

April 26, 1932.

W. D. LA RUE

1,855,840

TALKING MACHINE

Filed May 23, 1923

5 Sheets-Sheet 1

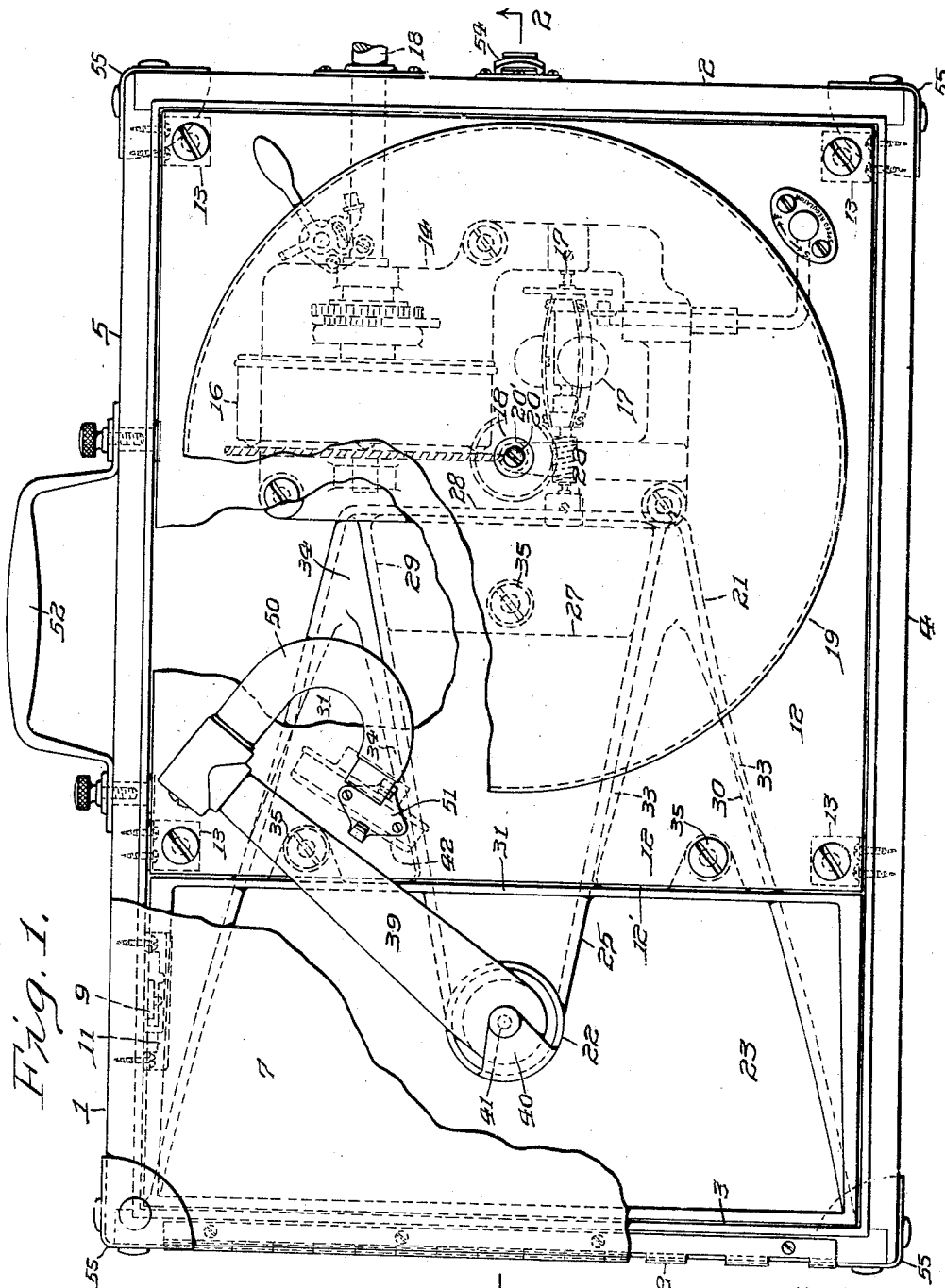


Fig. 1.

WITNESS

F. J. Hartman.

INVENTOR
William D. La Rue.
BY *Clouet, Moulton & Heller*
ATTORNEYS

April 26, 1932.

W. D. LA RUE

1,855,840

TALKING MACHINE

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5 Sheets-Sheet 2

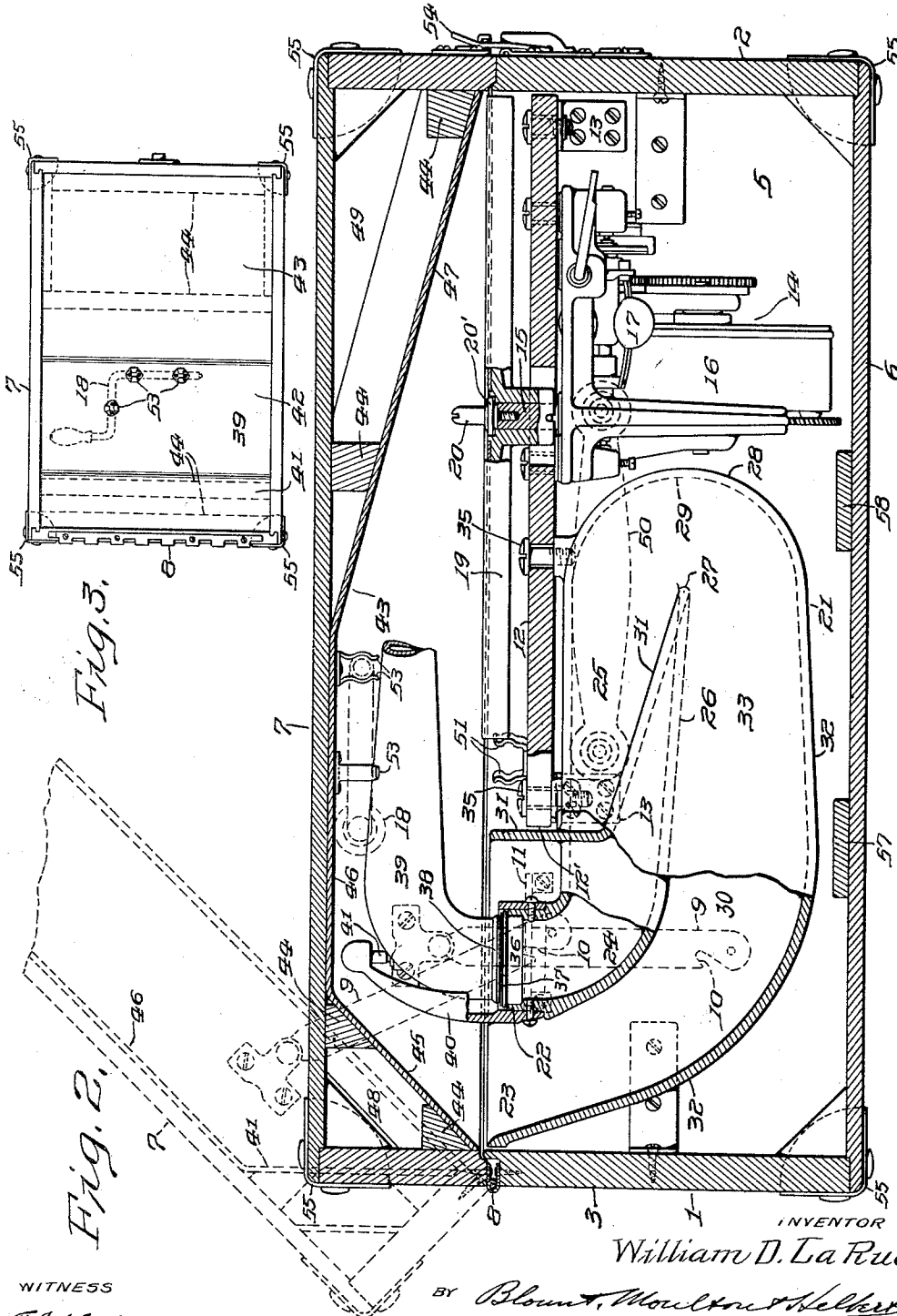


Fig. 3.

Fig. 2.

WITNESS

H. J. Hartman,

BY *Blount, Moulton & Helbert*

ATTORNEYS

INVENTOR
William D. La Rue.

April 26, 1932.

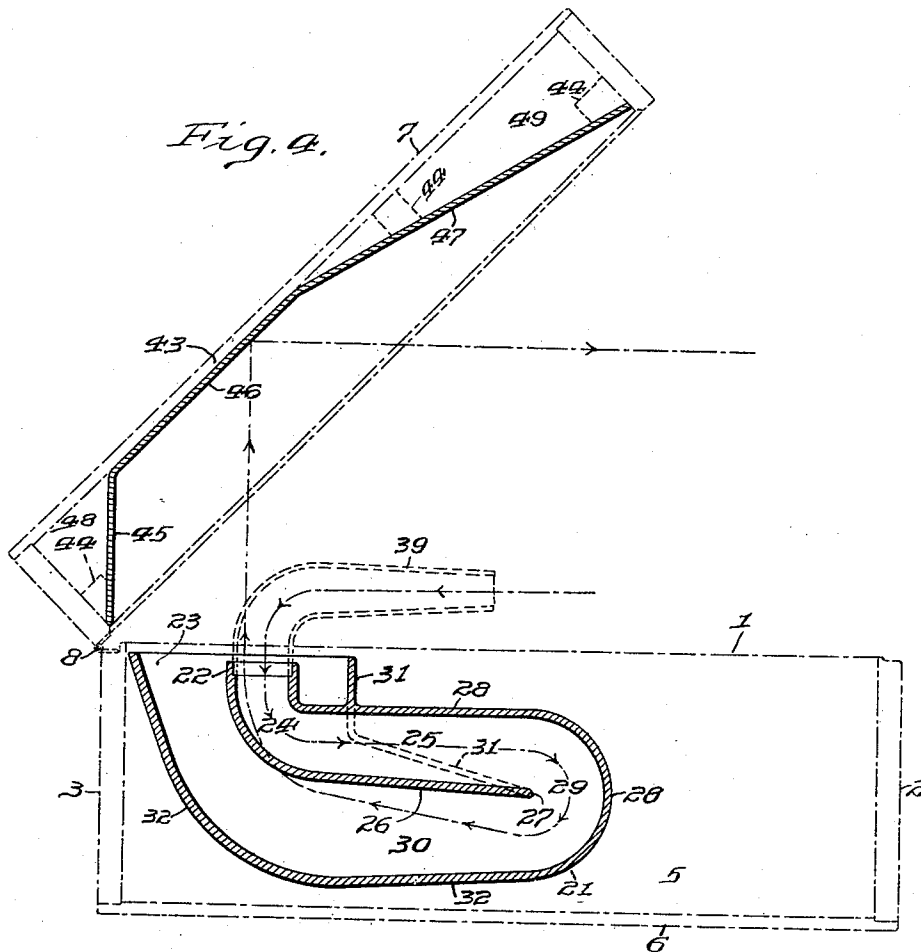
W. D. LA RUE

1,855,840

TALKING MACHINE

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5 Sheets-Sheet 3



WITNESS

F. J. Hartman,

INVENTOR

William D. La Rue.

BY

Abner T. Moulton & Helber

ATTORNEYS

April 26, 1932.

W. D. LA RUE

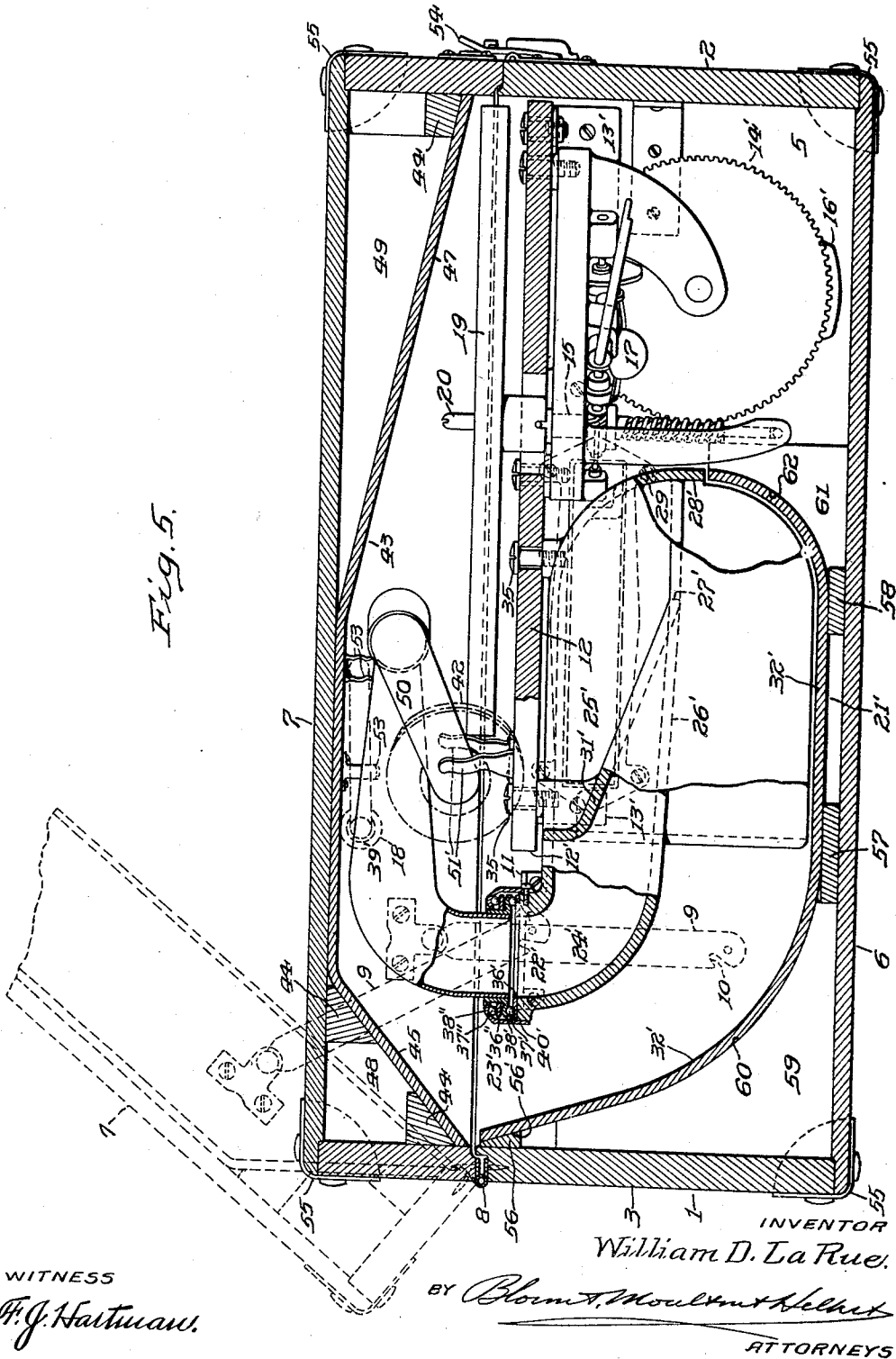
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TALKING MACHINE

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5 Sheets-Sheet 4

Fig. 5.



WITNESS

H. J. Hartman.

INVENTOR
William D. La Rue.

BY *Bloom, A. Moulton & Helms*
ATTORNEYS

April 26, 1932.

W. D. LA RUE

1,855,840

TALKING MACHINE

Filed May 23, 1923

5 Sheets-Sheet 5

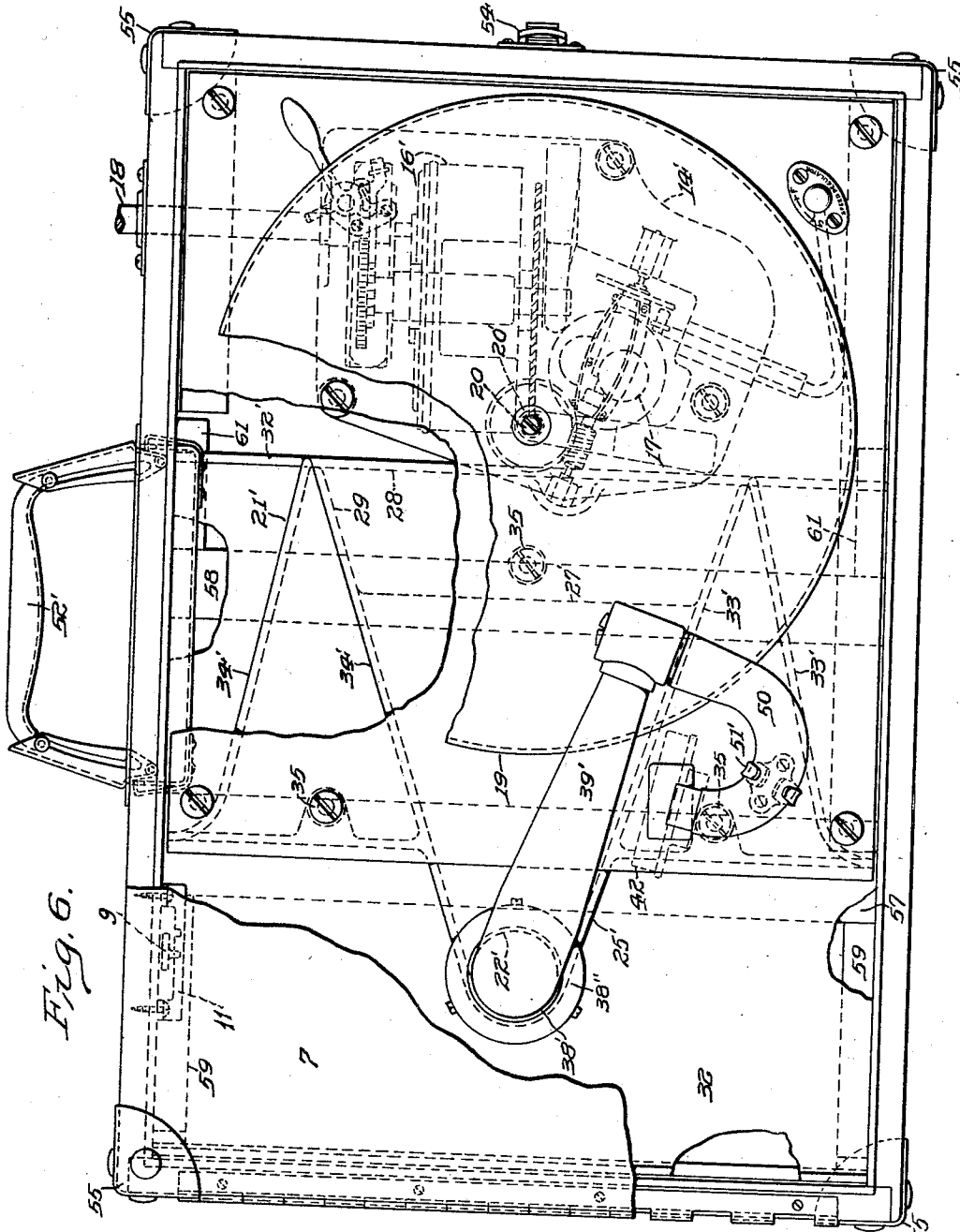


Fig. 6.

INVENTOR

William D. La Rue.

BY *Blount, Moulton & Helmer*
ATTORNEYS

WITNESS

F. J. Hartman.

UNITED STATES PATENT OFFICE

WILLIAM D. LA RUE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO RADIO CORPORATION OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

TALKING MACHINE

Application filed May 23, 1923. Serial No. 640,829.

My invention relates to talking machines, and more particularly to cabined or enclosed talking machines of the small light-weight portable type, from which heretofore it has been difficult to obtain the volume and pleasing quality of the tone during reproduction of sound from a record that is obtainable by the use of much larger machines. Generally speaking, it has heretofore been found necessary to sacrifice volume and quality in the reproduced sound in order to obtain the light-weight and the small size which should characterize a portable talking machine.

One of the objects of my invention is to overcome these objections; that is to say, to produce a small, light-weight, portable talking machine capable of reproducing, from a record, sound having substantially as great a volume and as pleasing a quality as that which is obtainable from said record when reproduced on large, heavy, substantially non-portable machines.

A further object of my invention is to provide a talking machine with an amplifying means of such shape, proportions, material and effective length, that the sound amplified thereby, is not trapped, lost, absorbed, muffled, or reflected back upon itself in passing therethrough, but is rather so deflected, without absorption or interference, as to pass directly through the amplifying means, following, substantially, the median line of the tapering passage therethrough, and to be delivered substantially horizontally from the machine.

A further object of my invention is to make a sound amplifying horn of such materials and the walls thereof of such rigidity and the interior surface thereof of such smoothness that the energy of the sound waves conducted thereinto is not substantially absorbed or expended in vibrating the walls thereof, but instead is reflected longitudinally of the passage therethrough and directly out of the larger end thereof.

A further object of my invention is to make an amplifier, or a substantial part thereof, of a single integral casting of metal, (preferably aluminum, for lightness, rigid-

ity and the property of not absorbing sound) having a longitudinal passage therethrough affording smooth progressively diverging walls.

A further object of my invention is to make the height of the cabinet only so much greater than the combined height of the motor, turntable and tone arm or tone arm mounting as will provide only a mere clearance between the motor and the bottom wall, and between the top of the tone arm and the upper inner wall of the lid or cover when the latter is closed; and to make the width of the cabinet approximate the diameter of the turntable so that the space between the inner side walls of the cabinet and the periphery of the turntable, is substantially only clearance.

A further object of my invention is to so dispose the turntable and motor in the casing that the turntable merely substantially clears said front wall and to dispose substantially all of the motor mechanism between the said front wall of the cabinet and the turntable spindle, whereby all the space to the rear of the spindle is available for housing or enclosing the amplifier, or a substantial part thereof.

A further object of my invention is to provide a talking machine wherein the amplifier occupies substantially all of the space between the turntable spindle and the rear wall of the cabinet, and the said spindle is spaced from the inner side of the front wall of the cabinet a distance slightly greater than the radius of the turntable.

A further object of my invention is to provide the space to the rear of the spindle of a talking machine having a relatively shallow cabinet or casing, with an amplifier having an effective length considerably longer than the length of the cabinet from the front to the rear thereof, and to provide such amplifier with a discharge end or mouth, having a width substantially as great as the inside width of the casing, whereby the structure and the effective size of the amplifier are such as to give large volume to the reproduced sound with the minimum size which it is possible to successfully employ.

A further object of my invention is to dispose or position all of the motor mechanism in the space between the turntable spindle and the front wall of the cabinet and to utilize substantially all of the space between the spindle and the opposite rear wall of the cabinet for housing the amplifier.

A further object of my invention is to provide means operative during the transportation of a portable talking machine from preventing the swinging of the tone arm and the sound box; for holding and retaining the winding key or crank in position within the cabinet; and for preventing the separation of the turntable from the spindle.

A further object of my invention is to provide an amplifying means which is compact, occupies a very small space, provides a very long tapering passage therethrough, has a large mouth, bell or discharge opening, is capable of producing a large volume of sound when placed in communication with the sound reproducing mechanism, and is particularly adapted for but is not limited to use in small cabineted or enclosed talking machines, wherein the space for housing the amplifier is limited.

Other objects of my invention will appear in the specification and claims below.

In the drawings forming a part of my specification and in which the same reference characters are used throughout the various views to designate the same parts, Fig. 1 is a plan view of my improved portable talking machine, the greater portion of the lid of which is broken away to show the reproducing mechanism, turntable and other parts mounted in the top of the cabinet proper.

Fig. 2 is a vertical longitudinal sectional view on the line 2—2 of Fig. 1, the tone arm and turntable, however, being substantially shown in elevation, and the lid or cover being shown in its closed position.

Fig. 3 is a plan view on a greatly reduced scale of the inside of the cover or lid showing the clips by means of which the winding key or crank may be secured to the inside of the lid when the machine is being carried from place to place.

Fig. 4 is a general diagrammatic view showing the amplifier in longitudinal cross-section, and its position within the cabinet with respect to the lid or cover when the same is raised and the machine is being used to reproduce sound from a record. This figure clearly shows the median line of the tortuous amplifying passage following which the sound waves may pass without being reflected back upon themselves, and the relation of the raised lid or cover, thereto.

Fig. 5 is a vertical sectional view similar to Fig. 3, of a modified form of construction; and

Fig. 6 is a plan view of Fig. 5 with the

major portion of the lid or cover broken away.

In both forms of my invention herein shown my improved cabinet 1 preferably comprises a front vertical wall 2, a rear vertical wall 3, two lateral or side walls 4 and 5 respectively, a bottom wall 6, and a lid or cover 7 connected preferably by hinges 8 to the top of the rear wall 3 of the main or body portion of the cabinet. To the lid or cover 7 which virtually comprises a continuation or a part of the amplifier may be pivoted the usual bar 9 having a notch 10 near the free end thereof to engage with a slotted plate 11, when the lid is raised to make substantially an angle of 45° with the main or body portion of the cabinet and to maintain the lid in that position.

Referring now to the structure illustrated in Figs. 1 to 4, the casing or cabinet 1 is provided with a motor-board 12 horizontally disposed within the same and extending from the front wall 2 thereof toward the rear wall 3 of the cabinet but spaced from said rear wall to provide an opening from side wall to side wall. This motor-board may be secured to and supported by brackets 13 secured in any suitable manner to the inside of the side walls 4 and 5 of the cabinet.

On the underside of this motor-board 12 is secured the motor 14 comprising a vertical spindle 15 and a driving mechanism therefor, such as the spring barrel 16. The motor mechanism is so disposed within the cabinet that it does not extend any substantial distance to the rear of the turntable spindle 15. Substantially all of the motor mechanism including the barrel 16 and governor 17 is disposed between the spindle 15 and the intermediate wall 2 of the three consecutive vertical walls 4, 2, 5 of the cabinet and the amplifying horn is located within the cabinet between the spindle 15 and the fourth wall 3 (the rear wall) of the cabinet. The axis of the spring barrel 16 may extend longitudinally of the talking machine, so that the winding key 18 may be inserted into the interior of the casing through an opening in the front wall 2 in alinement with or parallel to the axis of the spring barrel 16.

As is clearly indicated in Fig. 2, the motor 14, secured to the underside of the motor-board 12, is spaced from the bottom wall 6 of the cabinet or casing by a distance sufficient merely to afford substantial clearance between the motor and said bottom wall and the motor-board 12 is disposed below the top edge of the main or body portion of the cabinet a distance sufficient to bring the top flat surface of the turntable 19 slightly above the top edge of the main or body portion of the cabinet. In other words, the depth of the main or body portion of the cabinet is substantially the same as the distance between

the lowest part of the motor and the top flat surface of the turntable 19.

It is also to be noted that the spindle 15 is so disposed on the motor-board as to bring the periphery of the turntable 19 closely adjacent the front wall 2 and the side walls 4 and 5 of a cabinet, so that the turntable is spaced from said walls only substantially a distance necessary to provide clearance therebetween. The turntable is preferably permanently secured to the top end of the spindle 15 by a detachable centering pin 20 providing a shoulder 20' arranged to prevent the removal of the turntable 19 from the said spindle 15. The upwardly extending cylindrical portion of the pin 20 fits into the hole at the center of the usual disc talking machine record.

The motor-board 12 does not extend to the rear wall 3 of the cabinet. It extends only a little beyond the rear edge of the turntable 19. There is a relatively large space between the rear edge 12' of the motor-board and the inner surface of the rear wall 3 of the cabinet.

Arranged as above described, it will be apparent that it is one purpose of the present invention to utilize substantially all of the space bounded by side walls 4 and 5 and the rear wall 3 of the cabinet, and the rear edge 12' of the motor-board, or as much thereof as possible, for the reception of the mouth or bell of the horn section of an amplifier which may be completely enclosed within the main or body portion of the cabinet. If, therefore, the shallow and narrow cabinet herein described be provided with a more efficient or powerful amplifier having an effective length nearly as great as or greater than that found in the large non-portable cabined talking machines and having a passage progressively increasing in cross-sectional area therethrough terminating in a mouth or discharge opening as described, then the volume of sound obtainable from the small portable machine will be substantially equal to or greater than that obtained from such larger machines. In the present invention I have provided such an amplifier, and mounted the horn structure thereof within the cabinet, and within the space which I have provided between the turntable spindle and the rear wall of the cabinet, the same being constructed, arranged and mounted in the cabinet as follows:

The horn structure 21 of the amplifier consists of a hollow preferably cast-metal body having therethrough a passage, the cross-sectional area of which progressively increases from the small or inlet end 22 to the large end 23, the latter constituting the mouth, bell or discharge end of the horn section. Beginning at the smaller preferably circular tapering end 22 of the amplifier, the conduit extends first vertically downwardly,

then by a curved portion or elbow 24 extends laterally and substantially at right angles to the first direction to form a relatively straight but tapering substantially horizontal portion or section 25. At the end of this section 25, the lower wall 26 terminates in an edge 27 and around this edge 27 the outer wall 28 is curved so as to maintain a passageway of continually increasing cross-sectional area. This curved portion of the outer wall 28 substantially forms a reversely curved passage or bend 29 so that after traversing the same the sound travels in substantially the opposite direction to that in which it traveled when passing through the section 25. The end of the reversed bend or curved portion 29 leads into a substantially straight tapering portion 30 formed by the portions 31 and 32 of the outer walls of the amplifier. At the end of the straight section 30 the walls 31 and 32 curve upwardly so as to form the discharge end, mouth or bell 23 of the horn section of the amplifier from which the amplified sound is delivered upwardly to the lid section of the amplifier. Immediately below the cylindrical inlet 22, the walls forming the passage through the horn section of the amplifier smoothly merge into a form rectangular in transverse cross-section, so that the amplifying passage is practically rectangular in cross-section substantially throughout its length.

The upper wall 31 of the large end of the horn section of the amplifier extends substantially from the end 27 of the wall 26 upwardly at an angle to the lower wall 32 of the passage 30. It will thus be seen that from the smaller cylindrical end 22 to the end of the curved upwardly directed bell or mouth 23, the width of the passage in a vertical plane progressively increases. The width of this passage in a longitudinal plane between the side walls 33 and 34 of the horn section also consequently increases as clearly appears in Fig. 1 until at the mouth the said side walls of the horn section are closely adjacent the side walls 4 and 5 of the cabinet. The end of the bell 23 is preferably at or about the level of the top of the main section or portion of the cabinet 1.

It will also be observed that the small cylindrical end 22 is within and is surrounded by the walls of the larger end 23 and that the laterally extending straight portion 25 virtually passes through the wall 31 of the larger end 23 of the horn. The taper of the passage from the end 27 of the wall 26 to the mouth or bell 23 of the horn is such that the passage therethrough is of substantially increasing area in transverse cross-section notwithstanding the fact that the small end 22, the curved part 24 and a considerable part of the smaller straight section 25 lie within the passage 30 and the bell and are enclosed thereby, but the relatively small volume of these parts so pro-

jecting into the larger portion of the horn is more than compensated for by the divergence of the vertical side walls of the horn from the point 27 on to the end of the horn.

It is also to be observed that the passage through this amplifier so increases in width (see Fig. 1) that the larger end, mouth, or bell 23 is as long as the space between the walls 4 and 5, and that the other dimension of the passage so increases that at the mouth 23 it is as wide as the space between the rear wall 2 and the rear edge 12' of the motor-board 12.

This part 21 of the amplifier is preferably secured to the underside of the motor-board 12 by three screws 35. It will be observed that the reversely curved wall 28 approaches close to and substantially just clears the spindle 15 of the motor 14; and that the lower wall 32 of the horn section of the amplifier merely substantially clears the bottom wall 6 of the cabinet; that substantially all of the space to the rear of the edge 12' of the motor-board 12 is devoted to and is occupied by the bell or larger end 23 of the horn section of the amplifier.

The small end 22 of the amplifier may be provided with a lower ball race 36 for a ring of antifriction balls 37, and an upper ball race 38 may be provided on the larger down turned end of the taper arm 39. The upper smaller end of the amplifier may also support and carry a bracket 40 having a pin or pintle 41 in the top therein in alignment with the ring or balls 37 for holding the taper arm or tone arm 39 on the antifriction bearing formed by the said balls 37.

The depth of the interior of the lid 7 is made as small as possible, that is to say, so that the top of the lid substantially merely clears the top end of the bracket 40 when the lid is closed.

The total height of the interior of the entire casing 1, including the lid 7, is thus made substantially of the smallest possible dimensions, it being but a trifle more than the combined heights of the motor 14, with the turntable 19 mounted therein plus the distance which the taper arm 39 or its bracket 40 necessarily extends above the level of the turntable.

The inner hollow side of the box-like lid 7 may be provided with a facing or lining 43, preferably made of thin board or veneer secured at suitable points to cleats or braces 44 attached in any suitable manner to the inside of the lid 7. This lining is preferably bent, curved or otherwise shaped to form a plane surface 45 extending across the corner of the lid 7 adjacent the hinges 8 and preferably at an angle of 45° to the lower edge of the lid, so that when the lid is raised at an angle of 45° to the main casing, and held there by the bar 9, the surface 45 extends vertically and does not outwardly deflect the

sound issuing from the horn. From the inclined surface 45 the lining is secured substantially flat against the interior surface of the lid 7 to form a surface 46 to reflect horizontally over the top of the machine the sound issuing from the mouth 23 of the amplifier 21. Beyond this reflecting surface 46 the lining may be bent at an angle to the bottom of the lid to form a plane surface 47 from said bend to the lower front edge of the lid. The angle that this last surface 47 makes with the lid is such that when the lid 7 is in the raised position shown in Fig. 4, the surface 47 forms with the top of the machine (i. e. the motor-board and turntable) a substantial continuation of the tapering passage through the amplifier 21, and the sound issuing from the amplifier and striking the reflecting surface 46 is reflected outwardly and amplified in the tapering passage between the flat tops of the motor-board and turntable of the talking machine mechanism and the surface 47 of the lid. The lid 7 and the motor-board 12 thus form, in fact, a part or section of the amplifying means with which the machine is provided.

While the main purpose of the slowly inclined surface 47 is to provide a smooth, straight or plane surface on the lid, from the reflecting surface 46 outwardly under the lid or cover, consistent with and for the same reasons that the amplifier 21 is provided with the smooth non-choking diverging surfaces, the lining 43 forms hollow chambers 48 and 49 in the lid, which, by reason of the thin walls provided by the lining, may possibly improve the sound which reaches an auditor.

The depth of the lid 7, particularly from the point where the surface 45 joins the surface 46 and on to the front wall 2 of the machine, that is to say, under the surface 46, of the lining 43 is not sufficient to permit one to close the lid with the sound box 42 over the record. To close the lid 7, the tone arm 39 should be swung to one side of the cabinet clear of the turntable 19 as shown in Fig. 1 and then the sound box 42 and gooseneck 50 must be inverted, as shown in Fig. 5. The motor-board may be provided with a pair of spring clips 51 for clamping and holding between them the inverted sound box 42. The clamps or springs 51 will thus retain the sound box 42 firmly between them and prevent the tone arm 39 and parts mounted thereon from swinging over the turntable during transportation of the machine.

One of the vertical sides of the box or casing, as for instance, the side 5, is preferably provided with a strong carrying handle 52 by means of which the machine when closed may be lifted and carried from one place to another place with facility.

I preferably provide the underside of the plane reflecting surface 46 of the lid 7 with small clips 53 between which the winding 130

key 18 may be placed while the device is being carried from place to place.

The lid 7 may be provided with spring catches or clips 54 for securely holding the lid closed against the main or body portion of the casing, while the device is being transported. The corners of the lid and the main portion of the cabinet are preferably provided with sheet metal corner pieces 55 to strengthen the cabinet and protect the surface finish.

In Figs. 5 and 6 is shown a construction which is slightly different in some respects from that shown in Figs. 1 to 4 but embodying my invention.

The differences in brief, are as follows: The motor 14' is so disposed within the cabinet as to enable one to insert the winding key or crank 18 through the side wall 5 instead of through the front wall 2, the spring barrel 16' being disposed at an angle of 90° to the position in which it is shown in Figs. 1 and 2, but in both instances substantially all of the motor mechanism is disposed entirely between the spindle 15 and the front wall 2 of the cabinet and the space within the cabinet to the rear of the spindle 15 is available for containing and enclosing the horn section of the amplifier.

The motor-board 12 is mounted or supported on metal cleats 13' secured to the inner face of the side walls 4 and 5, thus supporting the motor-board practically throughout its length.

The tone arm 39' is mounted on the small or inlet end 22' of the horn 21' on ball bearings of such a character that the bracket 40 shown in Fig. 3 may be dispensed with. In this construction I provide a lower ball race 36' on the upper end 22' of the horn, balls 37' seated thereon and an upper raceway 38' secured to and rigid with the larger end of the tone arm 39. Above the antifriction bearing so formed, I provide a second lower ball race 36'' on which is held another set of balls 37'' by a ball retainer 38'' on a sleeve 40' surrounding the balls and races and adjustably secured around the upper end 22' of the horn by means of a screw and slot as shown in Fig. 5. By this arrangement the tone arm is supported in such a manner as to be free to swing over the record in a horizontal plane and no bracket 40 is necessary. The advantage of this is that the inside of the lid or cover 7 may be brought even closer to the tone arm when the lid is closed thus reducing the total vertical height of the cabinet.

The sound box 42 may be retained in its inverted position by clips 51' embracing the gooseneck 50.

The carrying handle 52' may be a collapsible one such as is shown in Letters Patent of the United States No. 1,495,752 granted May 27, 1924, and further description thereof is therefore unnecessary.

But the principal differences in construction between the embodiment of my invention as shown in Figs. 5 and 6 and that previously described resides in the horn section of the amplifier and consists in making the horn of two parts, one of which is of cast-metal and the other of which is a separate board or sheet of suitable material fixedly mounted within and attached to the cabinet. The small inlet 22', the elbow 24', the forwardly extending tapering passage 25' having a lower wall 26' terminating in an edge 27'; the upper walls 31'; and the upper half of the reversed band 28' are almost identical with the corresponding parts of the cast-metal horn 21 previously described. But the upper wall of the passage 25' in the modified construction is in the same plane as the top edge of the wall 31' and the inlet 22' is a little above the top edge of the wall 31'. The side walls 33' and 34' terminate in the vertical plane in which lies the upper end of the wall 31', and terminate closely adjacent to the side walls 4 and 5 of the cabinet.

All of the parts of the horn 21' above described are preferably made as a single aluminum casting. The lower wall 32' of this horn is, however, separate from the other parts thereof and may be made of thin wood (preferably a three-ply veneer board) having a width equal to the distance between the side walls 4 and 5 of the cabinet and firmly secured to the cabinet structure as distinguished from being attached to the motor-board or as distinguished from being an integral inseparable part of the amplifier casting.

Before the board forming the lower wall 32' of the horn 21' is placed within the cabinet, I secure a strip of wood 56 to the casing or cabinet near the top edge of the rear wall 3 thereof, parallel thereto, and adjacent to the hinge 8. The inside face 56' of this strip is preferably slightly beveled as clearly shown in Fig. 5. On the inside of the bottom wall 6 I also secure a plurality (two are shown) of strips 57 and 58, preferably parallel to the front and rear walls 2 and 3 of the cabinet structure. I also secure to the inside of each of the opposite side walls 4 and 5 respectively, a block 59, squarely fitting into the corner formed between the rear wall 3 and the bottom wall 6. The shape of each of these blocks 59 might be roughly described as that of a right angle triangle, although the hypotenuse of such triangle is not a straight line but a curved concave wall 60 corresponding to the curved outside wall 32 of the bell of the horn 21 shown in Figs. 1 to 4 inclusive.

Also secured to the inner side of each of the opposite side walls 4 and 5 is a similar smaller block 61, generally speaking triangular in shape but also having a curved concave hypotenuse having a curve correspond-

ing to the lower half of the reversed curve 29 of the wall 32 shown in Figs. 1 to 4. The rear end of the base of these blocks 61 preferably abuts against the edge of the strip 58.

These strips 56, 57 and 58 and the blocks 59 and 61 may be secured to the interior of the casing in any suitable manner.

The beveled surface 56' of the strip 56, the curved surface 60 of the block 59, the tops of the strips 57 and 58 and the curved surface 62 of the block 61 are then preferably given a coat of glue and then a thin plane rectangular piece of wood having a width substantially the same as the distance between the interior side walls 4 and 5 of the cabinet and the proper length is placed in the cabinet and a form having a contour like the inside surface of the strip 32' shown in Fig. 5 is brought down firmly on it to press it against the curved surfaces 62 of the blocks 61, against the tops of the strips 58 and 57, against the curved surfaces 60 of the blocks 59 and against the beveled surface 56' of the strip 56, thus bending it into the shape shown in Fig. 5 and holding it firmly against said glued surfaces until the glue has had time to set and thus permanently hold the board in its bent position seated upon the said strips and blocks within the cabinet. After the board or wall 32' of the horn 21' has thus been placed in position, the motor-board 12 having mounted thereon the motor 14' and the cast-metal portion of the horn 21' rigidly secured thereto, is inserted into the cabinet and secured to the ledges or brackets 13' on the side walls thereof.

The depth of the walls 33' and 34' of the casting is such that their lower edges will just clear the upper surface of the board 32' and the upper half of the reverse bend of the casting will be just out of contact with the upper inner edge of the board 32' so that the metal portion of the amplifier is just out of contact with the wooden portion thereof.

In this manner the horn section of an amplifier substantially like that shown in Figs. 1 to 4 and having substantially all of the advantages thereof is made partly of metal and partly of wood and in this way the cost of production may be materially decreased.

However, instead of using a strip of wood or veneer for the wall 32' of the horn, it may be made of thin metal such as a sheet of aluminum bent into the form shown in Fig. 5. If metal is used for this wall it would be preferably secured to strips 56, 57 and 58 and to the blocks 59 and 61 by screws or nails instead of by being glued thereto.

My improved horn thus arranged and constructed is of what may be termed a return-bend horn type, wherein the greater length of the horn structure consists of two substantially horizontally arranged sections, the

smaller section 25 tapering in one direction and the larger section 30 tapering in the opposite direction, the larger end of the smaller section being connected to the smaller end of the larger section by a return-bend 29.

The opposite ends of the smaller section 25 are curved vertically in opposite directions (one upwardly and the other downwardly) and the opposite ends of the larger section 30 are vertically curved in the same direction (both upwardly).

The lower wall 26 of the smaller tapering section and the side walls thereof are disposed downwardly in the larger tapering passage 30. In cross-section, therefore, the larger passage 30 may be considered to be composed of a lower space (below the level of the wall 26) having one continuous taper for the full width of the passage, and two upper spaces respectively on opposite sides of the side walls of the upper passage 25.

It will now be plain that my improved sound amplifying means with which the talking machine above described is provided, in fact consists of two main parts or portions, namely, the horn section or portion extending from the tone arm and terminating in a mouth filling the space between the rear edge and the lid section which is formed between the lining of the lid and turntable when the lid is raised; that the median line of said amplifying means is substantially greater than the length of the cabinet or casing; that in it are three substantially horizontal sections through which the sound waves pass successively in opposite directions; and that the sound passage therethrough is curved twice through substantially 180° to cause the sound to issue therefrom horizontally over the turntable of the machine. This amplifying means, therefore, is very long and the volume of the sound delivered therefrom will be large and full as compared with that obtainable from the usual amplifier which is not substantially longer than the cabinet itself; and that this relatively long amplifier does not increase the size of the cabinet over what it would have to be to house the turntable and motor alone except by a distance from the rear wall of the motor-board to the rear wall of the casing, that is to say, merely a distance which is substantially equivalent to the height of the delivery opening of the horn section of the amplifier. In this amplifying means, as a whole, the sound waves are directed in three substantially parallel but successively opposite directions, namely, from the small end of the horn structure horizontally forwardly toward the spindle; second, after passing from a reverse bend of substantially 180° backwardly substantially horizontally toward the rear wall of the casing and third, after passing through a reverse bend of substantially 180° formed by the bell of the horn section and the hinged end

of the lid substantially forwardly through the tapering amplifying space between the lining of the lid and the top of the machine.

Although the inner vertical walls 2, 4 and 5 of the casing or main portion of the cabinet are close to the periphery of the turntable 19, they do not impose any limit on the size of the record which may be reproduced on the machine. A disc record of a diameter larger than that of the turntable will seat evenly upon the turntable and the marginal edge of the record beyond the periphery of the turntable will be above and out of contact with the top edges of the said vertical walls. This construction therefore permits of the use of a relatively small turntable with the periphery thereof close to the walls of the casing or main portion of the cabinet and enables me to reduce the width of the cabinet to the smallest dimension that will insure the positive rotation of the record by the turntable and will also provide sufficient space within which to house the amplifier.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States is:

1. In a talking machine the combination with a casing, of a hollow sound amplifying member mounted in said casing and extending first downwardly, then forwardly, then by a return bend rearwardly and then upwardly, and terminating in a vertically discharging mouth or larger end.

2. In a talking machine the combination with a casing, of a hollow sound amplifying member extending downwardly in said casing, then forwardly in said casing, then by return bend rearwardly and then upwardly, and terminating in a vertically discharging mouth extending substantially the full width of the interior of said casing.

3. In a talking machine the combination with a casing, sound reproducing mechanism and a reproducer arm, of sound amplifying means comprising a horn structure forming a support for said arm, and extending downwardly from said arm, then forwardly, then by a reverse bend rearwardly and then upwardly adjacent one side of said casing, and discharging upwardly, said parts above-mentioned being all mounted within said casing, and a cover forming a part of said casing and hinged to that side of said casing adjacent the discharge end of said structure and when open cooperating with and forming a part of said amplifying means to modify the sound issuing from said horn structure and to direct it substantially horizontally outwardly from said talking machine.

4. In a talking machine the combination with a casing, having a horizontal motor-board supported therein and a motor under said motor-board and adjacent the front side of said casing, of sound amplifying means extending in said casing, first downwardly

in the rear of said motor-board, then forwardly under said motor-board, then by a reverse bend rearwardly under said motor-board, and then upwardly to discharge sound upwardly between the rear edge of said motor-board and the rear wall of said casing.

5. In a talking machine the combination with a casing, sound reproducing mechanism and a reproducer arm, of sound amplifying means comprising a horn structure, the smaller end of which forms a support on which said arm is pivotally mounted, said horn structure being of progressively increasing cross-sectional area from its point of attachment to said arm and extending from said arm first downwardly in said casing, then forwardly, then by a reverse bend rearwardly and then upwardly, and discharging upwardly near the rear wall of said casing, all of the said parts above-mentioned being mounted within said casing, and a cover hinged to said rear wall of said casing adjacent the discharge end of said horn structure and when open, forming a part of said sound amplifying means and cooperating with said horn structure to modify the sound issuing therefrom.

6. In a talking machine the combination with a casing, a turntable and a motor comprising a spindle on which said turntable is mounted, and a mechanism for driving said spindle, said mechanism being mounted in said casing between said spindle and the front wall of said casing, of sound amplifying means comprising a horn structure extending downwardly in said casing, then forwardly, then by a reverse bend rearwardly and then upwardly, and discharging sound upwardly adjacent the rear wall of said casing, and a hinged cover secured to the top of said casing and when raised at an angle to said casing, forming a section of said sound amplifying means serving to deflect sound delivered by said horn section substantially horizontally.

7. In a talking machine the combination with a casing, a turntable and a vertical spindle on which said turntable is mounted, and a motor mechanism for driving said spindle, said mechanism being mounted in said casing between said spindle and the front wall of said casing and close to said front wall, of an amplifying horn extending downwardly in said casing, then forwardly, then by reverse bend rearwardly and then upwardly, and discharging sound upwardly, said horn occupying substantially all of the longitudinal space of said casing between the said spindle and the rear wall of said cabinet.

8. In a talking machine the combination with a casing of sound amplifying means comprising, a hollow tapering horn within said casing, sound reproducing means supported on the smaller end of said horn, and a hollow cover movably connected to said

casing and adapted in closed position to enclose said reproducing means and in the open position to constitute a section of said sound amplifying means, said horn extending from said sound reproducing means downwardly in said casing, then extending forwardly and then by a return bend downwardly and rearwardly and then upwardly, and discharging sound adjacent the point of connection between said cover and said casing.

9. In a talking machine the combination with a cabinet having a body portion, a lid hinged to one side of said cabinet and a motor-board secured within said cabinet, and sound reproducing mechanism including a taper arm, of a hollow tapering amplifier comprising a horn structure, the smaller end of which forms a support for and communicates with the large end of said taper arm, said horn structure extending downwardly in said cabinet, then forwardly, then by return bend rearwardly, and then upwardly, and discharging sound upwardly against said lid when open, and adjacent the hinge connection between said cabinet and said lid, said lid when open, and motor-board cooperating to form a continuation of said amplifier to discharge sound horizontally from said talking machine.

10. In a talking machine comprising, as mechanism, a motor, a turntable driven thereby and located above said motor, a sound amplifying member having a tapering passage therethrough, a tone arm and a sound box arranged to swing over and across said turntable, the combination of a cabinet comprising a casing and a lid completely enclosing said mechanism, the width of the interior of said casing being substantially the same as the length of the mouth of said amplifying member, and slightly greater than the diameter of said turntable; the height of the interior of the casing being substantially equal to the vertical height of said motor with the turntable thereon, and the length of the interior of the casing being substantially equal to the diameter of said turntable plus the width of the mouth of said amplifying member, and the depth of the interior of the lid being substantially the same as the distance that said tone arm extends above the level of the top edge of said casing.

11. In a talking machine comprising, as mechanism, a motor, a turntable driven thereby and located above said motor, a horn structure having a tapering passage therethrough, a tone arm and a sound box arranged to swing over and across said turntable, the combination of a cabinet comprising a casing and a lid completely enclosing said mechanism, the width of the interior of said casing being substantially the same as the width of the mouth of said horn structure, and slightly greater than the diameter of said turntable; the height of the interior

of said cabinet being substantially equal to the combined heights of said motor with the turntable thereon and the distance said tone arm extends above said turntable, and the length of the interior of the casing being substantially equal to the diameter of said turntable plus the width of the mouth of said horn structure, the length of the median line or axis of the passage through said horn structure being substantially greater than the length of said casing.

12. In a talking machine, the combination of a casing having a vertical wall, a turntable having its periphery close to but out of contact with said wall, and a motor comprising a turntable spindle and a motor mechanism for driving said spindle, said mechanism being mounted in said casing between said spindle and said wall of said cabinet, said casing also having a vertical wall opposite and parallel to said first-mentioned wall and spaced from said turntable and a horn structure providing a progressively tapering passage therethrough mounted in said casing and having its larger or sound discharging end in a plane substantially parallel to said turntable, said larger end substantially filling the space between said turntable and said opposite wall.

13. In a talking machine, the combination of a casing having a vertical wall, a turntable having its periphery close but out of contact with said wall, and a motor comprising a turntable spindle and a motor mechanism for driving said spindle, said mechanism being mounted in said casing between said spindle and said wall of said casing, said casing also having a vertical wall opposite and parallel to said first-mentioned wall and spaced from said turntable and a horn structure providing a progressively tapering passage therethrough mounted in said casing and having its larger or sound discharging end in a plane substantially parallel to said turntable, said larger end substantially filling the space between said turntable and said opposite wall, the small end of said horn structure extending downwardly into the mouth of said amplifier and then substantially horizontally through a wall forming the large end of said horn structure to a point closely adjacent to said spindle, then reversely curved to extend toward said opposite wall, and then curved upwardly to form said mouth of said horn structure.

14. In a talking machine, the combination of a casing having a vertical wall, a turntable having its periphery close but out of contact with said wall, and a motor comprising a turntable spindle and a motor mechanism for driving said spindle, said mechanism being mounted in said casing between said spindle and said wall of said casing, said casing also having a vertical wall opposite and parallel to said first-mentioned

5 wall and spaced from said turntable, and a
horn structure providing a progressively tapering
passage therethrough mounted in said casing
and having its larger or sound discharging
end in a plane substantially parallel to said
turntable, said larger end substantially filling
the space between said turntable and said
opposite wall, the small end of said horn
structure extending downwardly into the mouth
10 of said horn structure and then substantially
horizontally through a wall forming the large
end of said amplifier to a point closely adjacent
to said spindle, then reversely curved to extend
toward said opposite wall and then upwardly
curved to form said mouth of said horn structure,
the median line of said passage being substantially
longer than the distance between said walls.

15 15. In a talking machine, the combination
of a casing, a turntable spindle, and an
amplifying horn structure having the axes of
its smaller and its larger ends respectively
extending substantially parallel to each other
and vertically in said casing, said larger end
being adjacent a vertical wall of said casing,
said smaller end extending into the mouth of
said horn structure, then away from said
vertical wall toward and close to said spindle,
then curved to extend toward said vertical wall
and then curved upwardly to form said larger
or discharge end of the horn structure.

16. In a talking machine, the combination
of a casing, a turntable spindle, and an
amplifying horn structure having the axes of
its smaller and its larger ends respectively
extending substantially parallel to each other
and vertically in said casing, said larger end
being adjacent a vertical wall of said casing,
said smaller end extending into the mouth
of said horn structure, then away from said
vertical wall toward and close to said spindle,
then curved to extend toward said vertical wall
and then curved upwardly to form said larger
or discharge end of the horn structure, and
means pivotally mounted adjacent the upper
edge of said wall to change the direction of
the sound delivered by the mouth of said horn
structure.

17. In a talking machine, the combination
with a casing having four substantially vertical
walls, of a turntable, and a motor comprising
a turntable spindle and a motor mechanism
for driving said spindle, said mechanism
being located between said spindle and one
wall of said casing, a motor-board and an
amplifying horn structure providing a passage
of progressively increasing cross-sectional area
throughout its length extending first downwardly
in said casing, then substantially horizontally
under said motor-board toward said spindle,
then reversely curved close to said spindle, to
extend substantially horizontally toward said wall
opposite said first specified wall, then curved

upwardly and terminating in a delivery end
substantially filling the space between said
motor-board and said wall opposite said first
specified wall, and between the two side walls.

18. In a talking machine, a sound amplifying
member providing a passage therethrough of
progressively increasing area in cross-section
from the smaller to the larger end thereof,
said passage beginning at the small end of
said amplifier first extending relatively downwardly,
then being curved through substantially 90°
and extending substantially horizontally through
a wall of said amplifying member near the large
end thereof, then curved through substantially
180° and extending therefrom straight substantially
horizontally in the opposite direction, and
then being curved through substantially 90° to
extend substantially vertically.

19. In a talking machine, a sound amplifying
member providing a passage therethrough of
progressively increasing area in cross-section
from the smaller to the larger end thereof,
said passage beginning at the small end of
said member first extending relatively downwardly,
then being curved through substantially 90°
and extending substantially horizontally through
a wall of said member near the large end
thereof, then curved through substantially 180°
and extending therefrom straight substantially
horizontally in the opposite direction, then
curved through substantially 90° to extend
substantially vertically, the small end of
said member being surrounded by the walls
of the larger end thereof.

20. In a talking machine, a sound amplifying
means providing a continuous passage therethrough
of progressively increasing cross-sectional area
from the smaller inlet end thereof to the outlet
end thereof, said inlet end being surrounded
by the walls of said outlet end, the portion of
said amplifying means adjacent said inlet end
passing through the wall of the portion of
said amplifying means near said outlet end
and forming a lateral reversely curved passage
and then being again curved toward said inlet
end to form said outlet end of said amplifying
means.

21. In a talking machine, the combination
of a casing, a turntable, a motor comprising
a spindle, and a motor mechanism between
said spindle and a wall of said casing, sound
amplifying means between said spindle and the
opposite wall of said casing and a motor-board
spaced from said opposite wall, said
amplifying means being provided with a passage
therethrough of progressively increasing
cross-sectional area and which extends first
downwardly with respect to said casing and
then horizontally within said casing toward
said spindle, is then curved close to said
spindle, then extends toward the said opposite
wall and is then curved upwardly, terminat-

ing in an upwardly discharging mouth substantially filling the space between said motor-board and said opposite wall.

22. In a talking machine, the combination of a casing, a turntable, a motor comprising a spindle and a motor mechanism between said spindle and a wall of said casing, sound amplifying means between said spindle and the opposite wall of said casing and a motor-board spaced from the said opposite wall, said amplifying means providing a passage therethrough of progressively increasing cross-sectional area which extends first downwardly with respect to said casing, then substantially horizontally within said casing toward said spindle, is then curved close to said spindle, then extends toward said opposite wall, and is then curved upwardly terminating in an upwardly discharging mouth substantially filling the space between said motor-board and the said opposite wall, the smaller end of said amplifying means being surrounded by the larger end thereof.

23. In a talking machine, the combination of a casing, a turntable, a tone arm, a motor comprising a spindle and a motor mechanism between said spindle and a wall of said casing, sound amplifying means between said spindle and the opposite wall of said casing and a motor-board spaced from the said opposite wall, said amplifying means providing a passage therethrough of progressively increasing cross-sectional area which extends first downwardly with respect to said casing, then transversely within said casing toward said spindle, is then curved close to said spindle, then extends toward the said opposite wall and is then curved upwardly, terminating in an upwardly discharging mouth substantially filling the space between said motor-board and said opposite wall, the smaller end of said sound amplifying means being surrounded by the larger end thereof and forming a support for said tone arm.

24. In a portable talking machine, the combination with a casing having four consecutive substantially vertical walls, of a turntable, a motor comprising a spindle and a motor mechanism for driving said spindle, the inner faces of three consecutive walls of said casing being arranged close to the periphery of said turntable, said motor being mounted within said casing and said motor mechanism being located between said spindle and the intermediate wall of said three walls, and a sound amplifying member also mounted in said casing, substantially filling the space between said spindle and the fourth wall of said casing and having its large end substantially filling the space between said turntable and said fourth wall.

25. In a portable talking machine, the combination with a casing having four substantially vertical walls, of a turntable and a motor comprising a spindle and a motor

mechanism for driving said spindle, all mounted within said casing, the inner faces of three consecutive walls being arranged close to the periphery of said turntable, said motor mechanism being located between said spindle and the intermediate wall of said three walls and said spindle, of a sound amplifying member mounted in said casing and having its large end substantially filling the space between said turntable and the fourth of said walls, and of a width substantially equal to the distance between the walls of said cabinet which are separated by said intermediate wall and said fourth wall.

26. In a talking machine, a sound amplifying member providing therethrough a continuous passage of progressively increasing cross-sectional area from the smaller to the larger end thereof, the smaller end of said member being surrounded by the walls of the larger end thereof and extending first downwardly into the mouth of said member, then substantially horizontally through a wall of said larger end, then in a reversed curve, then substantially horizontally, and then in a curve upwardly to form the large end of said member surrounding said smaller end.

27. In a talking machine, the combination with a cabinet having a lid hinged to its upper part, and sound reproducing means of a sound amplifying member, comprising a return bend horn structure providing a tapered sound passage, the greater length of said horn structure being arranged horizontally within the cabinet and the small and large ends of the sound passage opening upward in relatively close association, the large end being directed toward the lid and the small end being in communication with said sound reproducing means, the opposite ends of the smaller horizontal portion of the sound passage being curved vertically in opposite directions and the opposite ends of the larger horizontal portion of the sound passage being curved vertically in the same direction.

28. In a talking machine, the combination with a cabinet having a lid hinged to its upper part, and sound reproducing means, of a sound amplifying member comprising a return-bend horn structure providing a tapered sound passage generally rectangular in transverse cross-section, the greater length of said horn structure being arranged substantially horizontally within the cabinet, the small and large ends of the sound passage opening upwardly in relatively close association, the large end being directed toward said lid and the small end being in communication with said sound reproducing means, the opposite ends of the smaller horizontal portion of the sound passage being curved vertically in opposite directions, the opposite ends of the larger horizontal portion of the sound pas-

sage being curved vertically in the same direction, and the lower wall of the smaller portion of the sound passage forming a portion of the upper wall of the larger portion of the sound passage.

29. In a talking machine, the combination with a cabinet having a lid hinged to its upper part, and sound reproducing means and an amplifier comprising a return-bend horn structure providing a tapered sound passage generally rectangular in transverse cross-section, the greater length of said structure being arranged horizontally within the cabinet and the small and large ends of the sound passage opening upwardly in relatively close association, the large end being directed toward the lid and the small end being in communication with said sound reproducing means, the opposite ends of the smaller horizontal portion of the sound passage being curved vertically in opposite directions, the opposite ends of the larger horizontal portion of the sound passage being curved vertically in the same direction and the lower wall and portions of the side walls of the smaller portion of the sound passage being depressed downwardly into the larger portion of the sound passage wherein said larger portion of the sound passage is provided with a lower space of one continuous taper of the full width of the passage and with two upper spaces respectively on opposite sides of the side walls of said upper sound passage, whereby the lower sound passage is provided with a plurality of tapered portions, each rectangular in cross-section and in communication with each other to constitute a composite passage of substantially channel-shape in cross-section.

30. In a talking machine, the combination with a cabinet having a lid hinged to its upper part, combined with sound reproducing means, of an amplifier comprising a return-bend horn structure providing a tapered sound passage generally rectangular in transverse cross-section, the greater length of said structure being arranged horizontally within the cabinet, the large end of the sound passage being directed toward the lid and the small end extending into and opening upwardly in the large end and communicating with said sound reproducing means through a horizontally swinging sound conveyor mounted to move about said small end, the opposite ends of the smaller horizontal portion of the sound passage being curved vertically in opposite directions, the opposite ends of the larger horizontal passage being curved vertically in the same direction and the lower wall of the smaller portion of the sound passage forming a portion of the upper wall of the larger portion of the sound passage.

31. In a talking machine, the combination with a cabinet having a lid hinged to its up-

per part, and sound reproducing means, of an amplifier comprising a return-bend horn structure providing a tapered sound passage, the greater length of said structure being arranged substantially within the cabinet and the small and large ends of the sound passage opening upwardly in relatively close association, the large end being directed toward said lid and the smaller end being in communication with said sound reproducing means, the opposite ends of the small horizontal portion of the sound passage being curved vertically in opposite directions, and the opposite ends of the larger horizontal portion of the sound passage being curved vertically in the same direction, a vertical spindle mounted in said casing relatively close to the return-bend of said horn structure, a motor mechanism to drive said spindle arranged on the side of said spindle opposite said horn structure, and a turntable supported upon the upper end of said spindle and extending horizontally over the horizontal portions of said horn structure.

32. In a talking machine, the combination with a cabinet, and sound reproducing means, of an amplifier comprising a return-bend horn structure providing a tapered sound passage, the greater length of said structure being arranged substantially horizontally within the cabinet and the small and large ends of the sound passage opening upwardly in relatively close association, the large end being directed toward said lid and the small end being in communication with said sound reproducing means, the opposite ends of the small horizontal portion of the sound passage being curved vertically in opposite directions, the opposite ends of the larger horizontal portion of the sound passage being curved vertically in the same direction, and a box-shaped lid provided with a sound deflecting inner wall and hinged to said cabinet adjacent said large end of said sound passage.

33. An amplifier for a talking machine, comprising a return-bend horn structure providing a tapered sound passage bent upon itself, the greater length of the passage arranged in substantial parallel relation and wherein the large and small terminals open in the same general direction and are in close relation, the opposite ends of the smaller portion of the sound passage being curved in opposite directions, and the opposite ends of the larger portion of the sound passage being curved in the same direction.

34. An amplifier for a talking machine, comprising a return-bend horn structure providing a tapered sound passage bent upon itself and generally rectangular in transverse cross-section, the greater length of the passage being arranged substantially horizontally, the large and small terminals of said passage opening in the same general direction and in close relationship to each other, the

opposite ends of the smaller portion of said sound passage being curved in opposite directions and the opposite ends of the larger portion of said sound passage being curved in the same direction, the lower wall of the smaller portion of the sound passage forming a portion of the upper wall of the larger portion of said sound passage.

35. An amplifier for a talking machine, comprising a return-bend horn structure providing a tapered sound passage bent upon itself and generally rectangular in transverse cross-section, the greater length of the passage being arranged substantially horizontally, the large and small ends of said passage opening in the same general direction and in close relationship to each other, the opposite ends of the smaller portion of said sound passage being curved in opposite directions and the opposite ends of the large portion of said sound passage being curved in the same direction, the lower wall and portions of the side walls of the smaller portion of the sound passage being depressed downwardly into the larger portion of the sound passage and providing the latter with a lower space of one continuous taper of the full width of the passage and two upper spaces respectively on opposite sides of the side walls of the upper sound passage, whereby said lower sound passage is provided with a plurality of tapered sections and in communication with each other, to constitute a composite passage of substantially channel-shape in transverse cross-section.

36. An amplifier for talking machines, comprising a return-bend horn structure providing a tapered sound passage bent upon itself and generally rectangular in transverse cross-section, the greater length of the passage being arranged substantially horizontally, the large and small ends of said passage opening in the same general direction and in close relationship to each other, the opposite ends of the smaller portion of said sound passage being curved in opposite directions and the opposite ends of the larger portion of said sound passage being curved in the same direction, said small end of said smaller portion of said horn structure being surrounded by the wall of the large end of the larger portion of said horn structure the lower wall and portions of the side walls of the smaller portion of the sound passage being depressed downwardly into the larger portion of the sound passage and providing the latter with a lower space of one continuous taper of the full width of the passage and two upper spaces respectively on opposite sides of the side walls of the upper sound passage, whereby said lower sound passage is provided with a plurality of tapered portions in communication with each other, to constitute a composite passage substantially channel-shape in transverse cross-section.

37. In a talking machine, the combination with an amplifier comprising a return-bend horn structure providing a tapered sound passage bent upon itself and generally rectangular in transverse cross-section, the greater length of the passage being arranged substantially horizontally, the large and small ends of said passage opening in the same general direction and in close relationship to each other, the opposite ends of the smaller portion of said sound passage being curved in opposite directions and the opposite ends of the larger portion of said sound passage being curved in the same direction, said small end of said smaller portion of the horn structure being surrounded by the wall of the large end of the larger portion of said horn structure, the lower wall and portions of the side walls of the smaller portion of the sound passage being depressed downwardly into the larger portion of the sound passage and providing the latter with a lower space of one continuous taper of the full width of the passage and two upper spaces respectively on opposite sides of the side walls of the upper sound passage, whereby said lower sound passage is provided with a plurality of tapered portions each rectangular in cross-section and in communication, to constitute a composite passage substantially channel-shape in transverse cross-section, of a swinging tubular tone arm pivoted to the small end of said horn structure and movable over the return-bend portion of said horn structure.

38. A sound amplifying horn comprising a tapering passage bent upon itself to form a plurality of substantially parallel conduits, one wall of one conduit terminating adjacent the return-bend of the passage and constituting a wall in common with another conduit the smaller end of said amplifying horn being within the larger end thereof.

39. A sound amplifier comprising a tapering passage bent upon itself to form a plurality of substantially parallel conduits, one wall of one conduit terminating adjacent the return-bend of the passage and constituting a wall in common with another conduit, the smaller end of said passage extending into and opening in the same direction as the larger end thereof.

40. In a talking machine, sound amplifying means comprising a sound passage associated at one end with a tone arm and adapted to direct the sound waves in successively-opposite approximately-horizontal directions, the inlet end of said passage being surrounded by the outlet end thereof.

41. In a talking machine, an amplifier providing a passage therethrough of progressively increasing area in cross-section from the smaller end to the larger end thereof, said passage first extending relatively downward, then being curved through substantially 90°

and extending substantially horizontally, then being curved through substantially 180° and extending substantially horizontally in the opposite direction, then being curved through substantially 180° to issue substantially horizontally from said machine. the inlet end of the smaller portion of said passage being surrounded by the walls of a larger portion thereof.

42. In a talking machine, in combination with a tone arm of a sound amplifier having a sound passage therein extending from said tone arm first downwardly and then horizontally, the end of said passage being curved through 180° to form an intermediate portion extending on both sides of the downwardly extending portion of said downwardly and horizontally bent portion and having an outlet portion communicating with said intermediate portion of the sound passage through a bend of approximately 180°.

43. In a talking machine, in combination with a tone arm, a sound amplifier including a forwardly directed outlet portion for delivering sound in a substantially horizontal direction, a rearwardly directed intermediate portion communicating with the rear of said outlet portion and a forwardly directed inlet portion extending from the outlet of said tone arm to the forward end of said intermediate portion, said inlet portion extending downwardly into said intermediate portion.

44. In a talking machine, the combination with a cabinet having a motor-board mounted therein, of a continuous hollow sound conducting and amplifying member, including a casting secured to the underside of said motor-board forming a support at its smaller end for a swinging tone arm and providing a sound amplifying passage of progressively increasing cross-sectional area extending downwardly and then forwardly through a wall of said casting and under said motor-board and then curving downwardly, and also including means to continue said passage therefrom rearwardly and then upwardly to substantially the plane of the support of said tone arm.

45. A sound amplifying conduit for expanding the wave fronts of complex waves, said conduit being solidly constructed of stiff material and being reversely folded upon itself to form successive, adjacent lengths or folds extending in opposite directions, adjacent surfaces of the first of said folds being flattened to afford partial expansion of the waves, much greater in one dimension than in the other, adjacent folds being opposite surfaces of the same solid wall of stiff material, and successive opposite folds being connected by a deflector which is of stiff material and has deflecting surfaces curved in the direction of a thin dimension of the conduit.

46. A sound amplifying conduit for ex-

panding the wave front of complex waves, said conduit being solidly constructed of stiff material and being reversely folded upon itself to form successive, contiguous lengths or folds extending in opposite directions, and embodying a primary expansion portion having two opposite sides approximately parallel and two other sides substantially diverging, the successive oppositely extending folds being connected by a deflector, the deflecting surfaces of which operate by lateral deflection in the direction of the thin dimension of the conduit, to substantially reverse the direction of the sound waves for propagation through a projector having divergent walls permitting expansion in the direction of such deflection.

47. An amplifying conduit for guiding, expanding and projecting complex waves into the atmosphere, said conduit being solidly constructed of thick, stiff material and reversely folded upon itself, with the adjacent walls of adjacent, oppositely extending folds laterally united as a massive integral structure so as to minimize sympathetic vibration; said conduit including a conduit section formed for partial expansion of the waves in one dimension more than in the other; another conduit section formed for further expansion of said waves from the first mentioned conduit section in the direction of the thinner dimension thereof; and including also deflecting surface arranged to deflect the partially expanded waves from said first mentioned conduit section in the direction of said thinner dimension.

48. An amplifying conduit for guiding, expanding and projecting complex waves into the atmosphere, said conduit being reversely folded upon itself, the adjacent, oppositely extending folds having the inlet end of the wall of one fold and the outlet end of the next fold laterally united as a massive integral structure so as to minimize sympathetic vibration; said conduit including a conduit section formed for partial expansion of the waves in one dimension more than in the other; another conduit section formed for further expansion of said waves from the first mentioned conduit section in the direction of the thinner dimension thereof; and including also intermediate deflecting surface arranged to deflect the partially expanded waves from said first mentioned conduit section in the direction of said thinner dimension.

49. An amplifying conduit for guiding, expanding and projecting complex waves into the atmosphere, said conduit being solidly constructed of stiff material and reversely folded upon itself, with the adjacent walls of adjacent, oppositely extending folds laterally united as a massive integral structure so as to minimize sympathetic vibration; said conduit including a conduit section

formed for partial expansion of the waves in one dimension more than in the other; another conduit section formed for further expansion of said waves from the first mentioned conduit section in the direction of the thinner dimension thereof; and including also deflecting surface arranged to deflect the partially expanded waves from said first mentioned conduit section in the direction of said thinner dimension.

50. An amplifying conduit for guiding, expanding and projecting complex waves into the atmosphere, said conduit being solidly constructed of stiff material and reversely folded upon itself, with the adjacent walls of adjacent, oppositely extending folds laterally united as an integral structure so as to minimize sympathetic vibration; said conduit including a conduit section formed for partial expansion of the waves in one dimension more than in the other; another conduit section formed for further expansion of said waves from the first mentioned conduit section in the direction of the thinner dimension thereof; and including also deflecting surface arranged to deflect the partially expanded waves from said first mentioned conduit section in the direction of said thinner dimension.

51. An amplifying conduit for guiding, expanding and projecting complex waves into the atmosphere, said conduit being reversely folded upon itself, the adjacent, oppositely extending folds having the inlet end of the wall of one fold and the outlet end of the next fold laterally united as an integral structure so as to minimize sympathetic vibration; said conduit including a conduit section formed for partial expansion of the waves in one dimension more than in the other; another conduit section formed for further expansion of said waves from the first mentioned conduit section in the direction of the thinner dimension thereof; and including also intermediate deflecting surface arranged to deflect the partially expanded waves from said first mentioned conduit section in the direction of said thinner dimension.

52. An amplifier horn comprising a main horn having a back wall and diverging side walls extending outwardly therefrom, and a secondary horn built within said main horn in reversed relation thereto so as to be directed toward the back wall thereof, said secondary horn having one of its side walls formed by one of the side walls of said main horn.

53. An amplifier horn comprising a main horn of a truncated bell form having a back wall and diverging side walls extending outwardly therefrom, and a secondary horn built onto one of the side walls of said main horn using said side wall as one of the side walls of said secondary horn, said secondary

horn being reversed in relation to said main horn and directed toward the back wall thereof, the small end of said secondary horn being arranged to have communication with a source of sound, and the large end thereof communicating with the small end of said main horn.

54. A sound amplifier comprising a plurality of communicating conduit sections at least two of which are reversely directed and laterally united, one of said laterally united conduit sections having two opposite sides which are substantially parallel and two opposite sides which are substantially diverging and the other of said laterally united conduit sections communicating with said first section through a bend of substantially 180° having a curved deflecting surface and said second section having walls which diverge in a direction at right angles to the direction of divergence of the diverging walls of said first section.

55. A method of sound wave amplification comprising expanding the waves in a channel whose walls are sufficiently rigid to be substantially non-resilient to audible vibrations, causing at least two distinct and successive relatively reversed laterally contiguous stages of expansion, first expanding the waves substantially in one dimension only, then deflecting them in the direction of their thinness, and then expanding the waves substantially in another dimension in a succeeding stage.

In witness whereof, I have hereunto set my hand this 22nd day of May, 1923.

WILLIAM D. LA RUE.