June 27, 1939. E. P. KENNEDY 2,164,157

ACOUSTIC DEVICE

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FIG. 1

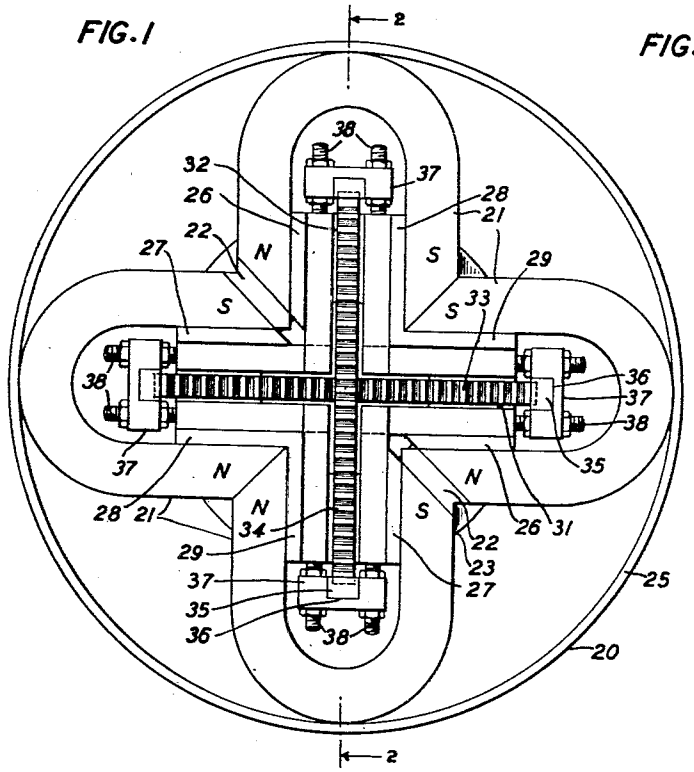


FIG. 2

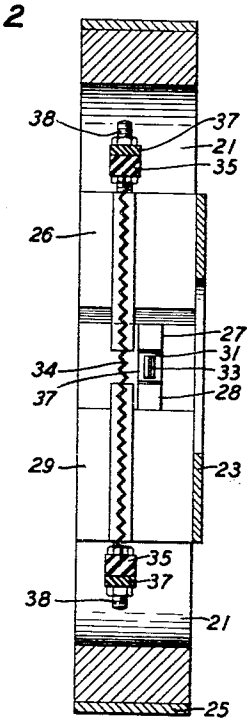


FIG. 3

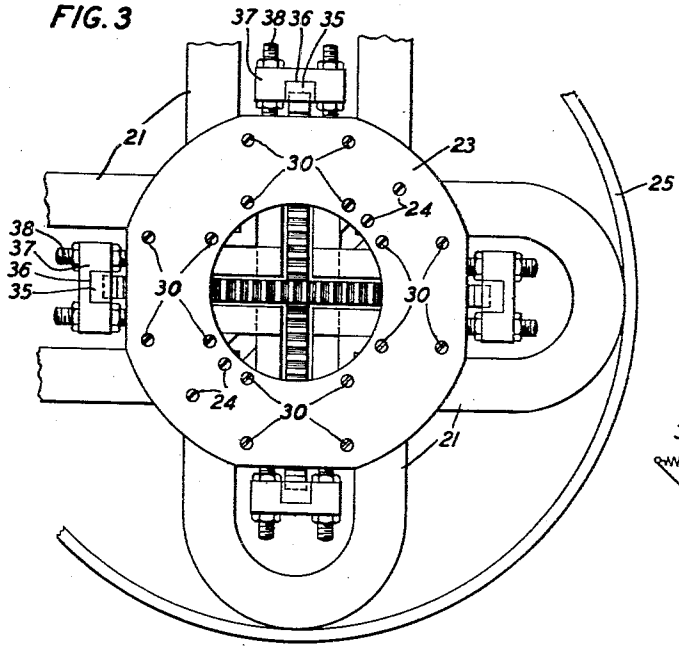
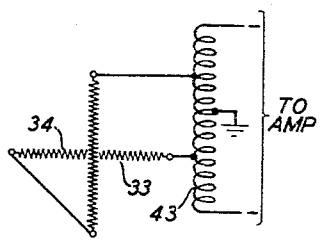


FIG. 4



INVENTOR
E. P. KENNEDY

BY
Walter C. Kiesel

ATTORNEY

June 27, 1939. E. P. KENNEDY 2,164,157

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FIG. 5

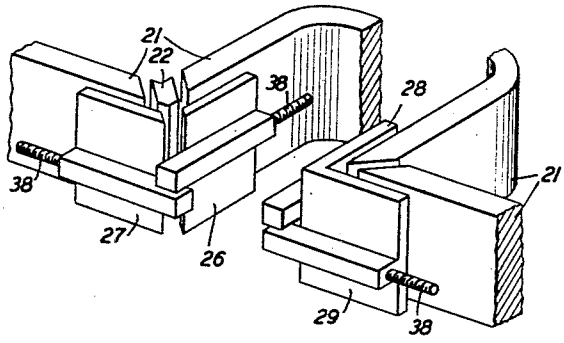


FIG. 6

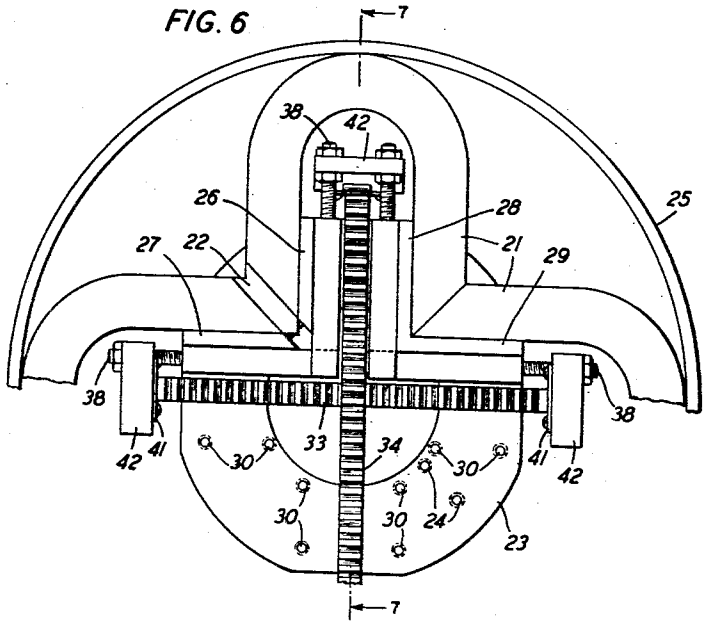


FIG. 7

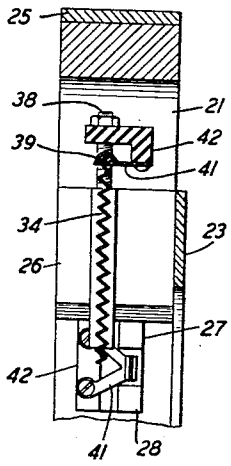
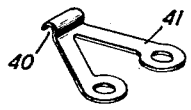


FIG. 8



INVENTOR
E. P. KENNEDY
BY
Walter C. Kiesel
ATTORNEY

June 27, 1939. E. P. KENNEDY 2,164,157

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FIG. 9

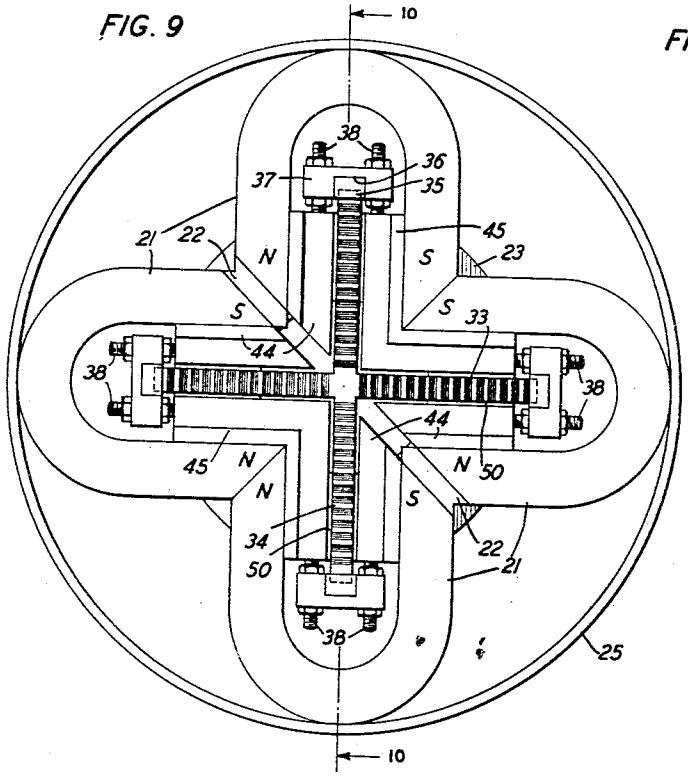


FIG. 10

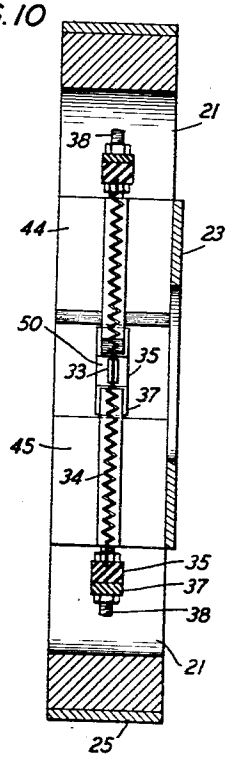


FIG. 11

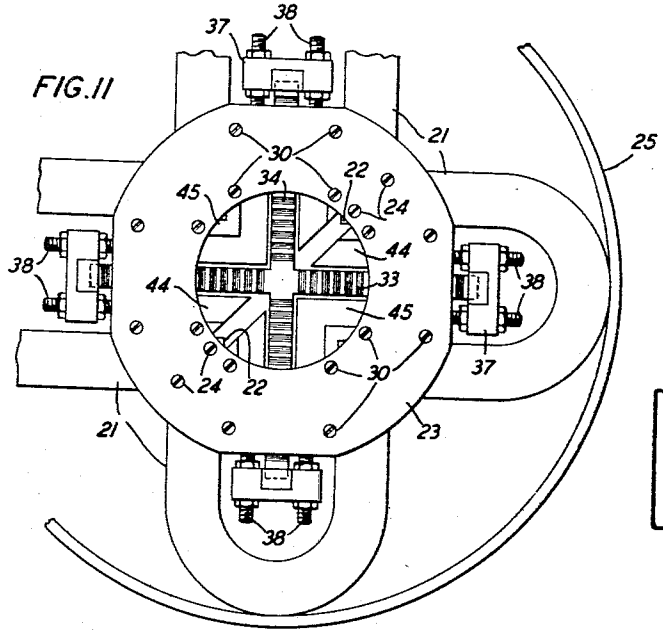
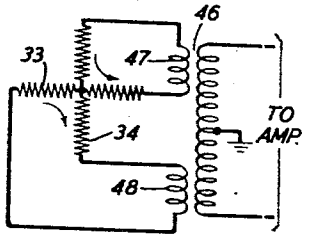


FIG. 12



INVENTOR
E. P. KENNEDY
BY
Walter C. Kiesel
ATTORNEY

June 27, 1939. E. P. KENNEDY 2,164,157

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FIG. 13

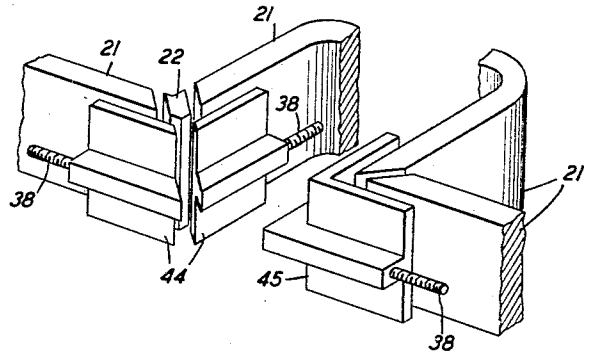


FIG. 14

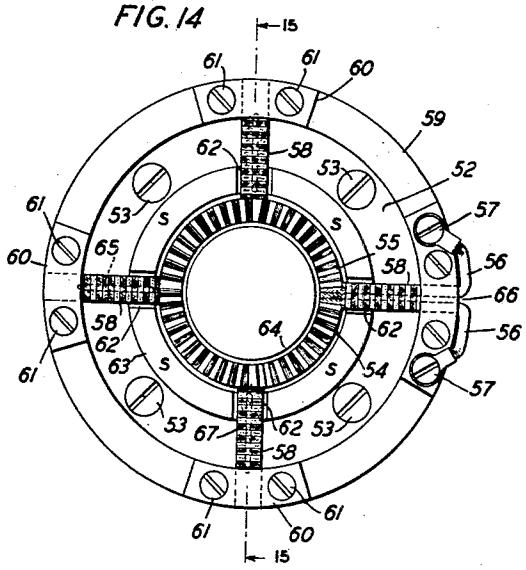


FIG. 15

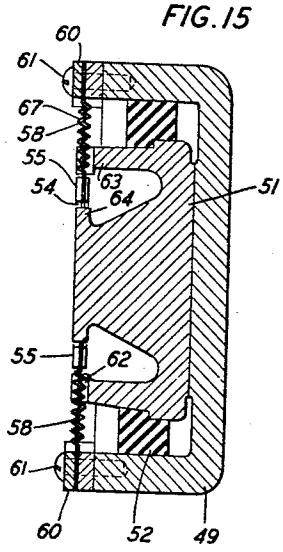
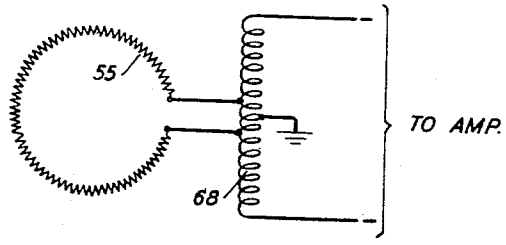


FIG. 16



INVENTOR
E. P. KENNEDY
BY
Walter G. Kiesel
ATTORNEY

Patented June 27, 1939

2,164,157

UNITED STATES PATENT OFFICE

2,164,157

ACOUSTIC DEVICE

Edward P. Kennedy, Berwyn, Ill., assignor to Electrical Research Products, Inc., New York, N. Y., a corporation of Delaware

Application July 11, 1936, Serial No. 90,065

13 Claims. (Cl. 179—115.5)

The invention relates to acoustic devices, and more particularly to ribbon microphones.

An object of the invention is to improve the structure and performance of ribbon microphones.

A feature of the invention comprises providing a plurality of magnetic air-gaps for a conductive ribbon diaphragm.

Another feature of the invention comprises a resilient support for each end of a ribbon diaphragm.

A further feature comprises providing a ribbon microphone with air-gaps arranged to present a substantially cross-shaped appearance and in which ribbon diaphragm means is disposed.

Still another feature comprises a combination of a carrier member, pole-piece members thereon, and permanent magnets secured together by a clamping band.

Other and further features will be apparent from the description hereinafter.

A more complete understanding of the invention will be obtained from the detailed description which follows, taken in conjunction with the appended drawings, wherein:

Fig. 1 is a front elevational view of a ribbon microphone embodying the invention;

Fig. 2 is a sectional view of the device of Fig. 1 along the line 2—2 thereof;

Fig. 3 is a fragmentary rear view of the device of Fig. 1;

Fig. 4 shows circuit connections for the ribbons of the microphone of Fig. 1;

Fig. 5 is a perspective exploded view of a portion of the magnetic structure of the microphone of Fig. 1;

Fig. 6 is a front view of a fragment of the ribbon microphone of Fig. 1, with modified supports for the ribbon diaphragms;

Fig. 7 is a sectional view of the device of Fig. 6 along the line 7—7;

Fig. 8 shows in enlarged perspective the angular or wishbone ribbon support of Figs. 6 and 7;

Fig. 9 is a front elevational view of a modification of the device of Fig. 1;

Fig. 10 is a cross-sectional view of the device of Fig. 9 along the line 10—10 thereof;

Fig. 11 is a fragmentary rear view of the device of Fig. 9;

Fig. 12 shows circuit connections for the ribbon diaphragm of the device of Fig. 9;

Fig. 13 is a perspective exploded view of a portion of the magnetic structure of the microphone of Fig. 9;

Fig. 14 is a top plan view of another embodiment of the invention;

Fig. 15 is a cross-sectional view of the device of Fig. 14 along the line 15—15 thereof; and

Fig. 16 shows the circuit connections for the ribbon diaphragm of the device of Fig. 14.

The acoustic device of Figs. 1 to 5 is a ribbon microphone 20 comprising four U or horseshoe permanent magnets 21, for example, of cobalt steel, in cross formation, with a pair of N poles and a pair of S poles adjacent and two pairs of N—S poles spaced apart by non-magnetic spacer members 22, which may be of aluminum. These spacers are fastened to a substantially annular plate 23 in any suitable manner, for example, by screws 24, and together with the magnets, are held in position by the retaining and clamping frame or annulus 25. Pole-piece members 26, 27, 28, 29 of magnetic iron, supported by the plate 23 and secured thereto in any suitable manner, for instance, by screws 30, are mounted adjacent the pole-ends of the magnets and define magnetic air-gaps 31, 32 which are arranged in substantially intersecting arrangement to present a cross-shaped appearance. A pair of ribbon diaphragms 33, 34 of transversely corrugated, thin, narrow strip duralumin are disposed in the air-gaps, being supported at their ends in members or blocks 35, of a resilient material, such as rubber. The members 35 are disposed in the recesses 36 of supports 37 mounted on studs 38 that thread into the pole-piece members. Alternatively, as shown by Figs. 6 to 8, the ribbon diaphragms may be supported at their ends in resilient members 39, which may be of rubber, positioned in recesses 40 at the apices of angular or wishbone springs 41 secured to supports 42 mounted on the studs 38. The ribbons may be tuned to or made to have a fundamental frequency different from each other. As shown by Fig. 4, the ribbons may be connected in series arrangement and coupled to an amplifier through an auto-transformer 43. If desired, the ribbon may be of greater thickness than is the present practice in ribbon microphones, the ribbon being compressed endways to overcome its normal rigidity.

The acoustic device of Figs. 9 to 13 is similar in some respects to the device of Figs. 1 to 8, like parts having corresponding reference characters. The ribbon diaphragms 33, 34 are connected at their mid-portions to form a single cross-shaped structure mounted in the magnetic air-gaps 50 defined by the pole-piece members 44, 45. As shown by Fig. 12, the ribbons are cou-

pled to an amplifier (not shown) through a transformer 46, the ends of the ribbons being connected to the primary windings 47, 48 of the transformer.

The acoustic device of Figs. 14 and 15 is a modification of the invention and comprises a shell or case 49 containing a magnet structure 51, held therein by any suitable means, for example, the clamp 52 and screws 53, and having a magnetic air-gap 54. A light, corrugated metallic ribbon conductor 55 is disposed in the air-gap, the spaced ends 56 of the conductor being brought out to terminals 57 and the conductor being supported by the radial corrugated flexible arms 58 that are secured to the rim 59 of the case 49 by clamping plates 60 and screws 61. Equally spaced slots 62, for the passage of the arms 58 and the conductor ends, are provided in the outer pole 63 of the poles 63, 64 defining the air-gap, and divide the outer pole into arcuate portions. The slits 65 in the supporting arms and the space 66 between the conductor ends may be covered by thin silk tissue 67. If desired, a square magnet structure may be used, providing a rectangular air-gap in which the ribbon diaphragm in the form of a hollow square is supported at each corner by flexible arms, such as 41 or 58. Fig. 16 shows how the ribbon diaphragm may be coupled to an amplifier (not shown) through an autotransformer 68.

While this invention has been disclosed with reference to specific embodiments thereof, it will be understood that it is not limited thereto but by the scope of the appended claims only.

What is claimed is:

1. A microphone comprising a cross-shaped conductive ribbon diaphragm and magnet structure defining air-gaps therefor.

2. A microphone comprising a one-piece conductive ribbon-like diaphragm having a central elongated portion and laterally projecting portions, and means defining magnetic air-gaps for each of said portions.

3. A microphone comprising a first conductive ribbon diaphragm, a second conductive ribbon diaphragm adjacent said first diaphragm but disposed at an angle thereto, and a single magnetic structure defining air-gaps for said diaphragms, said diaphragms being at right angles and together forming across-shaped surface.

4. A microphone comprising a conductive ribbon diaphragm, magnetic means defining an air-gap in which said diaphragm is positioned, and means at each end of said ribbon for supporting it in said air-gap, said means comprising a cantilever spring member with a block of resilient material secured to its free end, and the end of the ribbon being secured to said block.

5. A microphone comprising means defining magnetic air-gaps in substantially intersecting relation, and conductive ribbon diaphragm means in said air-gaps.

6. A microphone comprising a magnetic structure having an air-gap, a ribbon diaphragm in said air-gap, and a metallic spring member at each end of said diaphragm for supporting it, each of said members being angular in shape and being recessed at its apex to receive the end of the ribbon diaphragm.

7. A microphone comprising a magnetic structure having an air-gap, a ribbon diaphragm in said air-gap and a metallic spring member at each end of said diaphragm for supporting it, each of said members being angular in shape and being recessed at its apex to receive a body of resilient material with the end of the diaphragm secured to said body.

8. In combination, a plate member, a plurality of pole-piece members on said plate member spaced to define substantially cross-shaped air-gaps, a plurality of magnets having pole portions engaging with said pole-piece members, and means engaging said magnets for clamping said magnets and members together.

9. In combination, a plate member, a plurality of pairs of parallel pole-piece members secured to said plate member and spaced to define substantially cross-shaped air-gaps, a plurality of U-shaped permanent magnets with their pole portions in engagement with said pole-piece members, and a band member engaging with the magnets and clamping the magnets and pole-piece members together.

10. In combination, a plate member, a plurality of pairs of parallel pole-piece members secured to said plate member, one member of each pair being in angular relation to an adjacent member of another pair to define substantially cross-shaped air-gaps, a plurality of magnets having pole portions engaging with said pole-piece members, ribbon diaphragm means disposed in said air-gaps, means on said pole-piece members for supporting said ribbon diaphragm, and means engaging said magnets for clamping said magnets and members together.

11. A microphone comprising an annular plate member, a plurality of pairs of parallel pole-piece members secured to said plate member, one member of each pair being in angular relation to an adjacent member of another pair to define substantially cross-shaped air-gaps, conductive ribbon diaphragm means disposed in said air-gaps, means on said pole-piece members for supporting said diaphragm means, a plurality of U-shaped permanent magnets with their pole portions in engagement with said pole members, and an annular member engaging with said magnets and clamping them and said members together.

12. In combination, a carrier member, spaced pairs of parallel-pole-piece members secured to said carrier member, each member of a parallel-pole-piece pair being paired in angular relation with an adjacent member of another parallel pair, to form a plurality of air-gaps, radially arranged with respect to a common center, a permanent magnet for each pair of parallel-pole-piece members, each magnet having two pole portions, each pole portion engaging a pole-piece member and means engaging said magnets for clamping said magnets and pole-piece members together.

13. The combination as claimed in the preceding claim including ribbon diaphragm means in said air-gaps, and means on said pole-piece members for supporting said diaphragm means.

EDWARD P. KENNEDY.