 1*a*, we grind or otherwise dress the ends of the legs 2 or 2*a* and the end of the pole piece 3 or 3*a* so that they lie flush in a single plane. The thickness of the pieces of metal 6 lying on either side of our armature between the legs 2 and 2*a* will, of course, space the poles 3 and 3*a* apart an equivalent dis-

tance, and since there is no extra metal lying upon the sides of our armature between the poles, sufficient room will be allowed for the vibration of the armature 4 between the said poles. This will be readily understood from an examination of Figure 2 and it will also be appreciated that we can vary the space of our poles by varying the thickness of the metal pieces 6. So long as the cores 1 and 1*a* are held in opposed relationship as shown, with the armature between them, our motor will be an operative assembly.

It has hitherto been the practice, however, to fasten the cores to a rigid support, and this has allowed for no substantial adjustment of the armature. We gain one of the objects of our invention and secure a ready adjustability of our armature in relation to the gap between pole pieces 3 and 3*a*, as well as an adjustment of our armature with reference to the motion transmitting means of our speaker, and the cone or other vibratile device thereof, by mounting the motor assembly hereinabove described in a frame in which it can be made to slide, and then providing means for adjusting its position in the same frame, the frame being fixed in position with relation to the main supporting structure of our loud speaker and/or the motion transmitting device.

We have shown in several figures a frame work which may conveniently be of pressed metal and which comprises a top portion 7*a* and side portions 8. The side portions have flanges 9 bent over at their edges which serve both to make the side members rigid and also to form guideways in which our motor assembly as hereinabove described may slide. The top member 7*a* may likewise have turned over edge flanges 10 which flanges serve a stiffening function. The lower ends of the side members 8 are provided with perforations 11 through which ears on a supporting structure may extend. This supporting structure is shown in the several figures and comprises a top portion 12, turned over side members 13, and flanges 14 on the ends of the side members. The supporting structure is thus essentially a U shaped member, as shown in Figure 5, with turned over attachment flanges. The ends of the top portion 12 are prolonged and are formed into turned over ears 15 which extend through the perforations 11 in the side members of the frame hereinabove described and contact the lower portion 11*a* of the said side members.

We have indicated in the several figures a spring construction formed of one or more plates 16 of spring metal curved to arcuate shape and adapted to contact at its ends the ears 15 and at its central portion the central portion of the core member 1*a*. This is clearly shown in Figures 1 and 2. The function of this spring is to force our motor assembly in the frame described toward the top member 7*a* thereof. It has the coordinate function of holding the supporting structure comprising members 12, 13 and 14, in proper relationship with reference to the frame. We place a bar 17 in the channel formed by the top member 7*a* and the flanges 10 of our frame and we perforate this bar and the member 7*a*, threading the perforation in the bar for the reception of an adjustment screw or bolt 18. A lock nut 19 may be placed upon this bolt so as to engage against the top member 7*a* of our frame. The bolt may be used to force our motor assembly downwardly in our frame work as shown in Figure 2, against the resilience of the spring member 16. Thus by adjustment of the bolt or adjustment screw 18, we may control the position of our motor assembly within the frame comprising members 7*a* and 8.

Our motor is equipped with the usual drive rod 20, which is attached to our armature 4 at one end and extends through a perforation 21 in the pole piece 3*a*. The purpose of this rod is of course, to transmit motion from the armature to the cone or other vibratile device, but instead of attaching our cone directly to this drive rod, (which, however, may be done), we prefer to employ a motion transmitting device which we shall now describe. We have shown in Figure 1, a post 22 mounted upon the top portion 12 of our supporting structure or bracket, extending within the U shaped construction thereof in a direction opposite to the direction of extension of the frame. To this post as by means of a bolt 23, we have attached a motion transmitting lever 24, which advantageously may be of modified cantilever shape and which as shown (in the end of U of Figure 3) has a lever portion 24*a* and reinforcing triangular shaped flanges 24*b*. A drive rod 20 of our motor is attached to this lever as at 20*a* at some point between the bolts 23 and the outer end of the lever, when an increase in the amplitude of motion is desired. The ratio of motion increase or decrease can of course, be adjusted, as will be clear to one skilled in the art. In the embodiment shown we have indicated a cone driving lever at 25 which is attached to the outer end of the lever as shown at one end, and at the other may be attached to a cone 26. We have shown a cone housing 27 surrounding the cone and providing mounting means for the outer edges thereof. These mounting means are not a part of our present invention as such, but we have shown on the outer periphery of the rounded housing 27, a flange 27*a*. A ring 28 holds against this flange a circular piece 29 of mounting material, usually of a non-vibratile material, to which the edge of the cone 26 may be attached if desired. The drive rod 25 may be provided with the usual adjustment screw 30; and the housing 27 may

be provided with any means desired for mounting the speaker as such in a cabinet or set. We have shown as exemplary ears 31 struck up from the flange 27*a* and provided with perforations 32.

The rounded portion of the housing 27 terminates in a flat back or rear portion 33, which forms a convenient supporting surface for our motor, and to which the flanges 14 of our supporting structure as described may be attached as by rivets 34, bolts or other suitable means. The back portion 33 of our housing is cut out as at 35 to give clearance for the end of the drive rod 20*a* and for the passage of the drive rod 25. Ears 36 may be struck up from the back portion 33 of our housing as shown in Figure 1, and a motor housing device 37 arranged to slip over the motor and be held by these ears. The cover 37 may have about its open end an inturned head and the ears may be concaved slightly to cooperate with this head, so that our cover may be snapped on over the ears, but can readily be removed for motor adjustment.

It will be understood that our lever arm 24 is held upon the post 22 by the bolt 23 which passes through a perforation therein. The arm moves as a lever by flexing at or near its point of attachment by means of a bolt 23, the stiffening flanges 24*b* effectually preventing flexing elsewhere. Our armature may be adjusted for best reproduction, as hereinabove indicated, by moving the motor assembly in the grooves of our frame, the armature being adjusted in the air gap with or against the resiliency of the flexible part of our lever arm 24.

For the purpose of making a suitable electrical connection to our coils 6 and 7, we have shown a construction comprising ears 38 (Figure 4) to which fibre or other insulating plates 39 may be attached as by rivets 40. These ears are struck up on the flanges 9 of the side members 8 of our frame. Suitable terminals or binding posts 41 may be attached to these plates and the various leads from the coils brought out to these terminals.

Modifications may be made in our invention without departing from the spirit thereof.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a loud speaker, a mounting surface, supporting means attached to said mounting surface, a frame comprising guide ways held to said supporting means, a motor assembly, slidable in said guideways, an adjusting screw in said frame bearing against said motor and a spring holding said motor against said adjusting screw, and a motion transmitting lever mounted upon said supporting means.

2. In a loud speaker, a mounting surface, supporting means attached to said mounting surface, a frame comprising guide ways held to said supporting means, a motor assembly including field and armature structures, slidable in said guideways, an adjusting screw in said frame bearing against said motor and a spring holding said motor against said adjusting screw, projections on said supporting means engaging in slots in said frame, said spring holding said frame and said supporting means in assembled relationship, said mounting surface comprising a housing for a cone.

3. In a loud speaker, a mounting surface, supporting means attached to said mounting surface, a frame comprising guide ways held to said supporting means, a motor assembly, slidable in said guideways, an adjusting screw in said frame bearing against said motor and a spring holding said motor against said adjusting screw, and a motion transmitting lever mounted upon said supporting means, said mounting surface comprising a housing for a cone, an operative connection between the armature of said motor and said lever and an operative connection between said lever and said cone.

4. In a loud speaker, a mounting surface, supporting means attached to said mounting surface, a frame supporting guide ways held to said supporting means, a motor assembly, slidable in said guideways, an adjusting screw in said frame bearing against said motor and a spring holding said motor against said adjusting screw, and a motion transmitting lever mounted upon said supporting means, said mounting surface comprising a housing for a cone, an operative connection between the armature of said motor and said lever and an operative connection between said lever and said cone, a housing for said supporting means, said frame and said motor, and means for detachably connecting said housing with said supporting surface.

5. In a loud speaker motor construction, an assembly comprising a field element and an armature in which the armature is connected to the field element to vibrate relatively thereto, a support, a driven element mounted on said support, operatively connected to said armature for vibration therewith, and means whereby said assembly slides on said support for adjustment of the assembly toward and away from said driven element.

6. In a loud speaker motor construction, an assembly comprising field elements and an armature vibrating between said field elements, a support, a driven element mounted on said support, operatively connected to said armature for vibration therewith, and means whereby said assembly slides on said support for adjustment of the assembly toward and away from said driven element.

7. In a loud speaker motor construction, an assembly comprising a field element and an armature in which the armature is connected to the field element to vibrate relatively thereto, a driven element connected to the armature for vibration therewith, and a support for the driven element, said support and said assembly having guide means engaging together at opposite sides of the assembly, guiding said assembly to slide toward and from the driven element.

RONALD J. ROCKWELL.
AUSTIN F. PARKHURST.