Oct. 30, 1928.

W. D. HOUSE

1,690,011

RADIO LOUD SPEAKER

Original Filed May 2, 1923 2 Sheets-Sheet 1

Fig 1

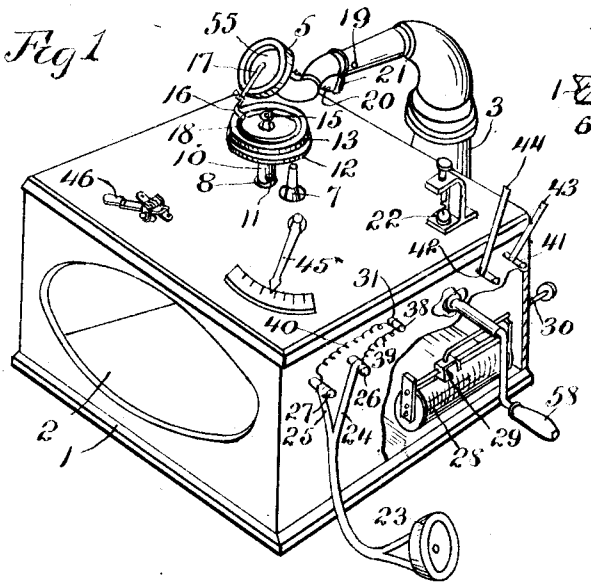


Fig 3

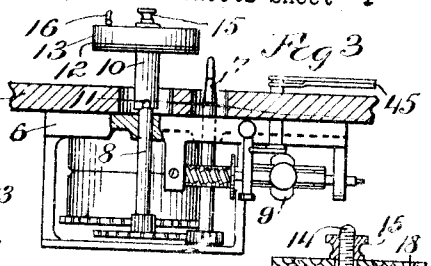


Fig 4

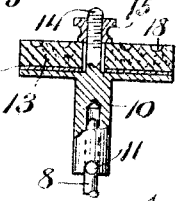


Fig 5

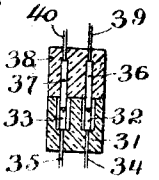


Fig 6



Fig 7

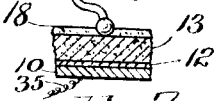


Fig 8

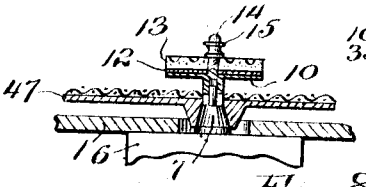


Fig 9

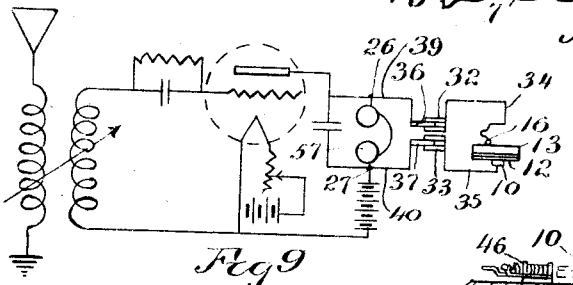


Fig 10

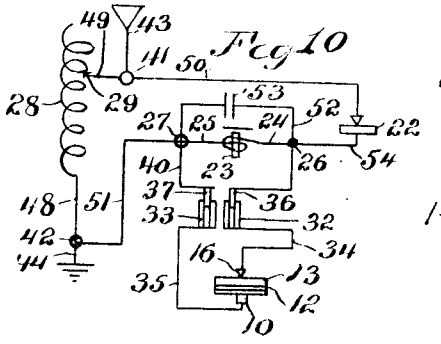
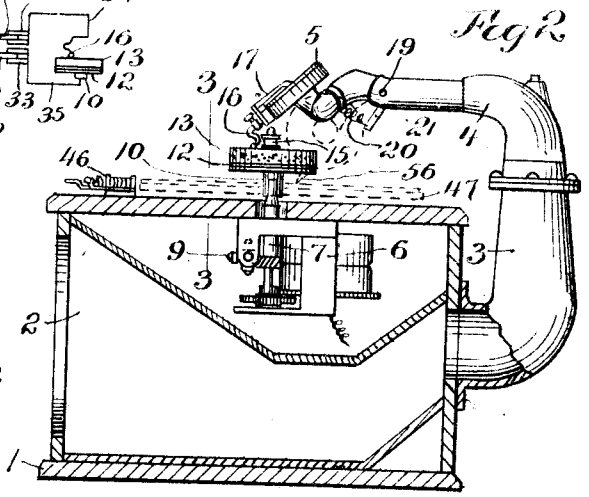


Fig 2



INVENTOR

Warren D. House

Oct. 30. 1928.

1,690,011

W. D. HOUSE

RADIO LOUD SPEAKER

Original Filed May 2, 1923 2 Sheets-Sheet 2

Fig 11

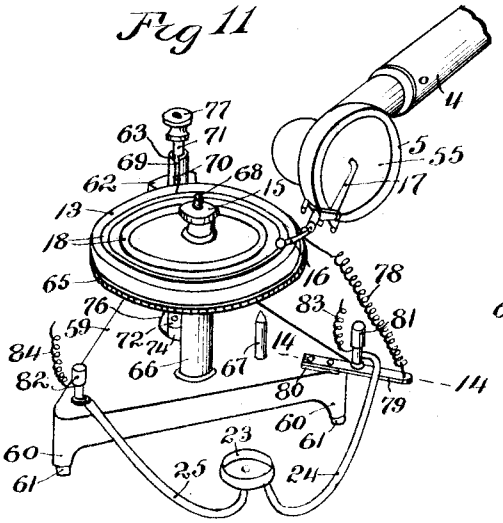


Fig 13

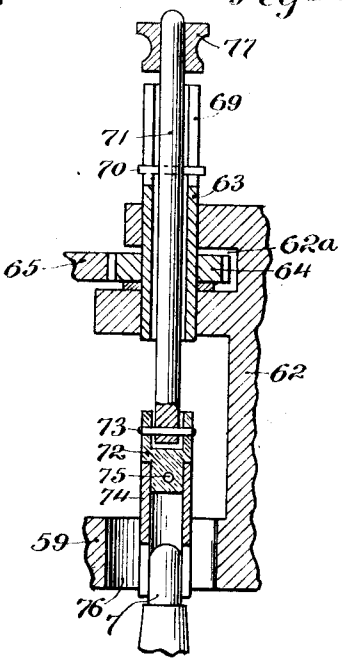


Fig 12

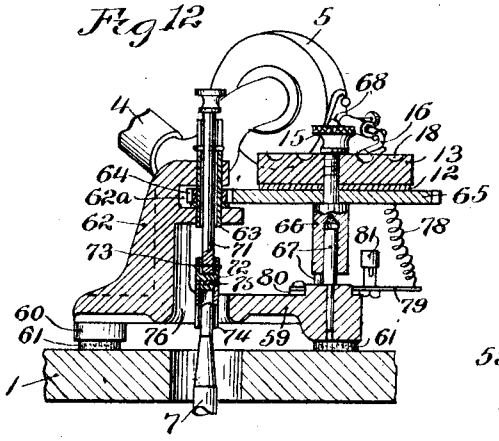


Fig 16

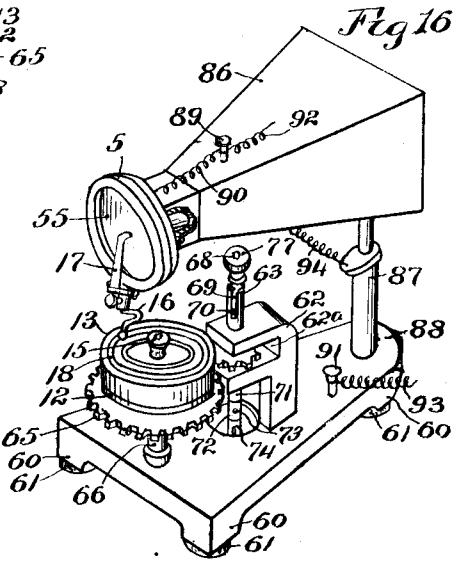


Fig 14

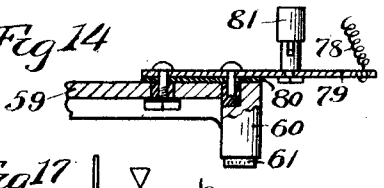


Fig 17

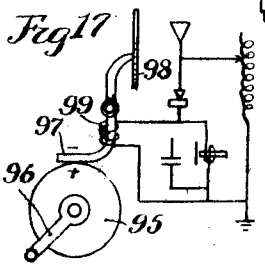


Fig 15



INVENTOR

Warren D. House.

Patented Oct. 30, 1928. 1,690,011

UNITED STATES PATENT OFFICE.

WARREN D. HOUSE, OF KANSAS CITY, MISSOURI

RADIO LOUD SPEAKER.

Original application filed May 2, 1923, Serial No. 636,203. Divided and this application filed November 7, 1927. Serial No. 231,440.

My invention relates to improvements in radio loud speakers. It provides a novel apparatus for converting radio waves into sound waves. This application is a division of my application for an improvement in radio telephony, filed May 2, 1923, Serial Number 636,203.

One object of my invention is to provide a loud speaker for crystal sets, which eliminates batteries, head sets and tubes; which converts radio waves with a minimum of distortion, which is cheaply installed and requires no expense for upkeep or operation; and which can be installed and operated by an unskilled person.

My invention contemplates the utilizing of electrolytic action between two sound producing members, and so controlling the electrolytic relationship between such members by the radio waves, as to produce sound waves corresponding to such waves. It further contemplates the effecting by an extraneous force of continuous movement between two sound producing members having a rubbing or dragging relationship which tends to effect movement of one from the other, such relationship being controlled by radio waves, in a manner such as to convert them with amplified effect into sound waves.

Such rubbing or dragging relationship between the two sound producing members may be frictional engagement by direct contact or interposed means. Or it may be by polarity relationship through attraction or repulsion between the members, effected by electric or magnetic relationship, power being used for effecting the rubbing or dragging relationship, and the action of such power being controlled by the radio waves.

My invention further provides novel means for amplifying the sound waves either by connecting one of the sound producing members with an amplifying member, such as a diaphragm, sounding board or horn, or by providing one of the sound producing members with a sufficient area for the purpose.

My invention further provides for connecting one of the rubbingly or draggingly related sound producing members with the stylus lever of an ordinary phonograph reproducing sound box and amplifying the sounds therefrom in the usual manner. It further contemplates using as the extraneous power for effecting the dragging relationship the motor of the phonograph, and the tone arm, sound box and horn of the phonograph for amplifying the sound waves, in which event the phonograph in addition to its usual functions of playing records of the lateral or vertical cut type, could also serve as a loud speaker to operate in conjunction with either crystal or tube radio receiving sets.

My invention further provides for utilizing shafts of the phonograph motor having different speeds for respectively playing records and reproducing radio wave transmitted sounds.

My invention further provides a novel attachment that may be applied to any ordinary phonograph for obtaining the required power for converting the radio waves into amplified sound waves, the attachment embodying the sound amplifying means.

My invention further provides a novel, simple attachment adapted to be applied to the motor of any usual type phonograph for obtaining the conversion of the radio waves, and having means by which one of the sound producing draggingly related members may be connected with the stylus lever of the sound box of the phonograph, whereby the sound waves can be amplified in the tone arm and horn of the phonograph, without any alteration of or special provision in the phonograph construction for such use.

My invention provides further a novel electrolytic member for co-operating with the movable sound producing member.

The novel features are hereinafter fully described and claimed.

Fig. 1 is a perspective view, broken away, of a phonograph provided with my improvement.

Fig. 2 is a vertical sectional view of the same.

Fig. 3 is an enlarged section on 3—3 of Fig. 2.

Fig. 4 is an enlarged vertical section of the electrolytic block and its holder.

Fig. 5 is an enlarged sectional view of the pole changer.

Fig. 6 is an enlarged perspective view of the needle electrode shown in Fig. 1.

Fig. 7 is an enlarged sectional view of a

sound box in connection with the needle electrode and electrolytic block.

Fig. 8 is a vertical sectional view showing the blockholder mounted on the record supporting shaft of a phonograph motor.

Fig. 9 is a diagram of a circuit to which my invention is applied, and which pertains to a tube set.

Fig. 10 is a diagram of a crystal set circuit to which my invention is applied.

Fig. 11 is a perspective view of the attachment adapted for using with an ordinary phonograph, and which uses the motor thereof for extraneous power, and which employs the sound box, horn and tone arm thereof for sound amplification.

Fig. 12 is a vertical section of what is shown in Fig. 11.

Fig. 13 is an enlarged vertical sectional view of the shaft attaching mechanism shown in Fig. 11 and Fig. 12.

Fig. 14 is an enlarged section on 14—14 of Fig. 11.

Fig. 15 is an enlarged perspective of the needle electrode shown in Figs. 11 and 12.

Fig. 16 is a perspective view of an attachment of my invention which can be used with ordinary phonographs and derives its extraneous power from the record supporting shaft thereof, and which embodies a sound box and horn.

Fig. 17 combines an elevation and a diagrammatic view of a modification which employs power operated electro-magnetic means for converting the radio waves into sound waves.

Similar reference characters designate similar parts in the different views.

Figs. 1 to 3 illustrate a phonograph provided with my improvement. 1 designates an ordinary phonograph box or case having therein a horn 2 connected to an outer tubular bracket 3, which supports an oscillatable tone arm 4 carrying a sound box 5 adapted in the position shown in solid lines in Fig. 2 to play vertical cut records, and arranged, in an ordinary manner to be swung to the position shown in dotted lines for playing lateral cut records.

Supported in the usual manner on the under side of the lid of the box 1 is an ordinary spring motor 6, which for playing records and also for providing extraneous power to convert the radio waves into sound waves, has a high speed record table supporting shaft 7 and a slower shaft 8 for supplying power to the radio mechanism to be described. The shafts 7 and 8 are geared together and to the spring barrel of the motor 6 in the usual manner.

The motor 6 is provided with the usual governor 9, adapted for external regulation.

Removably mounted on the upper end of the shaft 8 is the tubular lower end of the stem 10 of the electrolytic blockholder, Fig. 4, the lower end of which has a notch for receiving a transverse pin 11 in the shaft 8. The block holder 10 carries an electrode plate 12, preferably zinc, on which is mounted the electrolytic block 13, preferably plaster of Paris, or other porous substance, embodying an electrolyte, which may be salammoniac alone, or combined with sodium phosphate and bichloride of mercury absorbed by the block 13 when in solution.

The holder 10 has an upwardly extending stem 14, which extends through holes provided centrally in the plate 12 and block 13, and which on its threaded upper end has mounted removably a nut 15 which bears on the top of the block 13, and is preferably of material electronegative with relation to the electrolyte and plate 12, such as nickel, iron or brass nickel plated or other suitable material. The positions of the electropositive and the electronegative members may be reversed, but it is very important that the radio waves which pass through the block 13 from one electrode 12 to the needle electrode 16, adapted to be mounted in the socket of the stylus lever 17 of the sound box 5, shall pass in the proper direction with relation to the electric current passing constantly between the plate 12 and the nut 15, in order to get the loudest sounds. The block 13 in its best condition is quite dry, it being necessary to moisten that portion of it which carries the needle electrode 16 only sufficiently at times to provide some moisture for strong electrolytic action.

The electrode needle 16 is preferably electronegative with respect to the electrolyte, such as nickel or German silver.

For guiding means for the electrode 16, the upper side of the block 13 may be provided with concentric grooves 18 in which the ball end of the needle electrode travels, when the block 13 is rotated with the shaft 8. If the plate 12 is carbon or other electronegative material, the nut 15 should be zinc or other electropositive material with relation to carbon. The direction of the radio waves through the block should then be reversed to obtain the loudest sounds. The block 13 should be of nonconductive material, or at least a poor conductor to obtain the best effect.

The sound box 5 is arranged to swing on a horizontal pin 19 in the tone arm 4, and it has releasably attached to it one end of a coil spring 20, the other end of which is attached to a pin 21 in the tone arm, the tension of the spring being such as will have the needle 16 press against the block 13. When a record is to be played, the spring is detached from the sound box. The spring can be dispensed with in playing the radio, but not with as loud effects.

An ordinary crystal detector 22 may be mounted on the box 1 and connected in cir-

cuit with a resistance element, preferably inductive, as an ordinary ear phone 23, the terminal wires 24 and 25 of which are connected to binding posts 26 and 27 on the box 1.

In the box 1 may be mounted a tuning element, such as a tuning coil 28 having the usual slide contact 29 having an operating rod 30 extending outside the box 1, Fig. 1.

For changing the direction of the radio waves through the block 13, a simple pole changer is provided consisting of an insulation block 31, Fig. 5, mounted in the wall of the box 1, and having therein two separated contact tubes 32 and 33 to which are respectively connected conductors 34 and 35, which respectively connect with the electrode needle 16 and the electrode plate 12.

Adapted to slide in and conductively engage the tubes 32 and 33 are two contact pins 36 and 37 mounted in an insulation block 38 and respectively connected by conductors 39 and 40 with the binding posts 26 and 27. By reversing the pins with respect to the tubes 32 and 33, the direction of current through the block 13 is reversed. The proper connection with the pole changer is determined by trial. The ear phone 23 should have high resistance, as should the block 13, say of one thousand or more ohms, and they should be connected in multiple, with the detector and ground.

On the box 1 are binding posts 41 and 42 to which are respectively connected an aerial conductor 43 and a ground conductor 44.

45 is the speed regulating motor lever, and 46 the stop lever for engaging the record table 47.

In Fig. 8, the holder 10 is shown mounted on the shaft 7 over the record table. The block 13 may be used in this way, by slowing down the motor. As the speed required for the block 13 under the electrode 16 may be very slow, it is best to remove the record table 47 and mount the holder on the shaft 8, as shown in Fig. 1. The speed of revolution need not be more than two or three times a minute for the block 13. Loud sound waves will be produced at this speed, and the motor will not require frequent winding for playing the radio mechanism.

In Fig. 10 is shown an ordinary crystal set circuit which includes the pole changer, electrodes 12 and 16, block 13 and holder 10. The coil 28 is connect . as usual with ground by a conductor 48 attached to the binding post 42. A conductor 49 connects the sliding contact 29 with the binding post 41. A conductor 50 connects the binding post 41 with the detector 22. A conductor 51 connects the binding post 27 with the binding post 42. A conductor 52 including a phone condenser 53 may connect the binding posts 26 and 27. A conductor 54 connects the detector 22 and post 26.

Radio waves passing from the aerial conductor 43 through the binding post 41, conductor 50, detector 22, conductor 54, and post 26 will divide, some waves passing through the phone 23 by conductors 24 and 25 to the binding post 27, and others passing to the latter through the conductor 39, pin 36, tube 32, conductor 34, contact 16, block 13, plate 12, holder 10, conductor 35, tube 33, pin 37, and conductor 40. From the binding post 27, the waves will pass to ground through the conductors 51 and 44 and post 42.

In passing through from the electrode 16 to the block 13, or the reverse, depending on the adjustment of the pole changer, the radio waves will be converted into sound waves, if the block 13 is revolved in contact with the electrode 16, and the sound waves will be amplified in the usual manner by the diaphragm 55 of the sound box 5, the tone arm 4, tubular bracket 3 and horn 2.

To play a record of the vertical cut type, the electrode needle 16 is removed from the lever 17 and a phonograph needle 56, Fig. 2, substituted therefor. By positioning the sound box as shown in dotted lines in Fig. 2, a lateral cut record may be played.

In Fig. 9, is shown a diagram of a tube set circuit having a well known hook-up, which needs no further description than to say that the sound producing elements are connected to the phone binding posts 41 and 42 of the circuit in the same manner as shown in Fig. 10, the pole changer contact pins being connected to the binding posts in multiple with the usual head set 57, which will serve the function of the inductive electromagnetic resistance element, corresponding in function to the ear phone 23, while the sound producing elements of my invention and the sound amplifying means employed will serve as a loud speaker for the tube set.

From the above it will be understood that the phonograph shown in Figs. 1 and 2 is specially equipped for playing records and for operating any improved radio wave converter, the motor having means for supporting and revolving a record table and the electrolytic block holder, and that the change from one operation to the other may be readily accomplished by an unskilled person.

To operate the radio mechanism, it is but necessary to wind the motor with the usual crank 58, place the holder 10 on the shaft 7 or 8 with the block 13 and plate 12 on the holder, place the electrode needle 16 in the lever 17 and in one of the grooves 18, connect the spring 20 to the sound box 5, start the motor, thereby revolving the block 13 against the needle electrode 16, adjust the detector 22 and tune in with the rod 30 and contact 29 as usual.

In Figs. 11 and 12 is illustrated an attachment of my invention adapted to be quickly attached to the table supporting shaft of phonographs in use for rotating the block 13,

and which has means by which the electrode 16 may be connected with the sound box lever of the phonograph, whereby the tone arm and horn of the latter may be used for amplifying the sounds converted from the radio waves.

The attachment has a stand comprising a base 59 provided with feet 60 having on their bottoms insulation pads, of felt or soft rubber 61 adapted to rest on the top of the phonograph when the record table of the latter is removed. The stand has a standard 62 on the base, having a lateral slot 62^a, and a vertical hole intersecting the slot, and having rotatable in it a sleeve 63, to which is secured and rotatable therewith in the slot 62^a a pinion 64, which meshes with a gear wheel 65 having a vertical tubular hub 66 rotatable on a vertical stud 67 extending upwardly from the base 59.

The gear 65 has an upwardly extending threaded stem 68 extending through the electrode plate 12 and the electrolytic block 13, the plate 12 resting on the gear and the block on said plate. A nut 15 is mounted on the stem 68 and bears on the top of the block 13, the parts being assembled and corresponding to the parts shown in Fig. 4. For effecting turning of the sleeve 63 and the pinion 64, the upper end of the sleeve has end slots 69 in which is slidable a pin 70 mounted in a rod 71 loosely fitted in and vertically slidable in the sleeve 63, and having its lower end loosely fitted in a hole in the upper end of a block of insulation 72, to which the rod 71 is attached by a cross pin 73, Fig. 13. The lower end of the block 72 is tightly fitted in the upper end of a vertical tube 74, which is secured to the block 72 by a pin 75. The lower end of the tube 74 is preferably slotted so as to expand and contact, and adapted to fit tightly on and have a driving connection with the upper end of the usual record supporting shaft 7 of the phonograph. The base 59 has a hole 76 adapted to receive the shaft 7 and the clutch tube 74. The upper end of the rod 71 has a collar 77 mounted thereon, by which the rod 71 may be pulled upwardly to disengage the tube clutch 74 from the shaft 7, and also for effecting connection between the two. The insulation pads 61 and block 72 insulate the device from the metal top and other parts of the phonograph, when such parts are conductive.

When the sound box is disposed for playing lateral cut records, as shown in Figs. 11 and 12, the needle electrode 16 is mounted in the lever 17 in an inclined downward position, and placed with its ball end in either groove 18 of the block 13. In this inclined position of the electrode, the drag of the block 13 thereon will tend to swing the lever 17 so as to bodily move the diaphragm.

For connecting the needle electrode 16 in circuit, and also to press it against the block 13, it has releasably attached to it the upper end of a coil spring 78, or the spring may be releasably engaged with the lever 17. The lower end of the spring 78 is attached to a metal plate 79 fastened to the base 59, but insulated from it by insulation 80, Fig. 14. A binding post 81 mounted on the plate 79, and a binding post 82 is attached to the base 59 in conductive relation to the metal base and stud 67 and the plate 12.

An ordinary ear phone 23 may have its terminal wires 24 and 25 respectively connected to the posts 81 and 82. Conductors 83 and 84 are adapted to respectively connect the binding posts 81 and 82 with the phone binding posts of a crystal or tube set.

In operating the attachment just described, the clutch tube 74 being connected to the shaft 7 is rotated by the latter, thus turning the block 13 under the electrode 16, as described. The radio detected waves from the receiving set passing through the block 13 to or from the electrode 16, will when the block is rotated produce sound waves, which will be amplified by the diaphragm, tone arm and horn of the phonograph to which the attachment is connected. Upon removing the attachment and substituting therefor a record table and record and a phonograph needle for the electrode 16, the phonograph can be used to play records.

Another stud 67, Fig. 11, having the same radial distance from the axis of the pinion 64 as the other stud 67, may be used on which to mount the hub 66 of the gear 65, when it is desired to shift the base of the stand to avoid any projection on the top of the phonograph that might be in the way of the feet of the stand.

The modification shown in Fig. 16 is adapted for driving connection with the record supporting shaft 7 of phonographs in use, and is of similar construction to the attachment described, excepting, the attachment is provided with a sound box 5, the lever of which carries the electrode 16, the sound box being mounted in an amplifying horn 86 pivoted to swing vertically and laterally on a standard 87 supported on the base 88 of a stand corresponding to the one already described. The other parts are constructed and operate in the same manner as described with respect to the other attachment, so far as concerns the means for driving the block from the shaft 7 of the phonograph. A binding post 89 is mounted on the horn 86, if the latter is wood or other nonconductive material. The post 89 is connected by a conductor 90 to the sound box which is metal, as is the lever 17. A binding post 91 is attached to the base of the stand, and conductors 92 and 93 may respectively connect the posts 89 and 91 with the phone posts of a receiving set. When the phonograph is operated to turn the block 13, the sounds produced by the needle 16 and

block 13 from radio waves will be amplified in the horn 86. A coil spring 94 may be connected to the standard 87 and the horn 86 for pressing the electrode 16 against the block 13, if desired.

The modification shown in Fig. 17 effects conversion of radio waves into sound waves electro-magnetically. A rotary permanent magnet 95, adapted to be turned by a crank 96, and having a disk head as one pole is magnetically related to a lever 97 having one end of opposite polarity resting against the periphery of the disk head, the other end of the lever being attached to a diaphragm 98 of any ordinary sound box. A high resistance winding 99 encircles the lever 97 adjacent to the disk and has its terminals connected with the phone binding posts of any radio receiving set, as, for example, the crystal set, the circuit of which is shown in Fig. 17, and which is a well known hook-up.

If the crank 96 is turned, the attraction of the magnets 95 and 97 for each other will drag the lever magnet so as to effect a strain in the diaphragm. Radio waves passing through the winding 99 in a direction such as to demagnetize the lever 97 or change its polarity, will reduce the attraction of the magnets for each other, and will decrease the drag, so that the diaphragm will retract and make sound. The sound waves produced by the diaphragm will correspond to the radio waves which cause them.

It will be noted that in the different forms of my invention shown that the moving relationship between the two sound producing members is effected by an extraneous force which moves one member which is draggingly related to the other, as by being in frictional contact therewith. This extraneous or external force in being applied to effect the relative movement provides a relatively strong power, through the utilization of which loud sounds may be produced by the sound producing members, the radio waves merely controlling such power so as to produce sounds which correspond with the radio waves.

The extraneous force used to effect the continuous movement of one of the sound producing members relatively to the other for storing energy, may be directly applied manual power, as in Fig. 17, or it may be derived from any suitable motor operated by spring, electric, hydraulic or gravitational means.

Where the two sound producing members are electrolytically related, as by one being or containing electrolytical material, the extraneous force is employed to vary this relationship, by continuously moving one with relation to the other, so as to present constantly fresh contacting surfaces, whereby the radio waves may so control the electrolytic relationship as to convert radio waves into sound waves corresponding thereto.

It will be noted that in the different forms of my invention having a diaphragm operated by a lever, that the sound producing member which is attached to the lever engages the other sound producing member in a manner such that the latter will drag or tend to drag the lever in a direction at an angle to the diaphragm and the axis of the lever, whereby the lever bodily moves the diaphragm, and, of course, the maximum movement of the diaphragm, and the loudest sounds will be produced and amplified, when this angle is a right angle relative to such lever axis.

As shown in Figs. 6 and 15, the needle electrode 16 is bent and has a relatively large contact portion for engaging the electrolytic block, and has its other end portion other than circular in cross section, the cross section shown being triangular, whereby when the electrode 16 is mounted in a stylus holder having a similarly shaped socket, and the sound box 5 is in the lateral cut record playing position, shown in dotted lines in Fig. 2 and in Figs. 11 and 12, the spring pressure or gravity which holds the needle electrode 16 in firm contact with the block 13, will not tend to turn the needle electrode or stylus electrode in its holder from the inclined position of the electrode shown in Fig. 11.

The bent form of the needle electrode 16 enables it to have its ball contact end in substantial alinement with and between the axis of the stylus lever 17 and the axis of rotation of the block 13, whereby the most effective dragging action is obtained by the block 13 relative to the electrode 16. The bent form of the electrode 16 further affords in it a limited spring action, whereby the electrode is held against the block 13, even when violent radio wave conversion is being effected. This enlarged rounded end of the electrode reduces its liability to chatter or unduly wear the block 13, while presenting a relatively large surface contact for electrolytic action, much greater than would be the case, if the rounded end portion were of no greater diameter than the shank that can enter the stylus socket of an ordinary sound box lever.

By having the electrolytic block 13 provided with electrode guiding means, such as the grooves 18, the electrode 16 is held in one path of travel against the block 13, and I have found that this greatly increases the loudness of the sounds which are radio derived.

The grooves 18 of different diameters are provided so that if one groove becomes unduly rough or worn, the electrode 16 may be operated in the other groove, thus extending the period of utility of the block. The different grooves are provided also to enable the electrode to travel in the groove of smaller diameter when the block 13 is mounted on the fast moving shaft 7, or when the motor can

not be slowed down sufficiently to provide the proper relationship of speed between the block and electrode 16.

The shafts 7 and 8, as shown in Fig. 1, are disposed with reference to the axis of the tone arm 4, in positions such that the record playing stylus 56 and the electrode 16 shall have their most effective positions with relation to the record and the block 13 respectively.

With relation to the attachments shown in Figs. 12 and 16, one reason for mounting the block 13 on the reducing gear 65 having its axis eccentric to the shaft 7, is to provide relatively slow speed of revolution as compared to the speed of the record revolving shaft 7, thus reducing wear between the block and electrode, and also reducing the rubbing sound between them so as to render it inaudible at a very short distance. Another object of mounting the block on the gear 65, is that it will give a planetary adjustment of the block around the shaft 7, by circumferentially adjusting the stand base 59 around the shaft 7, whereby the needle electrode 16 may be mounted in the most effective position on the block 13, when the attachment is mounted on phonographs having different lengths of tone arms, and different distances between the axis of the tone arm and that of the shaft 7.

The form shown in Fig. 16, which embodies the sound box and horn in the attachment, ma be used in cases where it is not practicable or expedient to utilize the amplifying means of the phonograph for carrying the needle electrode and amplifying the sound waves, as is done with the attachment shown in Figs. 11 and 12.

The cylindrical upper end of the record revolving shaft 7, Fig. 13, in modern makes of phonographs playing disk records, is substantially of a standard diameter for fitting in the holes of different makes of records. This feature in the record shafts makes such cylindrical portions thereof particularly well adapted for driving engagement with the clutch tube 74 of the two types of attachments shown, the tubes being slightly resilient adapting themselves readily to shafts 7 and having these portions slightly varying in diameters. The clutch tube 74 may be vertically adjustable for the purpose of adapting the attachment to phonographs in which the record revolving shafts 7 extend different distances above the tops of the phonograph cases, and for the engagement and disengagement of the clutch tube 74 with the shaft 7. For the latter purpose, however such vertical adjustment is not essential, as without vertical adjustment of the tube 74 with relation to the base 59, or 88, as the case may be, the base may be lifted for disengagement of the clutch tube 74 with the shaft 7, or forced downwardly to effect such engagement.

While the forms of my invention shown in Figs. 1, 2, 11, 12 and 16 are particularly well adapted for loud speaking purposes in association with radio waves rectified with a contact detector, such as a crystal, or with a single tube detector, they may also be used for converting battery or electromagnetic telephone currents into loud speaking, and this under conditions which would prevent audible sounds being produced were the rectified radio waves substituted for the telephone currents. This difference in operation is due to the difference in amperage between telephone currents and radio waves. The amperage of the rectified radio waves is almost infinitesimal as compared with that of ordinary telephone currents. It is far less than a bolt of lightning, which, while having tremendous voltage, it is said, has insufficient amperage to decompose a drop of water. The principle involved in the operation of my invention, and also that of the well known Edison chalk cylinder and electrolytic tape speaking telegraphs, is the decomposition of the electrolyte of one of the contacting rubbing sound producing members by the electrical fluid which is passing through it. The greater amount of decomposition, the greater will be the slip of the metal contact on the electrolytic member, and the louder will be the sounds produced. The decomposition of an electrolyte is proportionate to the amperage and independent of the electromotive force of the traversing electrical fluid. Ordinary telephone currents have almost immeasurably greater amperage than radio waves, and, consequently, far greater electrolyte decomposing power.

The wet contact surface and broad contact member rubbing thereon, of the well known Edison electro-motograph and chalk cylinder chemical telephone, are well suited to the high amperage and low potential of ordinary telephone currents, but are wholly unsuited for use in connection with radio waves, and when so used, no audible results are obtained.

I discovered that to obtain practical audible resiflts with radio waves of the magnitude obtained with rectification with a crystal or single tube, it was necessary to concentrate the rectified waves to a very small contact space, to as near a point as the mechanical conditions of wear would permit, and to present to the rectified waves at such point of contact a very high electrical resistance, corresponding to and adapted for the very high potential and minute amperage of radio waves.

To obtain such relatively high contact resistance and concentration, the block 13, as hereinbefore stated, is used quite dry, and the ball of the needle 16, as best shown in Fig. 12, has a shorter radius than the radius of the groove 18 in the electrolytic block 13, thereby providing practically a point contact and the

very high contact resistance required for practical loud talking with crystal detected radio waves.

As the frictional pull on the needle is the same regardless of the area of surface contact, there is no decrease in the length of vibrations of the needle due to the small surface contact with the block.

As telephone currents have relatively large amperage, the requirements, necessitated for loud talking with crystal rectified radio waves, may be ignored when using telephone currents in connection with two electrolytically related contact members, and the best results are obtained, in the use of telephone currents, with a large contact area and a wet electrolytic member, but with such a construction and conditions audible sounds will not be produced with the use of crystal or similarly detected radio waves.

What I claim is—

1. A radio loud speaker comprising two relatively movable electrically conductive members in frictional engagement with each other, one of said members having electrolytic properties, said members having between them a relatively high electrical resistance corresponding to the high potential and adapted for the low amperage of rectified radio waves, sound amplifying means connected to and operated by one of said members, and means to effect relative movement between the members, the electrolytic and other characteristics of the electrolytic member being such that electric currents of the magnitude of those produced in a radio receiving circuit by a crystal detector or a single vacuum tube detector will serve to vary the friction between said members and thereby produce a clearly audible signal.

2. A loud speaker comprising a rotatable electrolytic member having a circular concentric guide, a metal electrode in direct contact with said guide and adapted for travel thereon, sound amplifying means connected with and operated by said electrode, and means whereby electric currents may be passed through the electrode and said rotatable member.

3. A loud speaker comprising a rotatable member having a circular concentric groove, a metal electrode in direct frictional contact with and adapted to travel in said groove, and means for passing electric currents through the electrode and through said movable member, the electrode and said movable member having such characteristics that the passage of the current from one to the other varies the friction therebetween.

4. A loud speaker comprising a rotatable member having a circular concentric guide, a metal electrode in direct frictional contact and adapted for traveling engagement with said guide, and means for passing electric currents through the electrode and through said movable member, the electrode and said movable member having such characteristics that variations of the current from one to the other tends to vary the friction therebetween.

5. A loud speaker comprising a rotatable member having a substantially horizontal operating surface, an electrode in frictional engagement with said member, sound amplifying means connected with and operated by said electrode, means for passing an electric current through the electrode and said movable member, and means whereby said movable member may be detachably connected to a vertical rotary spindle.

6. A radio loud speaker attachment for phonographs having a rotary spindle and sound box, said attachment comprising a supporting base, a rotary member mounted thereon, means whereby said rotary member may be operatively connected to the spindle of the phonograph, an electrode adapted to be inserted in the stylus holder of the phonograph sound box and be positioned in frictional engagement with said rotary member, and means whereby electric currents may be passed through the electrode and through said rotary member.

7. A radio loud speaker attachment for phonographs having a rotary spindle and sound box, said attachment comprising a supporting base, a rotary member mounted thereon, means whereby said rotary member may be operatively connected to the spindle of the phonograph, an electrode adapted to be inserted in the stylus holder of the phonograph sound box and be positioned in frictional engagement with said rotary member, and means whereby electric currents may be passed through the electrode and through said rotary member.

8. A radio loud speaker attachment for phonographs having a rotary spindle and a sound box, said attachment comprising a supporting base, a rotary member detachably supported on said base, means for rotating said member, means for detachably connecting said last named means with the spindle of the phonograph, an electrode adapted to be inserted in the stylus holder of the phonograph sound box and be positioned in frictional engagement with said rotary member, and means whereby an electric current may be passed through the electrode and through said rotary member.

9. A radio loud speaker attachment for phonographs having a sound box, said attachment comprising a rotatable member, means for actuating the same from a rotary part of the phonograph, an electrode adapted to be inserted in the stylus holder of the phonograph sound box and be positioned in frictional engagement with said rotatable member and means whereby an electric current

may be passed through the electrode and through the rotatable member.

10. A radio loud speaker attachment for phonographs having a rotary spindle and sound box, said attachment comprising a supporting base, an electrolytic member having a substantially horizontal operating surface rotatably mounted on said base, means whereby said electrolytic member may be operatively connected with the phonograph spindle, an electrode adapted to be inserted in the stylus holder of the phonograph sound box and be positioned in frictional engagement with said electrolytic member, and means whereby an electric current may be passed through the electrode and through said electrolytic member.

In testimony whereof I have signed my name to this specification.

WARREN D. HOUSE.