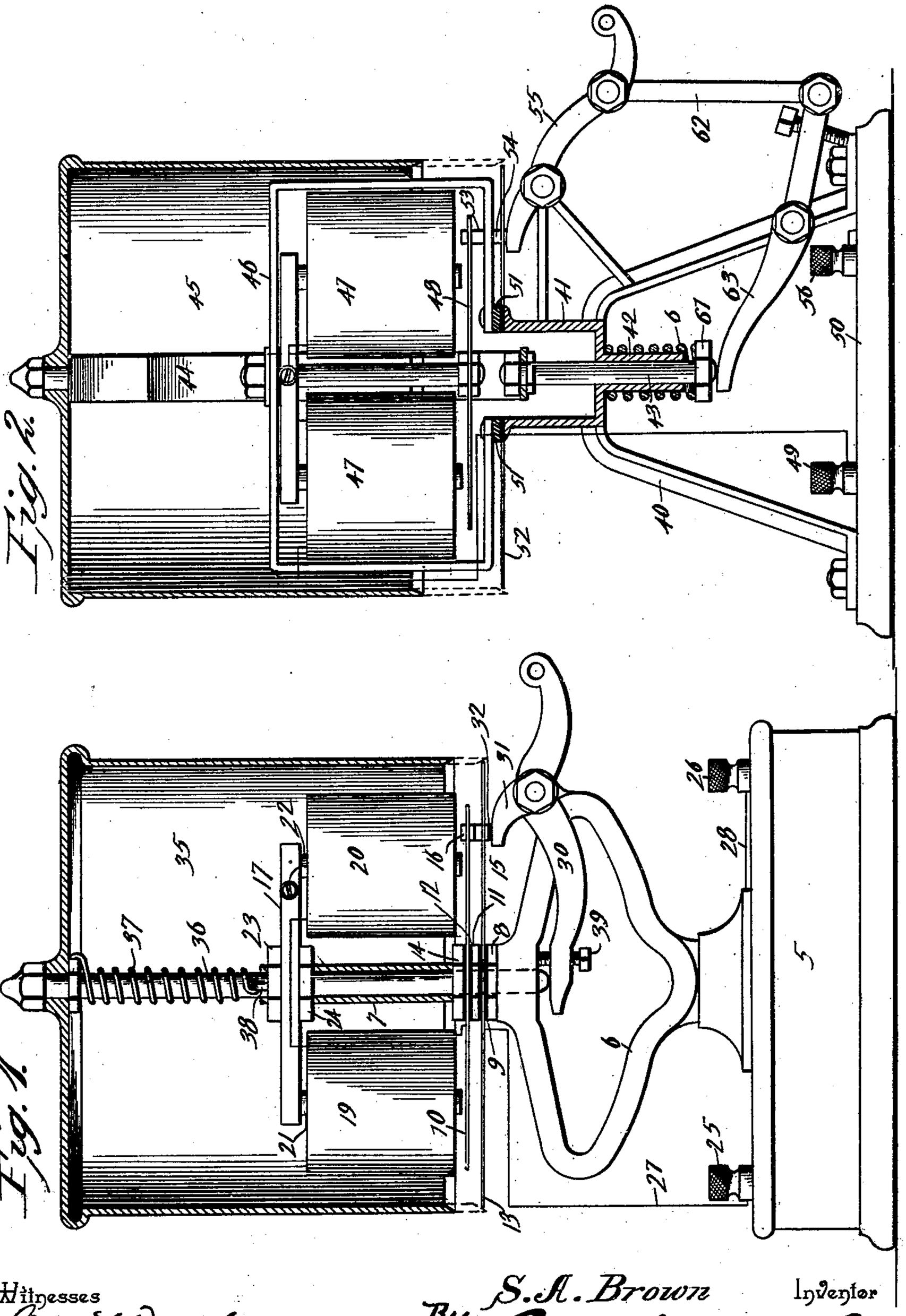
No. 677,772. Patented July 2, 1901.

S. A. BROWN.

ELECTRIC WHISTLE.

(Application filed Dec. 16, 1899.)

(No Model.) 4 Sheets—Sheet 1.



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(No Model.) 4 Sheets—Sheet 2.

Fig. 4.

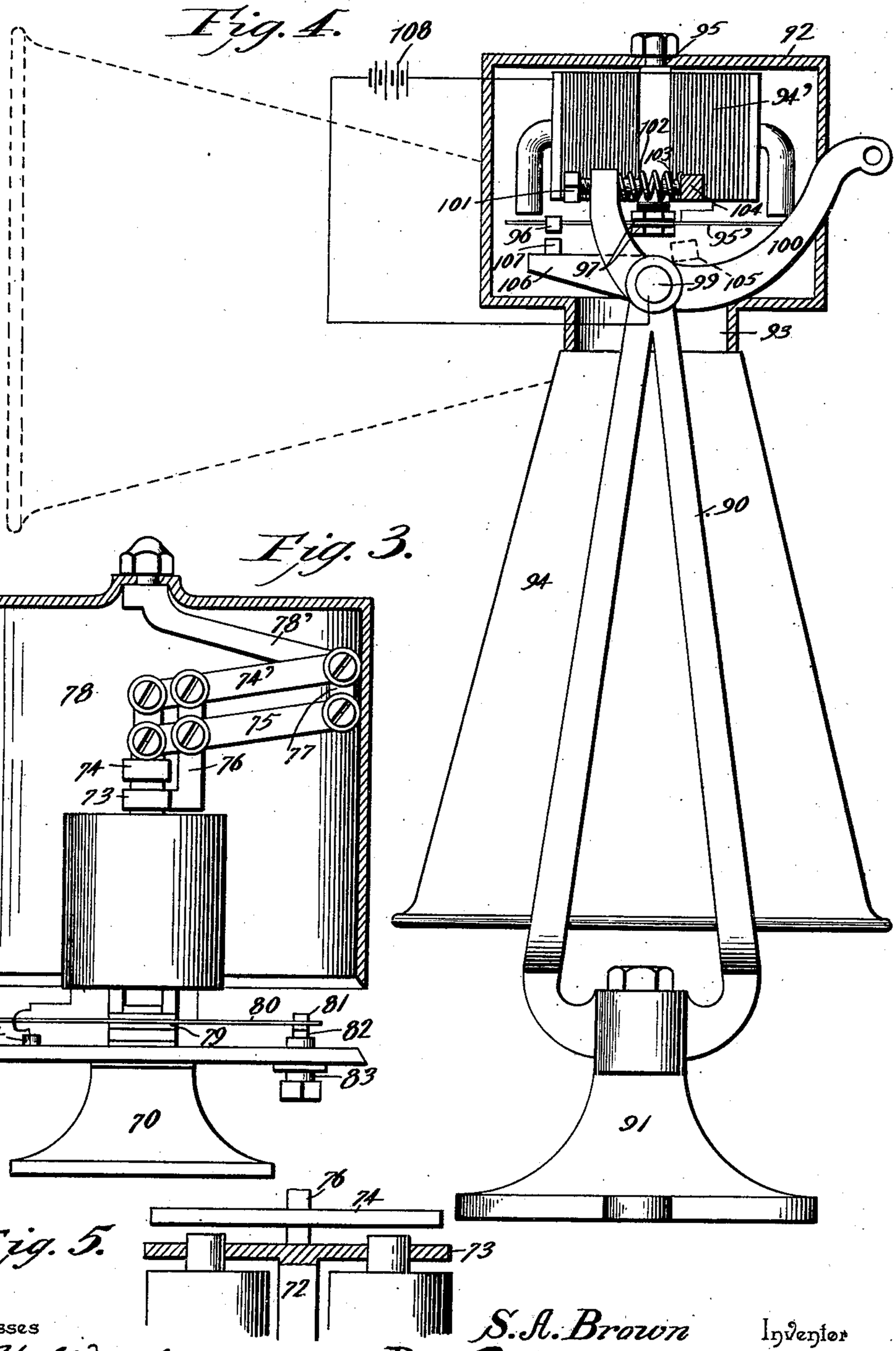

Fig. 3.

Fig. 5.

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(No Model.) 4 Sheets—Sheet 3.

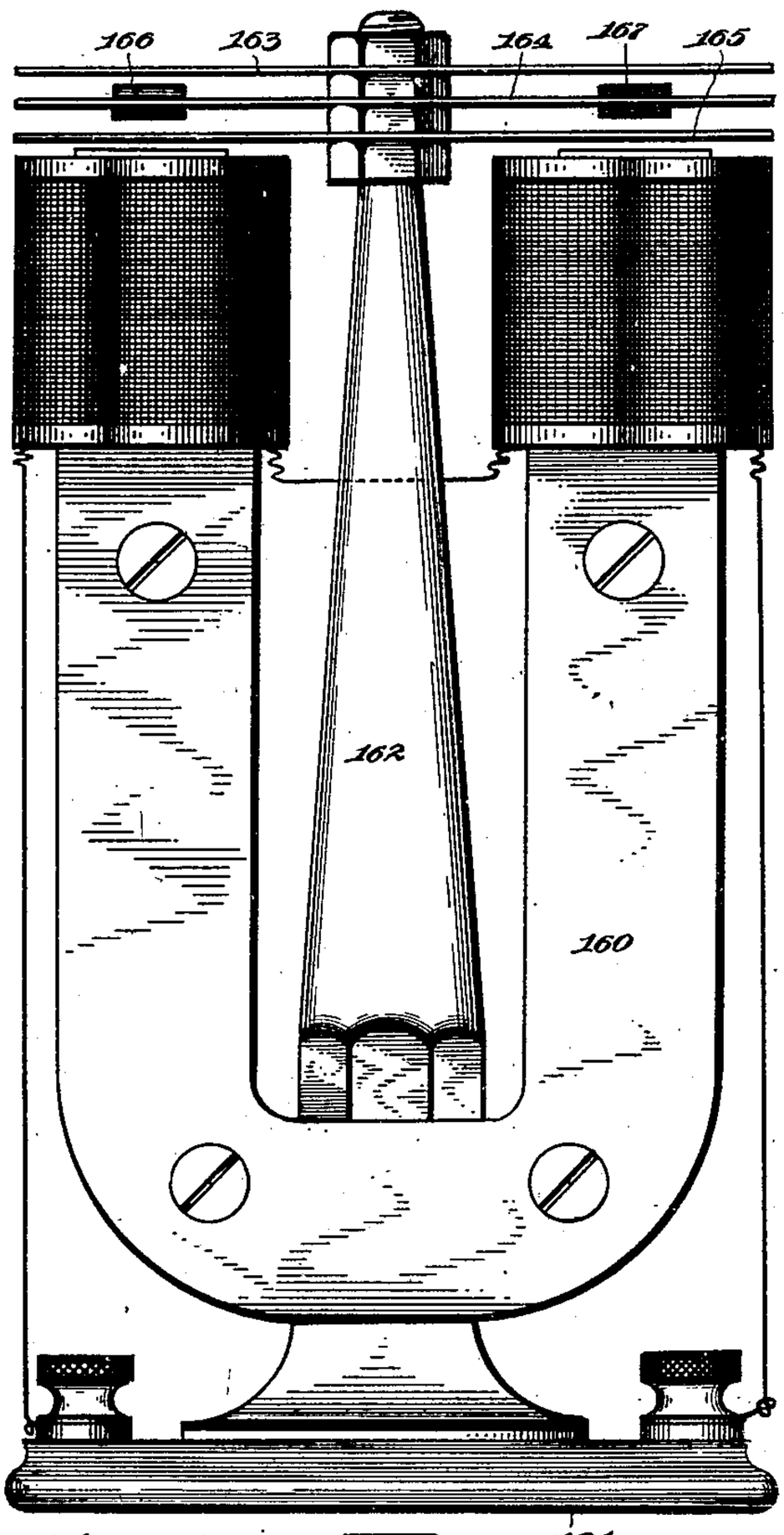

Fig. 10.

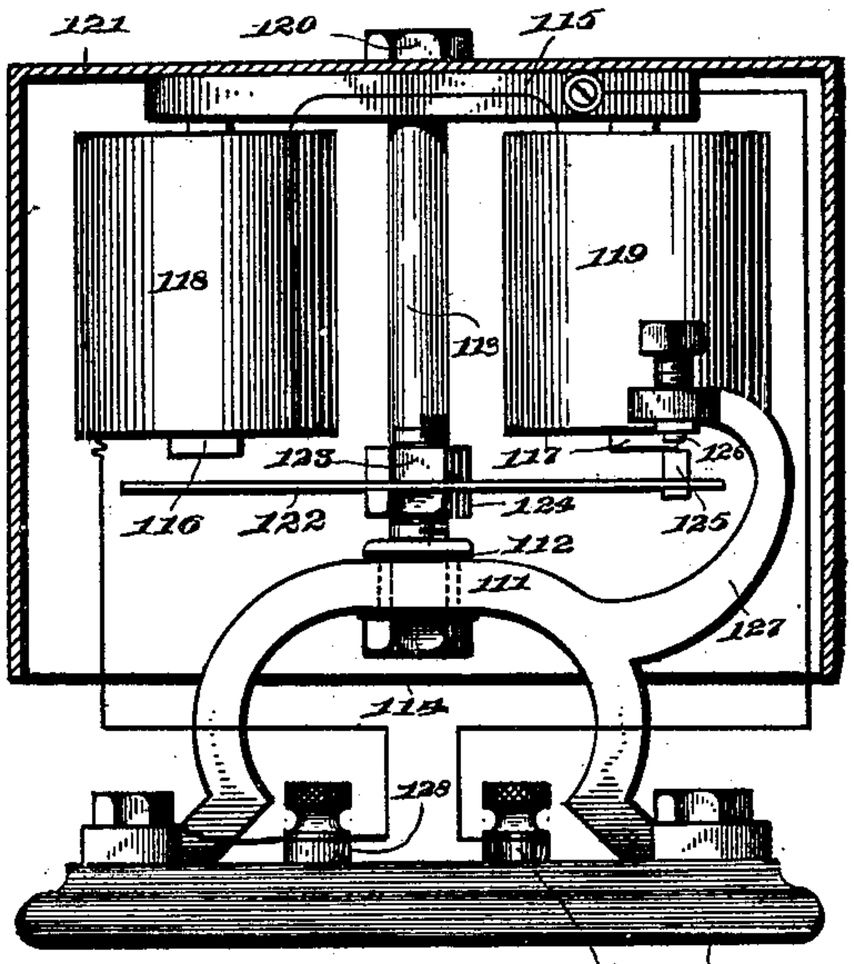

Fig. 7.

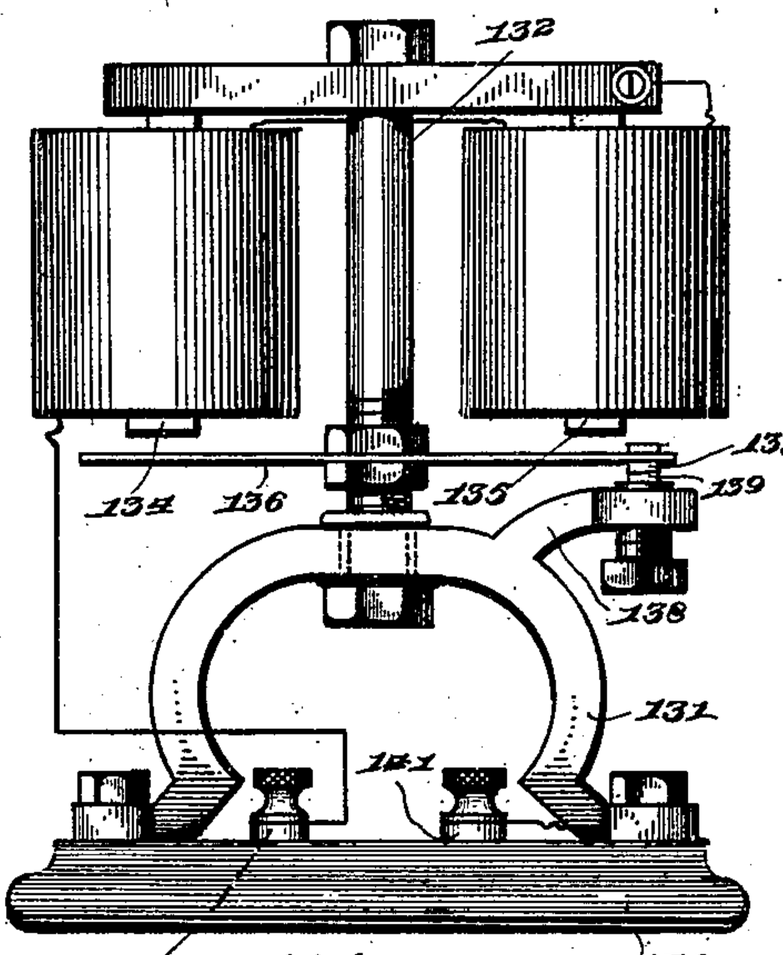

Fig. 8.

Fig. 9.

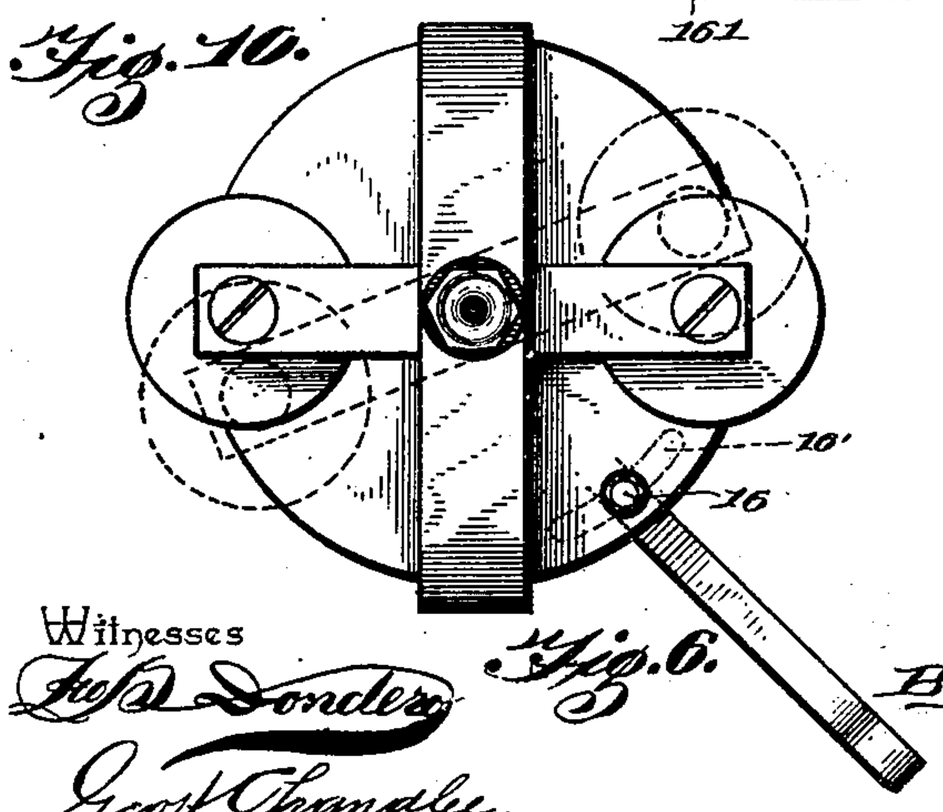

Fig. 6.

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(No Model.) 4 Sheets—Sheet 4.

Fig. 11.

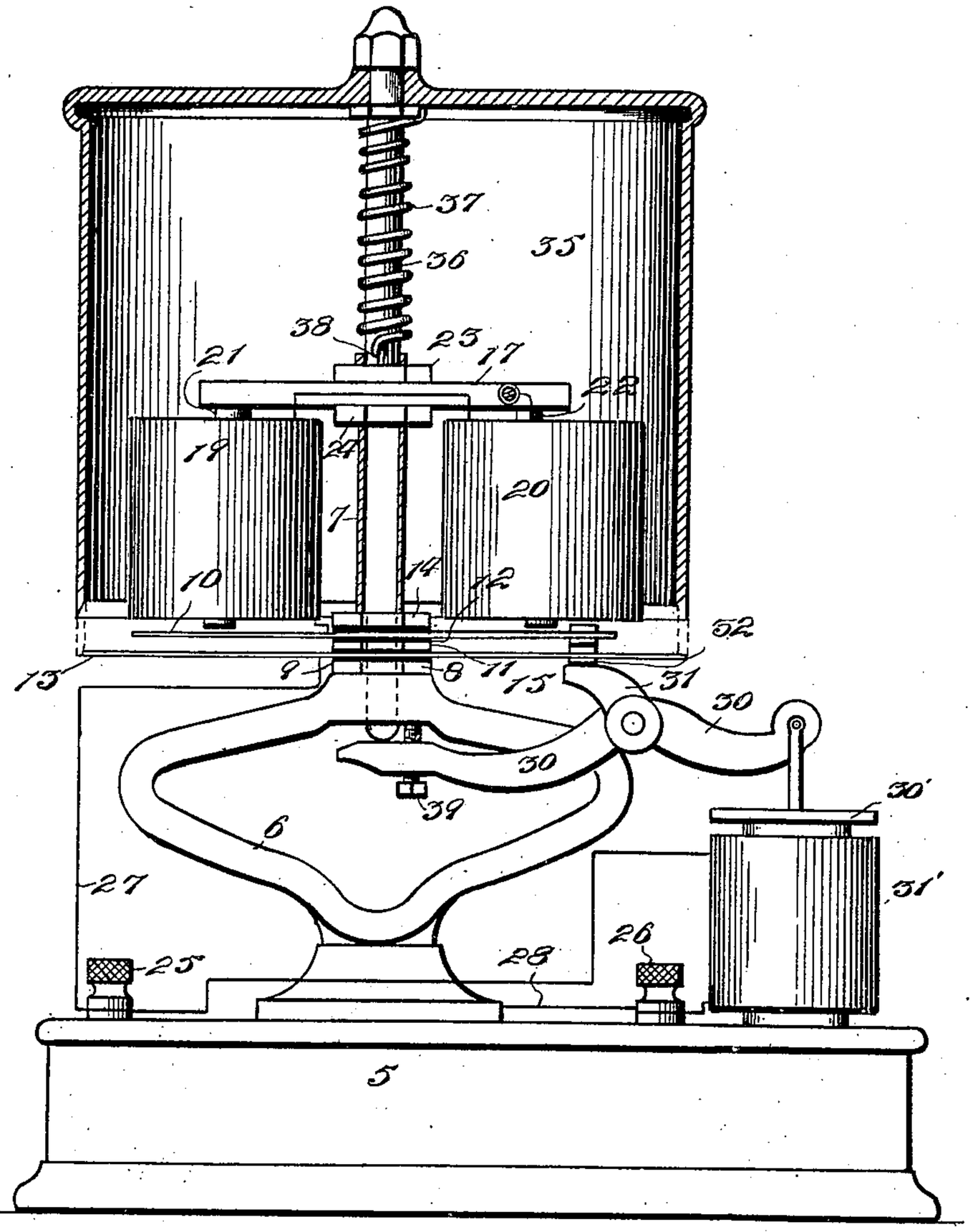
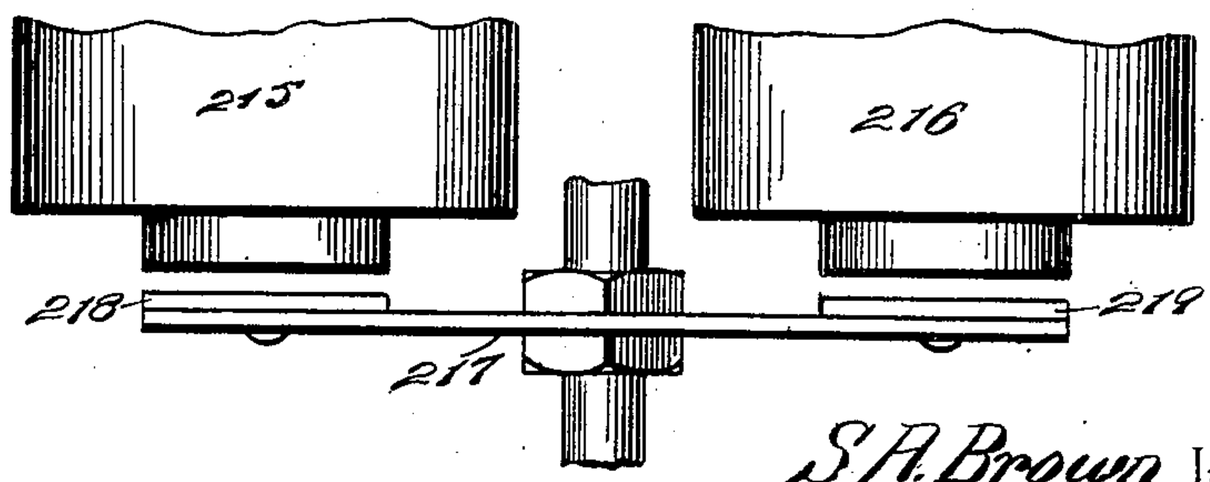


Fig. 12.



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UNITED STATES PATENT OFFICE.

STUART A. BROWN, OF MOUNT FAIR, VIRGINIA.

ELECTRIC WHISTLE.

SPECIFICATION forming part of Letters Patent No. 677,772, dated July 2, 1901.

Application filed December 16, 1899. Serial No. 740,563. (No model.)

To all whom it may concern:

Be it known that I, STUART A. BROWN, a citizen of the United States, residing at Mount Fair, county of Albemarle, and State of Virginia, have invented an Electric Whistle, of which the following is a specification.

This invention relates to signals in general, and more particularly to electric signals, and it has specific reference to electrically-operated whistles wherein air-vibrations are set up through the medium of electromagnetically-vibrated diaphragms, the object of the invention being to provide a simple and efficient construction in which the tone may be varied and which may be thrown into and out of operation in a simple manner.

Further objects and advantages of the invention will be evident from the following description.

In the drawings forming a portion of this specification, and in which like numerals of reference indicate similar parts in the several views, Figure 1 is a view, partly in section and partly in elevation, showing one form of the invention. Fig. 2 is a view similar to Fig. 1 and showing a somewhat different construction for operating the bell or resonator. Fig. 3 is a similar view showing a third form of the device, wherein the bell is raised by means of an electromagnet; and Fig. 4 is a view, partly in section and partly in elevation and showing a form of the invention designed especially for fog-signaling and similar uses. Fig. 5 is a detail view, partly in section, showing a portion of the structure of Fig. 3. Fig. 6 is a plan view with resonator removed and showing the adjusted position of the magnet in dotted lines, also showing in dotted lines a means for adjusting the contact on the diaphragm. Fig. 7 is a view similar to Fig. 1 and showing a shunt-wired instrument with a fixed resonator. Fig. 8 is an elevation showing a simple form of instrument for use with a continuous current. Fig. 9 is an edge view showing a modified arrangement of diaphragms. Fig. 10 is an elevation showing a form of the invention for use with a current of varying quality and including a plurality of diaphragms. Fig. 11 is a diagrammatic representation of a construction wherein an electromagnet is connected in multiple with the magnet that vibrates the armature for establishing initial contact of the make-and-break. Fig. 12 is a partial elevation showing a construction wherein the diaphragm is of non-magnetic material and is provided with soft-iron armatures.

Referring now to the drawings, and more particularly to Fig. 1 thereof, 5 represents an insulating-base of any suitable material and upon which is fixed a metallic standard 6, from which extends upwardly a tubular extension 7, the upper and lower ends of which are exteriorly threaded for a purpose which will be presently explained. Upon the lower portion of the tubular extension and directly above the standard proper there is engaged a nut 8, above which is disposed an insulating collar or sleeve 9, which carries a metallic diaphragm 13, which is thus insulated from the standard and its tubular extension, said insulating-sleeve being held firmly down against the nut therebelow by means of a second nut 11, which is screwed thereagainst. Above the second nut 11 is disposed a second insulating-sleeve 12, which carries a second metallic diaphragm 10 in insulated relation to the remaining parts described, this second sleeve being held in proper position by means of a third nut 14, which is engaged with the threads at the base of the extension 7. These diaphragms carry contact-pieces 15 and 16, respectively, which lie normally separated and adapted for movement into initial contact in a manner hereinafter described.

Mounted rotatively upon the upper end of the extension 7 is the back armature 17 of a bipolar electromagnet, including pole-pieces 19 and 20, having windings 21 and 22 thereon, these pole-pieces being disposed at opposite sides of the center of the diaphragm and with their axes in a common plane with the axis of the diaphragm, so as to include the diaphragm 10 in their field of force to attract said diaphragm when the magnet is energized. Thus the energizing motion is given to the diaphragm adjacent to the ends of a diameter thereof, the poles of the magnet being positioned near the edge or periphery of the diaphragm, and thus the most effective vibration of the diaphragm is secured. The back armature referred to is held normally in proper relation to the diaphragm and against

rotatable movement by means of clamping-nuts 23 and 24, disposed above and below the back armature and which are adjusted to impinge thereagainst.

Binding-posts 25 and 26 are mounted upon the base 5, one of which is connected electrically with the diaphragm 13, as indicated in diagram by the wire 27, while the second binding-post is electrically connected, by means of a wire 28, with the standard 6. One terminal of the winding of the electromagnet is connected directly with the back armature of the magnet, while the other terminal is connected with the diaphragm 10, as shown, whereby if a current of electricity be sent through the binding-posts the circuit will be from post 25 to diaphragm 13, through contacts 15 and 16, to diaphragm 10, to electromagnet, to back armature, to tubular extension 7, to standard 6, and binding-post 26, this being the circuit when the contacts are in mutual engagement, it being understood, however, that they stand normally apart and are brought into initial contact by means of a lever 30, having a finger 31, which is disposed to engage its insulated knob 32 against the diaphragm 13 when the lever is operated pivotally to move the lower contact against the upper contact, it being understood that said lever is mounted upon the standard 6.

A bell or resonator 35 for the diaphragm 10 is cylindrical in form and has its upper end closed, while its lower end is open. This bell or resonator is mounted upon an axial stem 36, which is slidably engaged with the tubular extension 7 and is held normally in a lowered position by means of a helical spring 37, which is attached at its upper end to the bell and at its lower end to an ear 38 upon the uppermost nut of the extension 7. The lower end of this stem projects through the lower end of the extension 7 for engagement by the end of the lever 30 to raise the bell, Fig. 1 of the drawings showing the bell in this raised position. The extent to which the bell is raised is regulated by a set-screw 39, which is engaged with the end of the lever and is disposed to strike against the standard 6 to limit the operative movement of the lever.

The operation of the device is as follows: A cord is attached to the outer end of the lever 30, through the medium of which the lever is operated, the first movement of the lever acting to raise the bell and then to make contact between the contact-pieces upon the diaphragms. Further movement of the lever acts to raise the bell higher and to change the tone produced. As soon as the contacts are engaged the electromagnet is energized and the diaphragm 10 is operated to sound. When the lever is released, the parts assume their normal positions, and the circuit being broken the diaphragm ceases to vibrate.

As above stated, the electromagnet is rotatably adjustable upon the extension 7, its axis of rotation being coincident with the axis of the diaphragm, so that the distance of the poles of the magnet from the center of the diaphragm is constant, and inasmuch as the contact 16 is fixed with respect to the diaphragm the poles of the magnet are adjusted one toward and the other away from the contact. As the diaphragm vibrates it strikes the contact 16, which acts to retard the vibration at this point and to establish a node, thereby breaking up the vibration of the diaphragm into complex movements, producing tones and overtones. As shown in Fig. 6 of the drawings, the contact-point 16 is normally spaced an angular distance of forty-five degrees from the line connecting the poles of the magnet, and this position of the contact is found to be the most effective. If the magnet be adjusted in either direction from this forty-five-degree relation to the contact-point, the tone produced by the vibration of the diaphragm will of course be changed, as will be readily understood, because of the change in the relative position of the established node. The essential point in this structure is that the diaphragm is rigidly mounted at its center and that the pull of the electromagnet is applied at diametrically opposite points and adjacent to the periphery of the diaphragm.

In Fig. 6 of the drawings one adjusted position of the electromagnet is indicated in dotted lines, and it will of course be understood that, if desired, instead of mounting the magnet for rotatable adjustment and fixing the contact 16 the said contact, which is in the form of a headed bolt passed through the diaphragm and provided with a retaining-nut, may be disposed in an arc-shaped slot, (indicated in dotted lines at 16′,) whereby the contact may be adjusted angularly with respect to the line of the poles of the magnet.

In Fig. 2 of the drawings the standard 40, mounted upon an insulating-base, has a yoke 41 at its upper end, and centrally of which depends a sleeve 42, in which is a slidable bolt 43, carrying a metallic hook 44 at its upper end, and upon this hoop is fixed the resonator or bell 45. A rectangular supporting-frame 46 has its ends fixed to the sides of the yoke 41 and lie transversely of and within the inclosure of the hoop 44. The upper side of the frame 46 carries a depending bolt, upon which is mounted the back armature of a bipolar electromagnet 47, and at the lower end of this bolt, which projects beyond the poles of the magnet, is fixed a diaphragm 48 in electrical relation to the back armature, which latter has one terminal of the electromagnet connected therewith, the opposite terminal of the electromagnet being connected with a binding-post 49 upon the base 50. As shown in the drawings, insulating-blocks 51 are disposed between the ends of the magnet-supporting frame and the yoke 41 to insulate the parts, and between these blocks and the yoke is clamped a diaphragm 52, the two diaphragms carrying contact pieces or blocks 53 and 54, which form a make-and-break. These blocks lie normally separated, and the lower

block is moved initally into contact with the upper block by means of a lever 55, pivoted upon the standard 40 and adapted for engagement with the lower end of the block which projects through the lower diaphragm. The lower diaphragm is in electrical connection with the standard, which is in turn connected with a binding-post 56 upon the base 50, and the magnet-supporting bracket is insulated from the bolt upon which the back armature is secured, and hence when the contact-block of the lower diaphragm is moved to the upper contact-block the magnet is energized and the diaphragm adjacent the magnet is caused to vibrate in the well-known manner, it being understood that a battery is connected with the binding-posts. The slidable bolt 43 is held normally and yieldably in a lowered position to hold the bell down round the magnet by means of a helical spring 60, which encircles the sleeve 42 and bears at its lower end against a nut 61 at the lower end of the bolt, and in order to raise the bell to expose the diaphragm, as shown, a lever 63 is pivoted to the standard and projects to lie against the lower end of bolt 43, said lever being connected by means of a link 62 with the lever 55, so that both may be operated simultaneously. In this construction also the electromagnet is rotatable to vary the angle between the line connecting its poles and the line connecting the contact and the center of the diaphragm and of rotation of the magnet.

In Fig. 3 of the drawings a base 70 has a disk-shaped plate 71 thereon, from which extends an upright 72, at the upper end of which is a diamagnetic transverse bar 73, with which are engaged the pole-pieces of a bipolar electromagnet having a movable back armature 74, which is pivoted to the ends of two levers 74′ and 75, which are in turn pivoted to an upwardly-directed arm 76 upon bar 73, so that when the back armature is attracted the outer ends of these levers will move upwardly. The outer ends of the levers are connected by a link 77, from which extends a rigid arm 78, which supports the bell 78, and thus as the back armature is attracted the bell is raised from its normal position covering the magnet. The lower end of the upright 72 is passed through an insulating-block 79, which carries a diaphragm 80, lying in the field of force of the electromagnet, and which diaphragm carries a contact-block 81 for engagement with a block 82, mounted upon and insulated from the disk plate 71, and having a binding-post 83 connected therewith. One terminal of the electromagnet is connected with the diaphragm and the other with a binding-post 84 upon the plate 71. Thus if a current of electricity be passed through the circuit including the binding-posts the electromagnet will be energized, when the back armature will be attracted in the manner described to raise the bell and expose the diaphragm, at which time also the diaphragm is vibrated to sound. The back armature directly engages the pole-pieces and is polarized to such extent that it does not leave them as the current pulsates, and only moves away when the current is broken for an appreciable length of time.

In Fig. 4 of the drawings a supporting-frame 90 of yoke shape is mounted upon a base 91, and pivoted between its upper ends is a casing 92, having an opening 93 in one side, from which extends a megaphone 94, which normally hangs downwardly. A bolt 95 is passed through a side of the casing opposite to the opening 93, and mounted thereon is a bipolar electromagnet 94, the faces of the poles of which are disposed in the direction of the side having the opening therein. Upon the free end of this bolt is secured a diaphragm 95, lying in the field of the electromagnet and carrying a contact-block 96, which is in electrical connection with one terminal of the magnet through the diaphragm, said diaphragm being insulated from its suspending-bolt by insulating-washers 97, as shown.

The pivot-shaft 99 of the casing has a lever 100 fixed thereto exterior to the casing, and one end of which has a pin 101, encircled by a helical spring 102, the opposite end of which encircles pin 103, mounted upon a block 104 upon the side of the casing, so that when the lever is operated the casing will be rotated to project the megaphone in a horizontal position. (Indicated in dotted lines.) When the casing reaches this position, a block 105 thereon strikes a side of the supporting-frame and prevents further movement of the casing, and further movement of the lever compresses the helical spring until the pin 101, which is in the form of a set-screw, strikes against pin 103. At this time—*i. e.*, during the compression of the helical spring—an arm 106 upon the pivot-shaft moves its contact-block 107 against the block on the diaphragm and closes the circuit of battery 108, one terminal of which is connected with the electromagnet and the other terminal with the arm 106. The magnet being energized, the make-and-break is operated and the diaphragm is vibrated. When the lever is released, the contact-blocks first move from coöperative positions and the casing then turns to lower the megaphone.

In Fig. 7 of the drawings there is shown a different embodiment of the invention, wherein 110 represents an insulating-base upon which is mounted a bracket 111, which stands vertically and has a central vertical perforation in which is an insulating-bushing 112. Through the bushing 112 is passed a post 113, held in place by a nut 114 at its lower end, while upon the reduced upper end thereof is rotatably disposed the back armature 115 of an electromagnet, comprising poles 116 and 117 and spools 118 and 119, the back armature being held against movement by a clamping-nut 120, which is disposed against the top of a cylindrical casing 121, which is disposed over the electromagnet and has a central opening

in its upper end through which the upper end of the post 113 is passed. The casing forms a fixed resonator, and its lower edge extends downwardly sufficiently far to inclose the diaphragm 122, which is mounted centrally upon the post 113 and is held fixedly below and in the field of force of the electromagnet by means of an upper and a lower nut 123 and 124, respectively. The diaphragm 122 carries a contact-piece 125, which projects upwardly therefrom for contact with an adjustable contact-screw 126, engaged with the overhanging end of an arm 127 upon the bracket 111, so that when the diaphragm is drawn in the direction of the poles of the electromagnet the contacts will be engaged. Upon the base 110 are two binding-posts 128 and 129, of which one post 128 is connected electrically with one terminal of the winding of the electromagnet, while the post 129 is connected directly with the back armature 115 and with the opposite terminal of the winding. The post 128 is also connected with the bracket 111. Thus a current of electricity when the posts 128 and 129 are properly connected up will initially pass from post 129 through the magnets and out at post 128, drawing the diaphragm to the magnet through the energization of the magnet. This movement of the diaphragm effects contact of the contact-points upon the diaphragm and bracket-arm when the current from post 129 is shunted around the winding of the magnet by way of the back armature 115, the post 113, the diaphragm, the contacts, and the bracket to the post 128, when the energy of the electromagnet is decreased to that extent that the diaphragm is permitted to return. When the shunt-circuit is broken by disengagement of the contacts, the energization of the magnet to the proper degree again takes place and the diaphragm is again attracted. This operation continues so long as the circuit to the binding-posts 128 and 129 is maintained.

In Fig. 8 of the drawings there is shown a simple form of the invention adapted for use with a continuous current, and in this structure 130 is a base, having a bracket 131 thereon, upon which is mounted a post 132, which carries the back armature 133 of an electromagnet comprising poles 134 and 135. The post is insulated from the bracket, and fixed thereon at its center is a diaphragm 136 in the field of the electromagnet and carrying a contact 137. An arm 138 upon the bracket has an adjustable contact-screw 139, adapted to contact with the contact 137 on the under side of the diaphragm and against which the contact 137 normally rests. A binding-post 140 upon the base is connected with one terminal of the winding of the magnet, the opposite terminal being connected with the back armature, which is in turn connected with the diaphragm through the post. A second binding-post 141 upon the base is connected with the bracket, and thus if a current of electricity be passed through the magnet by making connections with the binding-posts the diaphragm will have the action of the vibratory member of an ordinary make-and-break and will continue to vibrate so long as the circuit is closed to the binding-posts.

In Fig. 9 of the drawings there is shown another arrangement of diaphragms, wherein 150 represents the main diaphragm at diametrically opposite points, and adjacent the periphery of which are mounted the two smaller diaphragms 151 and 152.

In Fig. 10 of the drawings an electromagnet 160 is disposed upon a base 161, with its poles disposed upwardly, a post 162 passing upwardly between the poles to a point thereabove, and upon this post are disposed three diaphragms 163, 164, and 165, mounted rigidly at their centers in axial alinement. The middle diaphragm 164 has stops 166 and 167 fixed at diametrically opposite points thereof and spaced an angular distance from the line connecting the poles of the magnet to establish nodes when the upper and lower diaphragms contact therewith in the same manner as do the contacts above described. The terminals of the winding of the electromagnet are connected with binding-posts 168 and 169, and the apparatus is adapted for operation by a variable current, as will be understood, whereby the energy of the electromagnet is varied. It will be noted that in each instance the diaphragm is mounted rigidly at its center, and the poles of the magnet are disposed adjacent to the periphery of the diaphragm and in alinement transversely with the axis of the diaphragm, it being understood that the contact-point is spaced a proper angular distance from the line of the poles of the magnet. It will be understood that in practice the resonator may be fixed or movable, the magnet or the contact-point of the diaphragm may be shifted to vary the relative positions thereof, that bipolar or multipolar magnets may be used, that any suitable materials and proportions may be utilized, and that various other modifications of the structures shown may be made without departing from the spirit of the invention. It will be understood that instead of operating the levers 30, 55, and 100 by means of cords attached thereto they may be provided with armatures to be drawn down by electromagnets connected in multiple with the magnets which actuate the diaphragms.

In Fig. 11 of the drawings there is shown an arrangement wherein the lever 30 is provided with an armature 30′, attached to its outer end in the place of a cord, and this armature is disposed for movement by an electromagnet 31′, connected in multiple with the coils 19 and 20. Thus both magnets will be simultaneously energized when a circuit including the posts 25 and 26 is closed, and the make-and-break will be initially engaged and the resonator or casing raised.

In Fig. 12 is represented portions of vibrating coils 215 and 216, in the field of which is disposed a diamagnetic diaphragm 217, having armatures in the form of paramagnetic disks 218 and 219 attached thereto adjacent to the pole-pieces of the coils in order that the diaphragm may be vibrated under the influence of the coils.

What is claimed is—

1. A device of the class described comprising an electromagnet, a vibratory body in the field of the magnet, an electric circuit for the magnet including a make-and-break, a resonator disposed to cover the magnet, and a lever operatively connected with the cover and the make-and-break to expose the magnet and move the make-and-break into initial contact.

2. A device of the class described comprising an electromagnet, a vibratory diaphragm in the field of the magnet, an electric circuit for the magnet including a make-and-break, a movable casing for the magnet, and a lever operably connected with the casing and with the make-and-break to move the casing and establish initial contact of the make-and-break.

3. A device of the class described comprising an electromagnet, a vibratory diaphragm in the field of the magnet, an electric circuit for the magnet and including a make-and-break operable by the diaphragm, a movable casing for the magnet, and a lever connected with the casing and make-and-break for moving the casing and establishing initial contact of the make-and-break.

4. A device of the class described comprising an electromagnet having a support, a rod slidably mounted in the support, a casing for the magnet carried by the rod and movable therewith to cover and uncover the magnet, a pivoted lever in operative relation to the rod to move it, a vibratory diaphragm in the field of the magnet, an electric circuit for the magnet including a make-and-break operable by the diaphragm, and a finger upon the lever disposed to engage the make-and-break and move and hold it in operative position.

5. An electric whistle comprising an electromagnet, a vibratory diaphragm disposed in the field of the magnet with the lines of force of the field to concentrate at diametrically opposite points and adjacent to the periphery thereof, a make-and-break including the diaphragm and a contact for engagement thereby, and means for shifting the magnet to vary the angular distance between the contact-point and the adjacent point of concentration of the lines of force.

6. An electric whistle comprising an electromagnet, a vibratory body in the field of the magnet, an electric circuit for the magnet and including a make-and-break, and an electromagnet in operative relation to the make-and-break to move it into initial contact, the second electromagnet being connected in multiple with the first electromagnet.

7. An electric whistle comprising a diaphragm supported at its center and having its peripheral portion free to vibrate, a multipolar electromagnet having unlike poles disposed at diametrically opposite points of the diaphragm at one side thereof and adjacent to the periphery of the diaphragm, and a make-and-break including a contact carried by the diaphragm adjacent to the periphery thereof, said contact and the poles of the magnet being relatively movable to vary the angular distance therebetween to vary the tone produced, the make-and-break being included in the circuit of the electromagnet.

8. An electric whistle comprising a diaphragm supported at its center and having its peripheral portion free to vibrate, a multipolar electromagnet having unlike poles disposed at diametrically opposite points of the diaphragm at one side thereof and adjacent to the periphery of the diaphragm, and a make-and-break in the circuit of the electromagnet and comprising a contact carried by the diaphragm adjacent to the periphery thereof and spaced an angular distance from the adjacent pole of the electromagnet.

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