

L. GRUBMAN.
DIAPHRAMATIC SOUND PRODUCER.
APPLICATION FILED MAR. 29, 1915.

1,209,148.

Patented Dec. 19, 1916.
2 SHEETS—SHEET 1.

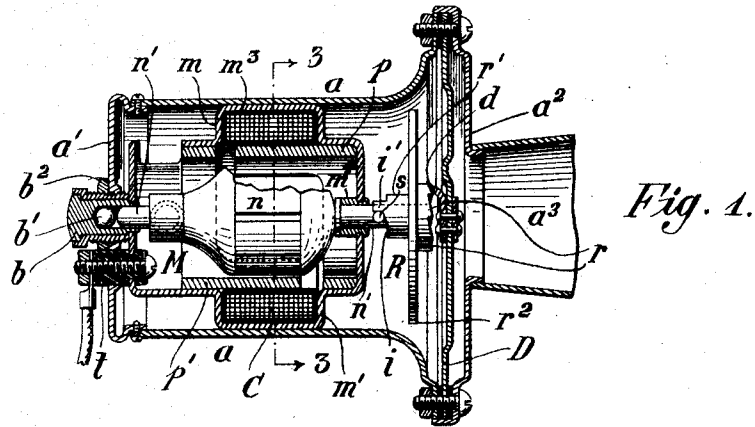


Fig. 1.

Fig. 2.

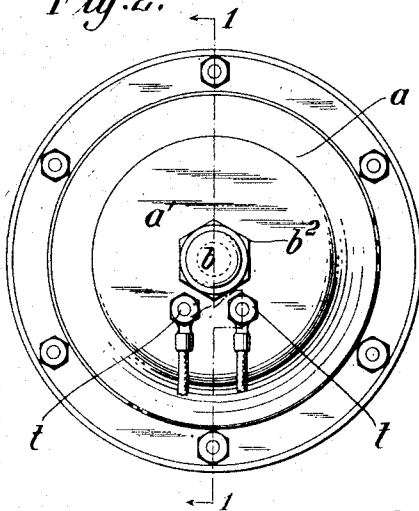


Fig. 3.

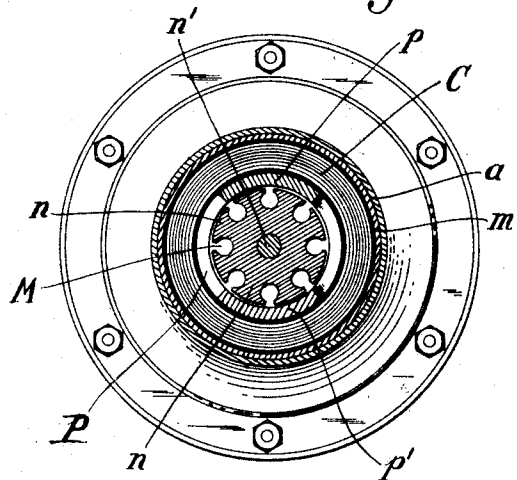


Fig. 5.

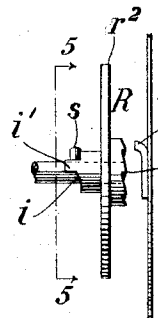
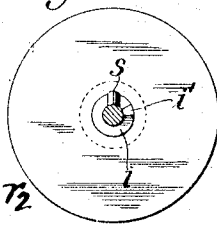


Fig. 6.

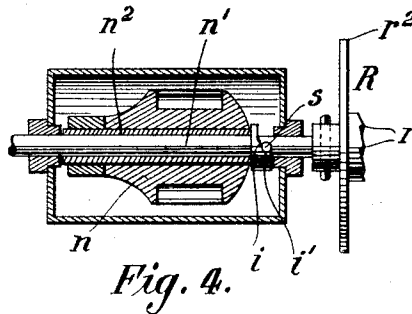


Fig. 4.

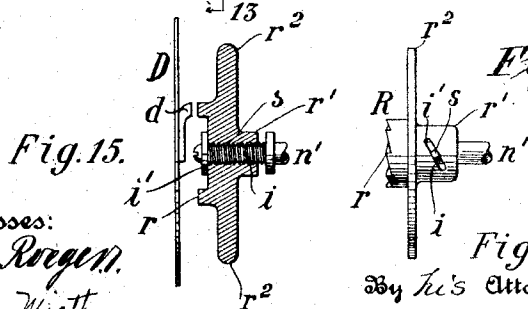
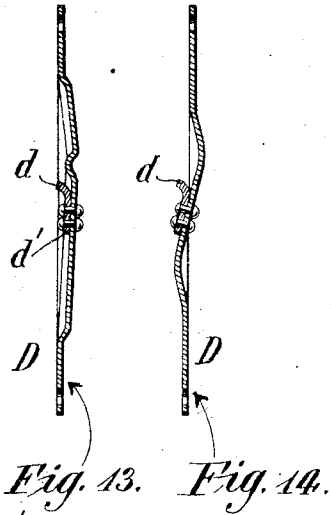
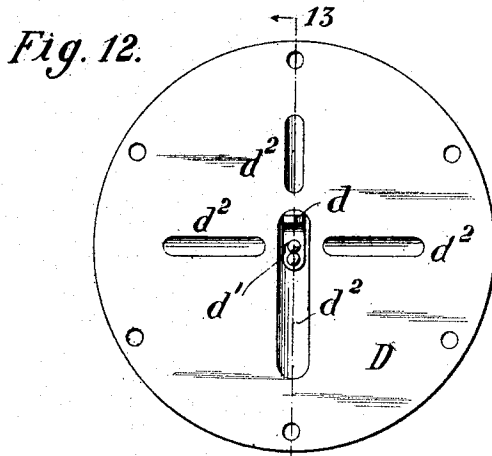
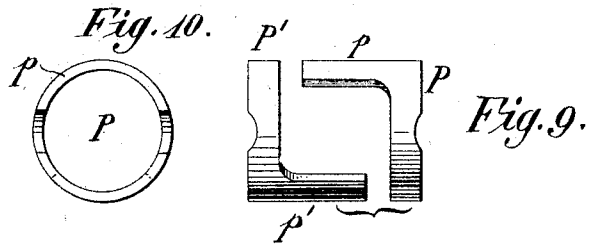
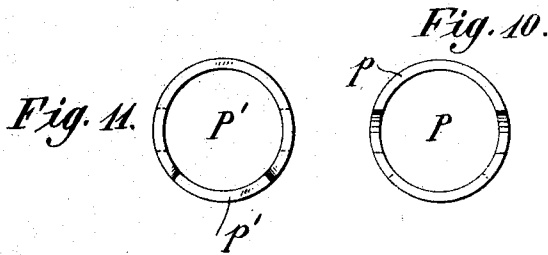
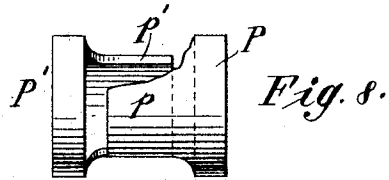
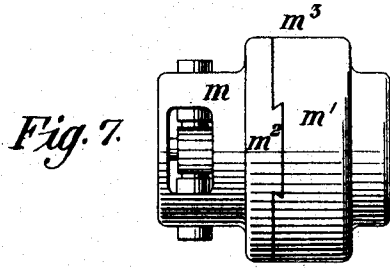
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Witnesses:
Fred. Rogen.
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Fig. 15.
Fig. 16.
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UNITED STATES PATENT OFFICE.

LEO GRUBMAN, OF BROOKLYN, NEW YORK, ASSIGNOR TO ELECTRIC SPARK APPLIANCE CO. INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

DIAPHRAGMATIC SOUND-PRODUCER.

1,209,148.

Specification of Letters Patent.

Patented Dec. 19, 1916.

Application filed March 29, 1915. Serial No. 17,636.

To all whom it may concern:

Be it known that I, LEO GRUBMAN, a citizen of the United States, and a resident of the borough of Brooklyn, county of Kings, and city and State of New York, have invented certain new and useful Improvements in Diaphragmatic Sound-Producers, of which the following is a specification.

My invention is designed more particularly for use in connection with automobile horns, although adaptable to other sounders of the vibratory diaphragm type, and consists in the construction and arrangement of parts hereinafter described and claimed specifically.

In the accompanying drawings, Figure 1, is a central sectional elevation of an automobile horn embodying the essential features of my invention, taken upon plane of line 1—1, Fig. 2, the resonator and other parts being broken away for convenience of illustration; Fig. 2, is a rear view of the device; Fig. 3, a transverse section upon plane of line 3—3, Fig. 1; Fig. 4, is a sectional elevation illustrating a modification alternative to the arrangement shown in Fig. 1; Fig. 5, is a sectional view taken upon plane of line 5—5, Fig. 6; Fig. 6, is a detail view illustrating in a general way the relation of the percussive rotor to the diaphragm and its protuberant contact; Fig. 7, is an external view of the motor shell; Fig. 8, a detail elevation of the magnetic field pieces, one of the poles being partly broken away; Fig. 9, is a view taken at right angles to Fig. 8; Figs. 10, and 11, are detail views of the field magnets separated and looking toward the pole extensions in each case; Fig. 12, is an elevation of the diaphragm; Fig. 13, is a sectional elevation of the diaphragm taken upon plane of line 13—13, Fig. 12; Fig. 14, is a similar view illustrating the buckling tendency of the old form of diaphragm and protuberant contact; Figs. 15, and 16, are detail views showing modifications of the means for effecting the lateral play of the percussive rotor with relation to the diaphragm.

The main portion a , of the casing is cylindrical, the rear end being closed by an end cap a' and front portion being flared outward and closed by the cap a^2 , to which the resonator a^3 , is attached. The elastic resili-

ent diaphragm D , is secured at its edges between flanged front edge of the casing and the cap a^2 , as heretofore, space being provided between the parts for the vibration of the diaphragm.

The electro-motor M , consists in part of a shell made in two sections m, m' , which interlock by means of dovetail joints m^2 , one of which is shown in Fig. 7, or by other equivalent interlocking means. The medial portion m^3 , of the shell is cylindrical and of a diameter to fit snugly within the outer casing a , without interfering with the adjustment of the motor shell longitudinally within said outer casing. This medial enlargement m^3 , of the motor shell affords accommodation for the single electric coil C , which surrounds the magnetic poles p, p' , and is inclosed on the other three sides by the shell m, m' , as shown in Fig. 1. The magnetic poles p, p' , consist of lateral extensions of the magnetic rings P, P' , which fit tightly within the shell sections m, m' ,—the poles p, p' , connected magnetically through the medium of the shell m, m' , extending inward centrally on opposite sides of the armature n , which is supported on the shaft n' , journaled at the front in a bearing m^4 , on the forward part m' , of the shell and at the rear in a bearing b , adjustably mounted on the end plate a' , of the exterior casing. This adjustable bearing b , also engages with and supports the rear member m , of the motor shell; and the rear end of the shaft n' , abuts against the interior of the bearing b , either directly or indirectly as shown in Fig. 1, through the medium of an antifriction ball b' .

The adjustment of the bearing b , may obviously be effected by resort to various mechanical expedients and I do not limit myself in this respect, the main object to be attained being the longitudinal adjustment of the motor and its armature shaft with relation to the diaphragm D . In the construction shown in the drawings the bearing b , is provided with a bushing formed with a peripheral screw thread which engages a female screw thread formed for its reception in the end cap a' ; and a lock nut b^2 , is provided to hold the parts in a prescribed position. This longitudinal adjustment of the motor and armature shaft with relation to

the mean position of the diaphragm D, is provided for the purpose of regulating with accuracy the extent of overlap or depth of engagement between the protrusions r, r , on percussive rotor R, and the protuberant contact d , on the diaphragm D. If the percussive rotor R, approaches too closely the mean position of the diaphragm D, equivalent to its normal position when at rest, it is obvious that the frictional resistance between the protuberances r, r , on the rotor, and the contact d , may seriously impede the vibration of the diaphragm or stop the motor. On the other hand if the impact or length of effective stroke of the protuberances r, r , on the rotor R, against the contact d , of the diaphragm, is very slight the vibration imparted to the diaphragm may be insufficient to produce the requisite pitch of sound waves and the horn will be feeble and inefficient. Furthermore it is desirable in starting to sound the horn that the actuating motor or driving element acquire sufficient momentum before the percussive rotor R, engages the diaphragm contact d , to overcome frictional resistance and the inertia of the diaphragm itself, otherwise the driving element may be clogged and action retarded if not prevented entirely. For these reasons I not only make the motor or driving element adjustable with relation to the mean position of the diaphragm as above intimated, but I also mount the percussive rotor, the driven element, loosely upon the driving element in the sense that the driving element under certain conditions, as when starting, may make a partial rotation on its longitudinal axis before positively engaging with and rotating the driven element. And as a corollary when the speed of the driving element slackens the driven element by acquired momentum will turn independently sufficiently to end positive engagement with the driving member so as to restore the two elements, driven and driving, to their normal relative positions when at rest. And the means for effecting positive engagement between the driving and driven elements are such that when disconnected as above stated the driven member on which the percussive rotor R, is mounted is free to yield to the vibration of the diaphragm, so that the rotor R, will be "kicked" back out of engagement with contact d , on the diaphragm, and hence in re-starting the diaphragm will afford no resistance until the percussive rotor R, is again forced forward as the positive connection between the driving element and the driven element is reestablished as hereinbefore more particularly explained.

I have deemed expedient to thus state the function and operation of my slidable percussive rotor with relation to the driving element in a general way as above because said rotor R, may be mounted rigidly upon

a sleeve (the driven element) slidable on the driving shaft (the driving element) or rigidly to a shaft (the driven element) slidable longitudinally within a driving sleeve, as will be seen by reference to the accompanying drawings. Thus in Figs. 1, 15, and 16, the driven member consists of a sleeve r' , integral with the percussive rotor R, whereas in the modification shown in Fig. 4, the percussive rotor R, is rigidly mounted on the shaft n' , which becomes the driven element,—the driving element being the sleeve n'' , to which the armature n , is directly attached. In either case the one element is formed with a radial shoulder s , engageable with an incline i , and a shoulder i' , on the other element, and the action and relative arrangement of the parts is essentially the same. In Fig. 15, the female screw of the sleeve r' , is the equivalent of the shoulder s , while the male screw thread i , is the incline.

Either the percussive rotor R, itself or the driven element to which it is rigidly attached is formed with a fly wheel r'' , or the equivalent thereof, *i. e.*, a preponderant mass of material (of which the fly wheel is itself an example) the inertia of which will be sufficient to overcome the frictional resistance between the driving and the driven elements, so that in starting the percussive rotor R, will lag behind until positive engagement between the said parts is effected, while in stopping the said rotor will continue independently for a part of a revolution at least, sufficient to end the positive connection between the parts and afford a preliminary start for the driving element as hereinbefore stated.

It is to be understood that in the construction shown in Figs. 1, and 4, when the motor starts, the shoulder s , first encounters the incline i , and consequently shoves the rotor R, into engagement with the diaphragm D, the extension of protrusion of the percussion points r, r , as related to the contact d , on the diaphragm D, being limited by and when the shoulder s , encounters the shoulder i' , as in Figs. 1, and 4. In Figs. 5, and 6, the retracted or normal position of these engageable parts is shown,—the vibration of the diaphragm D, having forced the rotor R, back as soon as the shoulder i' , moves away from the shoulder s , when power is cut off from the driving element.

It will thus be seen that by the above means the jamming of either motor or diaphragm is prevented, and the untrammelled and effective vibration of the diaphragm assured,—the longitudinal adjustment of the motor and driving element through the medium of the adjustable bearing b , being an important factor in this connection in that it enables the action between the driving element, percussive rotor, and vibratory dia-

phragm to be regulated positively and accurately. And all this I accomplish without the use of spring pressure, the advance and retraction of the percussive rotor, and the

- 5 adjustment of the driving element with relation to the diaphragm, being effected by positive means which do not relax in energy by reason of continuous use,—a defect inherent in spring pressure.
- 10 The best results are attained by the use of a percussive rotor having a plurality of contactual protuberances concentrically arranged and engaging with a single wearing contact or point on the diaphragm. For the
- 15 sake of symmetrical construction and arrangement of parts it is desirable that the centers of the rotor and of the diaphragm coincide, and hence it is necessary to use a contactual wearing point off actual central
- 20 alinement, but rigidly attached to the center of the diaphragm, ordinarily as shown in Fig. 14. This off center contact tends to buckle the diaphragm under stress of action as illustrated to a somewhat exaggerated extent in said Fig. 14, but nevertheless the
- 25 buckle or deflection is in practice sufficient to seriously impair the free and responsive resilience of the diaphragm which is so essential in attaining the desired quality and
- 30 volume of sound. This difficulty I obviate by forming the elastic resilient metallic disk D, with one or more radial embossments or corrugations d^2 , one of which extends beyond and includes the center of the dia-
- 35 phragm as particularly in Figs. 1, 12, and 13,—the lateral shank or base d' , of the contact member d , being preferably although not necessarily positioned within the hollow of the corrugation as shown and
- 40 rigidly secured to the center of the disk. This reinforcement counteracts the tendency of the diaphragm to buckle under strain, and distributes the latter evenly through the disk, especially when the latter is provided
- 45 with a plurality of equidistant embossments as shown in Fig. 12, for instance. Thus the eccentricity of the stress imparted by the percussive rotor is compensated for and all parts of the diaphragm move in the same direction during its vibration,—a result which
- 50 insures purity of tone and uniformity of pitch.

The terminal posts t , t , for the circuit wires extend through the rear cup a' , of the

55 casing and through the rear end m , of the shell to which latter they are attached, and incidentally perform the function of holding the motor and its shell against lateral turning within the casing a .

- 60 It will be seen that by my construction and arrangement of parts herein shown and described I attain great simplicity of construction combined with efficiency of operation. Furthermore the parts may be quickly
- 65 assembled without the employment of

skilled labor for the purpose, and the whole device is adapted to cheapness of manufacture without sacrifice of quality or efficiency.

What I claim as my invention and desire to secure by Letters Patent is,

70 1. In a sound producer of the character designated, the combination of a diaphragm, a percussive rotor adapted to actuate said diaphragm and movable laterally with relation thereto, a driving element, and means

75 for rendering operative said percussive rotor by inclined contact-engagement between it and the driving element.

2. In a sound producer of the character designated, the combination of a diaphragm, 80 a percussive rotor adapted to actuate said diaphragm and movable laterally with relation thereto, a driving element, means for rendering operative said percussive rotor by inclined contact-engagement between it and 85 the driving element, and engagingly related shoulders on said percussive rotor and said driving element, whereby in the operation of starting the percussive rotor it is first moved longitudinally with relation to 90 the driving member and transversely with relation to the diaphragm to bring it into contactual relation therewith and then rotated in unison with the driving element, for the purpose set forth. 95

3. In a sound producer of the character designated, the combination with the diaphragm of a percussive rotor adapted to actuate said diaphragm and movable laterally with relation thereto, a driving element, 100 means for rendering operative said percussive rotor by inclined contact-engagement between it and the driving element, an electric motor, and engagingly related shoulders on said percussive rotor and said driving element, the latter being rigidly attached to the armature of said electric motor, whereby when the latter is started the percussive rotor will be first moved longitudinally with relation to the driving element 110 and transversely with relation to the diaphragm to bring it into operative relation therewith, and then rotated with relation to the driving element, for the purpose described. 115

4. In a sound producer of the character designated, the combination with the diaphragm, of a percussive rotor adapted to actuate said diaphragm and movable laterally with relation to said diaphragm, a 120 driving shaft, said percussive rotor forming part of a sleeve slidable on the driving shaft, said sleeve being formed with an inclined surface and a shoulder, and said driving shaft formed with a contact shoulder 125 for engagement with the incline and shoulder on said percussive rotor sleeve, for the purpose described.

5. In a sound producer of the character designated, the combination with the dia- 130

phragm, of a percussive rotor adapted to actuate said diaphragm and movable laterally with relation thereto, driving and driven elements, said percussive rotor forming part of said driven element slidable longitudinally on the driving element, said driving element, means for rendering operative said percussive rotor by inclined contact-engagement between the driven element and the driving element, and engagingly related shoulders on said driven element and said driving element, whereby in the operation of starting the percussive rotor it will be first moved longitudinally with relation to the driving element and transversely with relation to the diaphragm to bring it into contactual relation thereto, and then rotated in unison with the driving element, said driven element being of mass adequate to acquire momentum sufficient to overcome frictional contact between it and the driving element so that when the rotation of the latter is retarded the driven element will move out of operative engagement therewith, for the purpose described.

6. In a sound producer of the character designated, the combination with the diaphragm, of a percussive rotor adapted to actuate said diaphragm and movable laterally with relation thereto, the percussive rotor being of mass adequate to acquire momentum sufficient to overcome frictional contact between it and the element by which it is driven so that when the rotation of the latter is retarded the percussive rotor will move out of operative engagement therewith, for the purpose described.

7. In a sound producer of the character designated, the combination with the diaphragm, of a percussive rotor adapted to actuate said diaphragm and movable laterally with relation thereto, a driving element, said percussive rotor forming part of a driven element slidable longitudinally on said driving element, means for rendering operative said percussive rotor by inclined contact-engagement between the driven element and the driving element and engagingly related shoulders on said driven element and said driving element, whereby in the operation of starting the percussive rotor will be first moved longitudinally with relation to the driving element and transversely with relation to the diaphragm to bring it into contactual relation thereto, and then rotated in unison with the driving ele-

ment, said driven element being provided with a fly wheel which, when the rotation of the driving member is retarded causes the driven element to move out of operative engagement with said driven member, for the purpose described.

8. In a sound producer of the character designated, the combination, with a percussive rotor, of a diaphragm formed with a radial embossment, and a contact member secured in said embossment, for the purpose herein set forth.

9. In a sound producer of the character designated, the combination, with a percussive rotor, of a diaphragm formed with a radial embossment and a protuberant contact member secured to said diaphragm coincident with said radial embossment, for the purpose herein set forth.

10. In a sound producer of the character designated, the combination, with a percussive rotor, of a diaphragm formed with a radial embossment, and a protuberant contact member secured to said diaphragm within the hollow of its said radial embossment.

11. In a sound producer of the character designated, the combination, with a percussive rotor formed with concentrically arranged contact protrusions, of a diaphragm formed with a radial embossment and a protuberant contact secured to said diaphragm coincident with said radial embossment, for the purpose described.

12. In a sound producer of the character designated, the combination with a percussive rotor formed with concentrically arranged contact protrusions of a diaphragm formed with a radial embossment and a protuberant contact secured to said diaphragm within the hollow of its said radial embossment, for the purpose described.

13. In a sound producer of the character designated, the combination, with a percussive rotor formed with concentrically arranged contact protuberances, of a diaphragm formed with a plurality of radial embossments and a protuberant contact secured to said diaphragm coincident with one of said radial embossments, for the purpose described.

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