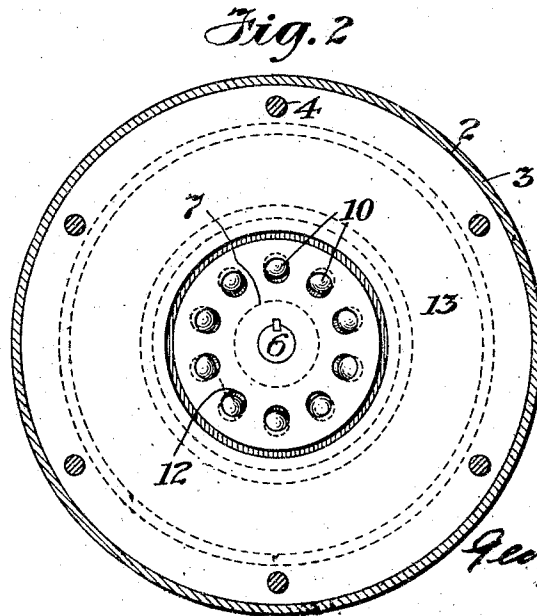
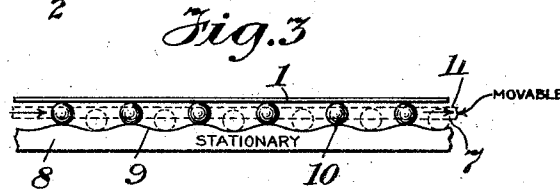
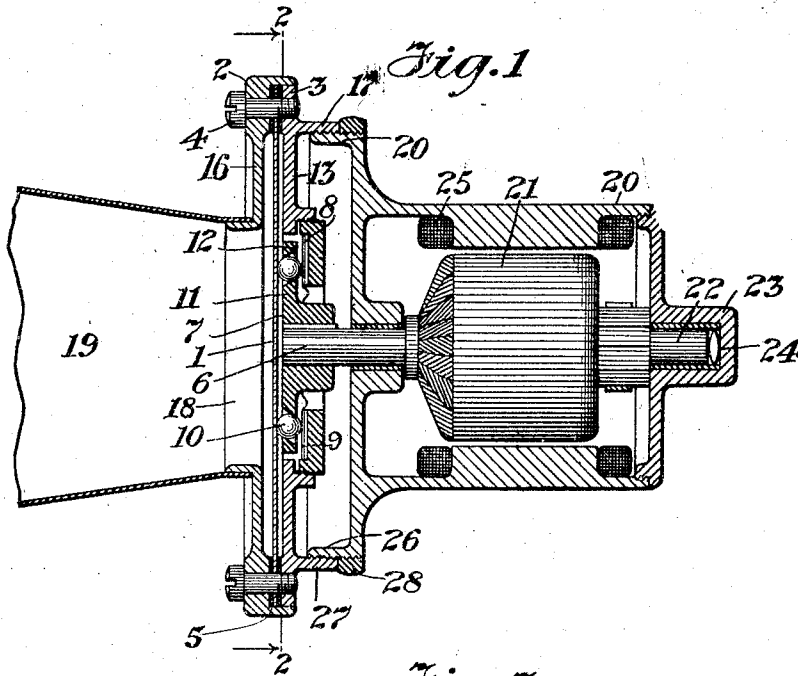


1,189,795.

Patented July 4, 1916.
3 SHEETS—SHEET 1.



INVENTOR

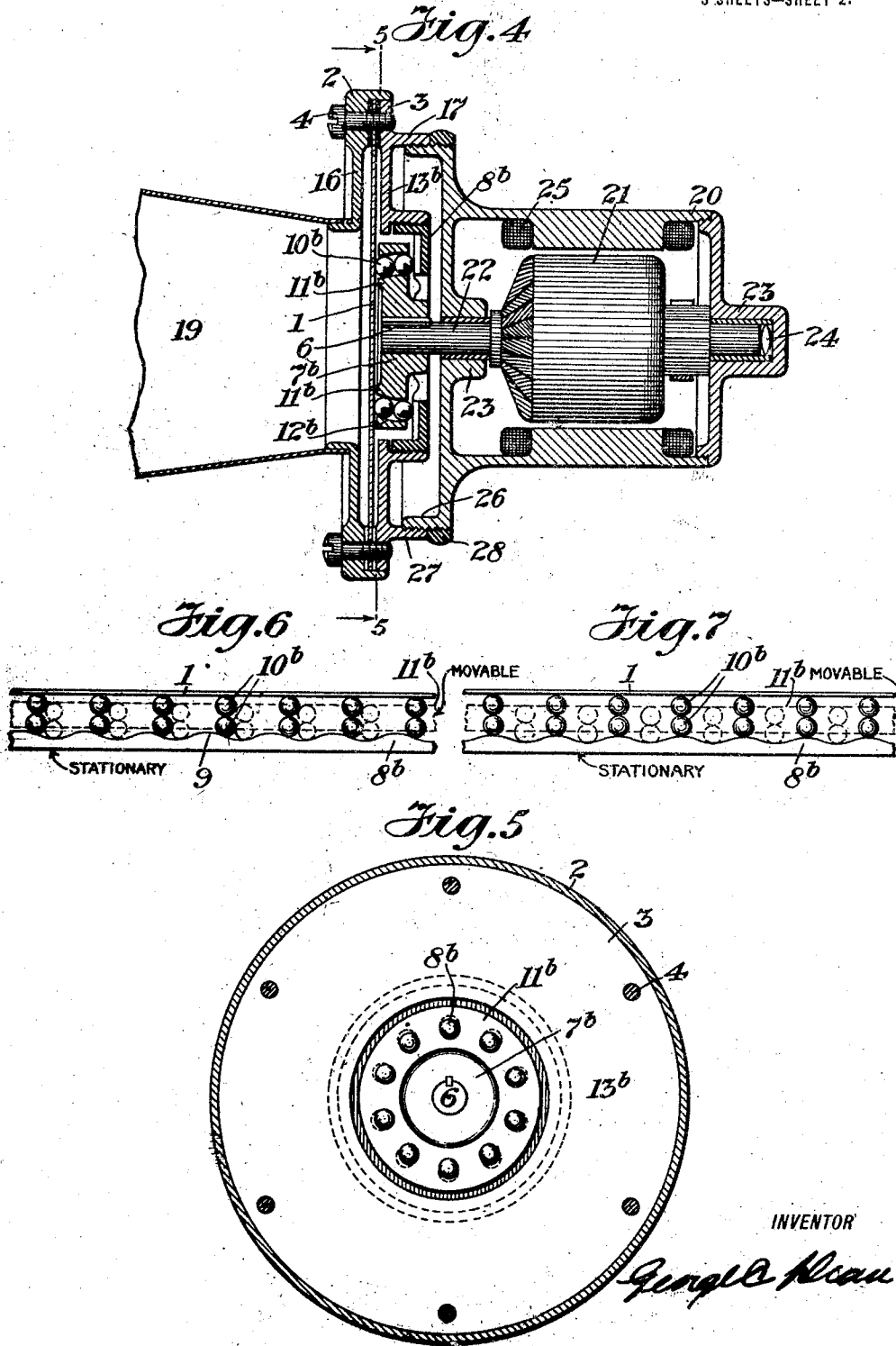
G. C. Dean

G. C. DEAN.
MECHANICAL HORN.
APPLICATION FILED JULY 22, 1915.

1,189,795.

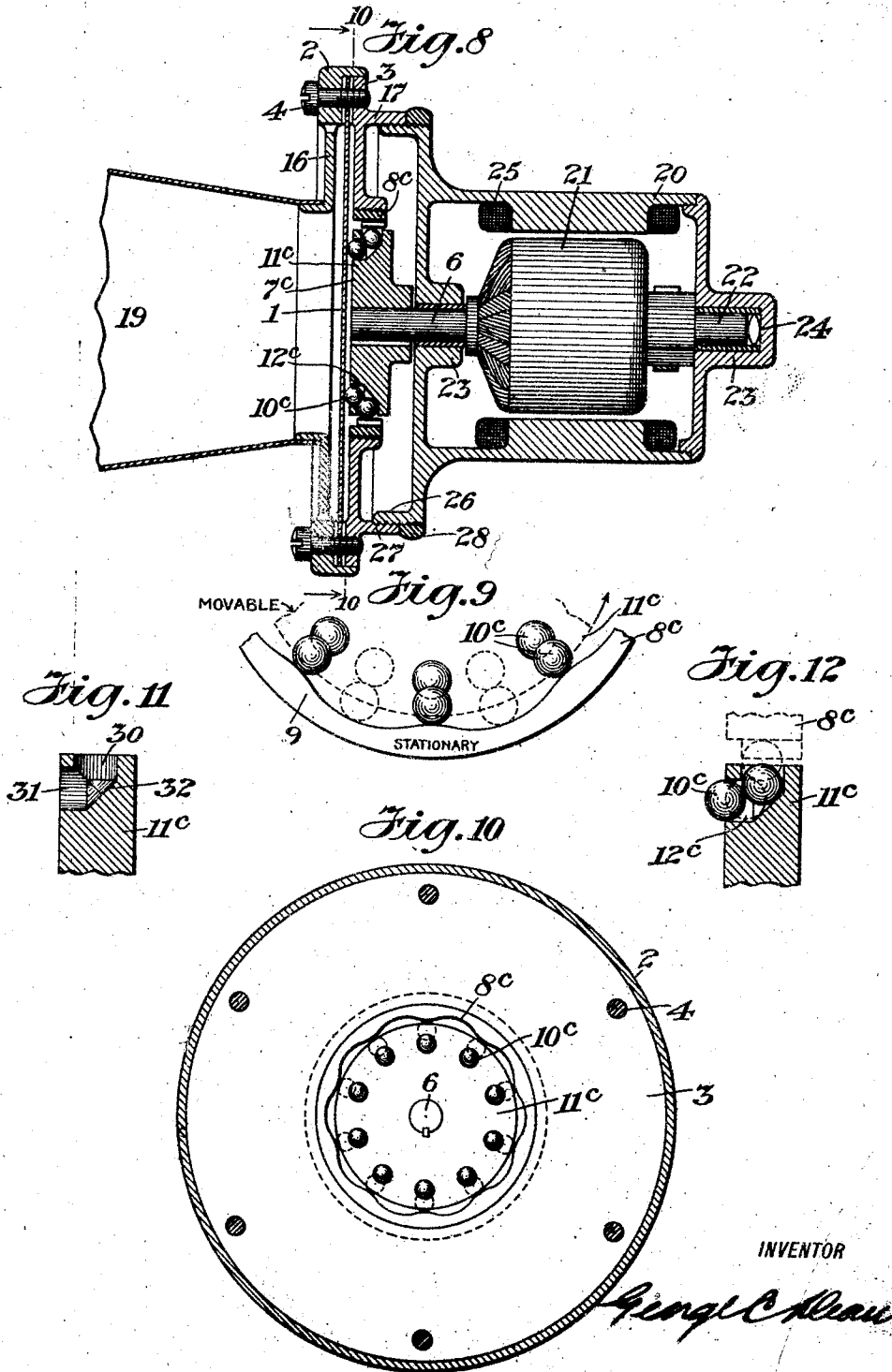
Patented July 4, 1916.

3 SHEETS—SHEET 2.



1,189,795.

Patented July 4, 1916.
3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

GEORGE C. DEAN, OF BRONXVILLE, NEW YORK, ASSIGNOR TO LOVELL-McCONNELL MANUFACTURING COMPANY, OF NEWARK, NEW JERSEY, A CORPORATION OF DELAWARE.

MECHANICAL HORN.

1,189,795.

Specification of Letters Patent.

Patented July 4, 1916.

Original application filed July 10, 1911, Serial No. 637,678. Divided and this application filed July 22, 1915. Serial No. 41,234.

To all whom it may concern:

Be it known that I, GEORGE COOPER DEAN, a citizen of the United States, and resident of Bronxville, Westchester county, New York, have invented certain new and useful Improvements in Mechanical Horns, of which the following is a specification.

This application is a division of my prior and copending application Serial No. 637,678, filed July 10th, 1911, (Patent No. 1,148,294, issued July 27, 1915) and relates to signal or alarm devices, embodying a diaphragm actuated or vibrated upon the rotation of a member or shaft, which is driven by suitable power means. Suitable connections or instrumentalities are employed which are capable of converting the rotary movement of the said member into reciprocatory movement of the diaphragm. In the invention there disclosed and claimed, I employ as diaphragm displacing members a series of members preferably in the form of balls, and preferably mounted in guides for forward and backward movement in respect to the diaphragm. These balls, of which there are two or more, are disposed about the axis of the diaphragm so as to contact therewith at points between its center and virtual periphery. They are preferably adapted to be actuated simultaneously, thereby securing a distribution of thrust about and distant from the diaphragm center, so that a diaphragm of large diameter may be vibrated in a perfectly unitary manner even though relatively thin and flexible. Moreover, these distributed thrusts are, from the nature of the thrust elements, perfectly normal to the diaphragm which may be entirely plane and imperforate.

The balls moving back and forth in their guides may be regarded as a species of pistons. These pistons may reciprocate in place, the cam, preferably a face cam, being rotated so as to travel in contact with the balls to force the latter successively toward or against the diaphragm. This form I have specifically claimed in the parent case. In the present application, I specifically claim those forms in which the balls are mounted to reciprocate when traveling in an orbit, the member having the guides being rotated to carry the balls over a stationary cam, although such is broadly claimed in the parent case.

In either type a single series of balls may be interposed between the cam or forcing means and the diaphragm, but inasmuch as this construction necessitates a considerable amount of sliding action of the balls on the parts with which they are in contact, friction and its attendant evils may be further reduced by utilizing a compound thrust element consisting of two or more balls, one behind the other, in place of each single ball. Thus, with two balls, one ball contacts with the cam and may roll thereon while the other ball may roll on the diaphragm, the slip being confined to the point where the two balls touch each other.

In the type forming the subject of the present application, means are preferably provided for constantly and yieldingly pressing or urging the balls away from the diaphragm or against the cam, during running. This provision makes it possible to secure very material advantages. In the first place, the weight of the balls or thrust members is taken off the diaphragm, so that the latter is entirely unweighted; and furthermore the behavior of the balls is rendered dependable, because they are normally maintained at one extreme of their reciprocatory movement. It will be obvious that means for causing a force to act constantly on the thrust members in a direction away from the diaphragm will be of advantage in instances where they are of a character other than balls, or where they do not reciprocate, or where they are supported by backing means other than a cam. Such means may be conveniently provided by constructing the guide openings or recesses holding the balls in such a manner that the thrust members are acted on by centrifugal force, in a direction away from the diaphragm or toward the cam.

The cam may be a face cam facing the diaphragm or it may be otherwise formed. When a face cam is employed I provide means for adjusting both the guide members and the cam toward and from the diaphragm, and preferably the means for adjusting the two parts are independent of each other, so that, at any adjustment, the balls, their guides, the diaphragm and the cam may be positioned in the best relation.

While the balls have been referred to as thrust elements, it will be clear that they

may actuate the diaphragm by impact, being thrown by the cam more or less freely against the diaphragm. With the cam adjusted or set away from the diaphragm so that the balls when resting in the hollows of the cam are spaced away from the diaphragm by a distance equal to or greater than the throw of the cam, and with a sufficiently steep inclination to the cam-face or sufficient speed of rotation or both, the balls will be thrown forcibly against the diaphragm and may entirely clear the crests of the cams. Particularly when a large number of balls are used encircling the center of the diaphragm, so that an annular volley of blows, as it were, is delivered, this mode of actuation may be very satisfactory. It has the advantage that there will be little likelihood of the diaphragm on its return swing being checked by positively supported balls.

In the accompanying drawings illustrating certain of the preferred embodiments of the invention: Figure 1 is a vertical longitudinal section through a horn signal, the horn being broken away; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a semi-diagrammatic view showing the relation between the cam, the diaphragm, the balls and their guide member; Fig. 4 is a view similar to Fig. 1, showing another embodiment of the invention; Fig. 5 is a section on the line 5—5 of Fig. 4; Fig. 6 is a semi-diagrammatic view on the order of Fig. 2, illustrating the relations in this form of the invention; Fig. 7 is a similar view showing a different relation; Fig. 8 is a view corresponding to Fig. 1 showing another embodiment of the invention; Fig. 9 is a semi-diagrammatic view showing the relation between the cam, the balls and their movable retainer in this form of the invention; Fig. 10 is a section on the line 10—10 of Fig. 8; Fig. 11 is a sectional detail showing an angular pocket for the reception of two balls constituting a compound thrust element; and Fig. 12 is a similar view showing the balls in place and indicating the cam and changed positions of the balls by dotted lines.

Reference will first be had to Figs. 1 to 3, though much of the description will be applicable to the remaining figures, since certain features are common to all the forms. 1 indicates the diaphragm which is preferably held at its marginal regions by clamps 2, 3, secured together by bolts or screws 4, and holding the diaphragm between gaskets 5, of cork or other suitable material. 6 is the drive shaft disposed normal to the diaphragm, preferably at the center thereof. 7 is a suitable head or enlargement secured to or formed on the forward part of the shaft adjacent the diaphragm. 8 is a cam provided with a series of projections 9. 10 is

a series of balls interposed between the cam and the diaphragm. 11 is a guide member or holder for the balls, having guide openings 12 formed therethrough for the reception of the balls. In this particular construction the guide member 11 is a part of the rotor and the cam 8 is stationary. Since the amplitude of vibration at the regions of thrust is materially less than the complete amplitude of vibration at the center of the diaphragm, balls may be employed with advantage, even though of small diameter, since the extent of their reciprocatory movement is slight. For this reason their guide openings 12 may be of the simplest formation, without the necessity of providing them with means for holding the balls against escape at either end, the presence of the cam and the diaphragm being sufficient to insure the retention of the balls. The cam 8 may be adjusted toward and from the diaphragm, by screwing the cam forward or backward on the head. The pitch of the screw threads may be low, so that very fine adjustments may be secured. The retaining member 11 may be adjusted between the cam and the diaphragm, by a construction which will presently be described.

The nature of the power means for rotating the driver or actuator, the casing structure, and the resonator or projector may be widely varied. I have shown the clamps 2, 3, formed on front and rear sections 16 and 17 of the diaphragm case part, the front part of which is formed with a sound-escape opening 18, from which extends a suitable projector or resonator 19. The cam 8 may be formed on or secured to the rear section 17. The rotary driver is preferably operated by an electric motor contained in a motor case part 20. The motor may be of any suitable or usual construction. The armature is indicated at 21, its shaft 22 being journaled in suitable bearings 23 in the motor case part, and a thrust bearing 24 being provided at the rear end of the shaft. The field 25 may be suitably secured to the walls of the case. Preferably the shaft 6 is an extension of the armature shaft or directly connected therewith. Adjustment between the head 7 and the diaphragm is conveniently provided by rendering the motor case part 20 adjustable with reference to the rear section 17 of the diaphragm case part, to which end the motor case part may be provided with a flange 26 having threaded engagement with a flange 27 on the section 17, a lock nut 28 being provided for holding the parts to their adjustment. This means for mounting the motor has been made the subject of another divisional application upon which was granted Patent No. 1,105,324, issued July 28th, 1914.

It will be noted that the balls 10, instead

of being reciprocated in place, are reciprocated while being caused to travel in an orbit about the axis of the diaphragm. The specific construction may be considerably varied. In form illustrated the cam member 8 is a ring screwed onto a stationary supporting flange 13 so that the cam may be adjusted toward and from the diaphragm. The ball-guiding member 11 is disposed between the cam and the diaphragm. The guiding or retaining openings 12 are preferably inclosed on all sides, though being entirely open at front and rear. The balls or thrust members are normally acted upon by the force tending to urge or press them away from the diaphragm and against the cam. In accordance with a simple embodiment of such means the walls of the opening 12 are inclined outward and rearward, so that, during running, centrifugal force constantly and yieldingly urges the balls rearward.

In operation rotation of the retaining or guiding member 11, which is here shown as a part of the head 7, carries the balls around the axis of the diaphragm and up and down over the crests and hollows of the cams 8. Centrifugal force constantly urges the balls away from the diaphragm and toward the cam, so that the balls are alternately thrust forward against the diaphragm by cam action, and retired by centrifugal force, or by the diaphragm or by both. The constant rearward urging of the balls insures that they will cooperate in a reliable manner with the cam, and has the further and very material advantage that the weight of the balls or thrust members is taken off the diaphragm at the termination of the thrusts, so that the diaphragm is entirely unweighted and may perform its elastic return movements to best advantage. It follows, also, from the fact that the balls are normally urged rearward or in a direction toward the cam, that the parts may be so adjusted or spaced that the signal will operate advantageously by impact rather than by thrust. If the spacing between the cam and the diaphragm is such that the balls contact with the diaphragm when part way up the slopes of the cam projections, the diaphragm will be actuated by positive thrusts delivered through the balls. If, however, the spacing or adjustment between the cam and the diaphragm be greater, so that the balls do not contact with the diaphragm until they have reached the crests of the projections, or if the spacing between the crests of the projections and the diaphragm be greater than the diameter of the balls, the diaphragm will be actuated by the balls acting as projectiles. With a sufficient speed of rotation or with a sufficiently high pitch on the forward sides of the cam projections, or both, the balls may be thrust entirely free of the crests of the projections.

Figs. 4 to 7 illustrate a construction very similar to the last form of the invention. Here, instead of a single ball, a plurality of balls 10^b occupy each guide opening or recess 12^b and constitute a compound thrust element. Preferably, two balls are employed in each pocket, one ball being free to roll upon stationary cam 8^b and the other upon the diaphragm 1, while they are also rolling on each other. The cam 8^b is similar to the cam 8, and the head 7^b, with its corresponding parts in the last form of the invention, while other parts not specifically referred to and bearing similar reference characters are similar to the corresponding parts described in the preceding construction. In the operation of this form of the invention rotation of the ball carrier causes the balls to travel around the axis of the diaphragm one ball rolling on the cam, and the other ball rolling on the diaphragm at each contact therewith. The balls are urged rearward by centrifugal force, as in the preceding construction. If desired, the rear portion of the guide openings 12^b, receiving the rear balls, may be substantially parallel to the axis of rotation, the forward portions of the recesses, holding the forward balls, being alone inclined outward and rearward, so that it is the forward balls which are acted upon directly by centrifugal force; but it will be obvious that all the balls are affected because the forward balls press upon the rear balls. Otherwise the operation is essentially the same as the operation in the preceding construction.

Fig. 6 illustrates an adjustment or spacing in which a pronounced thrust is secured, by causing the forward balls to contact with the diaphragm when the rear balls are part way up the slopes of the cam. In Fig. 7 the spacing or adjustment is different, so that the forward balls do not contact with the diaphragm until the rear balls have almost or entirely reached the crests of the cam. With this or a slightly greater spacing, the diaphragm may be actuated mainly by the impact of the balls thrown forward by reaction with the cam.

The construction illustrated in Figs. 8 to 12 is similar to the two preceding forms of the invention. This is a construction for securing the greatest possible influence of centrifugal force for holding the rear balls in contact with the cam. To this end the portions of the pockets 12^c receiving the rear or cam-contacting balls are in the nature of radial bores 30. The portions of the pockets receiving the diaphragm-contacting balls may be formed at right angles thereto, as shown at 31. These two bores may be formed by a tap having a 45° tip, so that the bores are connected at the back by a 45° wall 32. In this way the unfilled space in the pocket is minimized and the action of the cam-con-

tacting ball in crowding the diaphragm-contacting balls forward is materially assisted. In order to cooperate with the balls so arranged, the stationary cam 8° is an internal
 5 peripheral cam, with its crests projecting toward the axis of rotation. Otherwise, the cam 8° has functions similar to the stationary face cams 8 and 8^b; and the rotary head 7° and its ball-retaining portion 11° with the
 10 pockets 12, are in essential respects similar to the corresponding parts in the two preceding forms of the invention. Parts bearing the same reference characters are identical with the parts in the preceding constructions.

15 In operation rotation of the ball carrier causes the rear balls to travel around in contact with the internal cam, whereby these balls are forced radially inward to be pulled
 20 outward by centrifugal force. The inward forced movements of the rear balls by reaction with the walls of the pockets 12° force the other balls straight forward against the diaphragm. According to the
 25 spacing of the parts the diaphragm may be vibrated by normal thrusts or by the inertia of the balls acting as projectors as in the preceding forms of the invention.

30 While in any or all of the forms of the invention the diaphragm might be provided with projections or wearpieces for the reception of the thrusts or impacts of the balls, it is very desirable to construct the diaphragm as a simple disk, without perforations,
 35 projections or added weight of any kind.

It will be obvious that many of the advantages of the invention may be secured where the actuating connections are of a
 40 form other than balls.

What I claim as new is:

1. In a mechanically actuated diaphragm signal, the combination of a diaphragm, cam means, an interposed series of balls arranged
 45 to force the diaphragm at points intermediate the center and virtual periphery thereof, a member having guides in which said balls reciprocate, and drive means for rotating said member.

50 2. In a device of the class described, a diaphragm, a stationary cam provided with a series of actuating portions, a series of loose interposed members, and a rotatable guide member for said loose members constructed and arranged to cause the latter to
 55 travel over the cam.

3. In a device of the class described, a diaphragm, a stationary cam, a series of members constructed and arranged to force
 60 the diaphragm at distributed regions between its center and virtual periphery, and a rotatable carrier for causing said members to travel in contact with the cam.

4. In a device of the class described, a
 65 diaphragm, a stationary camming means

having a series of actuating portions, an interposed series of members constructed and arranged to force the diaphragm at distributed regions, and rotary means having its
 70 axis normal to the diaphragm for carrying said members around in contact with the camming means and guiding them in their consequent reciprocatory movement toward and from the diaphragm.

5. In a device of the class described, a
 75 diaphragm, stationary camming means, a series of balls interposed between the diaphragm and the camming means, and a rotary guiding member for causing said balls to travel around in contact with the cam-
 80 ming means.

6. In a device of the class described, a diaphragm, a rotary member disposed with its axis normal to the diaphragm and having
 85 a series of guide recesses disposed around its axis, a plurality of balls mounted in each recess, and stationary camming means constructed and arranged to contact with the rear balls in the several recesses to cause
 90 the forward balls to contact with the diaphragm.

7. In a device of the class described, a diaphragm, stationary cam means, a rotary member having a series of guide recesses,
 95 and a series of compound thrust elements, each consisting of a series of balls, interposed in said recesses between the diaphragm and the cam means.

8. In a device of the class described, a diaphragm, camming means, a series of compound members, each consisting of a series
 100 of balls, interposed between the diaphragm and camming means, guide means for said compound members, and means for producing relative rotation between said camming
 105 means and guide means.

9. In a device of the class described, a diaphragm, a rotary ball carrier having a series of angular guide recesses comprising
 110 radial portions and portions opening forward toward the diaphragm, a cam encircling said radial portions, balls in the forward-opening portions of said recess to contact with the diaphragm and balls in the radial
 115 portions to contact with the cam.

10. In a device of the class described, a diaphragm, a series of actuating balls disposed about the axis of said diaphragm,
 120 driving means for causing said balls to travel around said axis, means for backing said balls, and means whereby said balls are constantly urged against said backing means during running.

11. In a device of the class described, a diaphragm, camming means, an interposed
 125 series of balls disposed about the axis of the diaphragm, and means whereby said balls are constantly and yieldingly urged toward the camming means during running.

12. In a device of the class described, a 130

diaphragm, camming means, an interposed series of actuating members disposed about the axis of the diaphragm, a rotary carrier having guide recesses in which said members reciprocate, said recesses being formed so that centrifugal force urges the members against the camming means.

13. In a device of the class described, a diaphragm, camming means, a series of interposed balls arranged around the axis of the diaphragm, and a rotary member having guide recesses in which said balls are mounted, said recesses being formed so that centrifugal force urges the balls against the camming means.

14. In a device of the class described, a diaphragm, camming means, an interposed series of balls disposed about the axis of the diaphragm, guides in which said balls reciprocate toward and from the diaphragm and means whereby said balls are constantly acted on by a force in directions away from the diaphragm.

15. In a device of the class described, a diaphragm, a series of actuating members, a rotary member for causing said members to travel in an orbit about the center of the diaphragm, means for repeatedly forcing said actuating members toward the diaphragm, and means whereby centrifugal force urges said actuating members away from the diaphragm.

16. In a device of the class described, a diaphragm, a rotary carrier disposed with its axis normal to the diaphragm and having a series of recesses disposed about its axis, a series of diaphragm-actuating members in said recesses, said recesses being formed so

that centrifugal force urges said members away from the diaphragm, and means for repeatedly forcing said members toward the diaphragm.

17. In a device of the class described, a diaphragm, a ball arranged to contact therewith, and a rotary holder in which said ball is mounted and which is formed so that centrifugal force acts on said ball in a direction away from the diaphragm.

18. In a device of the class described, a diaphragm, a rotary member disposed with its axis normal to the diaphragm and having a recessed portion, and a diaphragm-actuating member in said recessed portion, being arranged so that centrifugal force acts upon it in a direction away from the diaphragm.

19. In a device of the class described, a diaphragm, a rotary member disposed with its axis normal to the diaphragm and having a recessed portion, and a series of diaphragm-actuating balls in said recessed portion, arranged to force the diaphragm at points between its center and virtual periphery, said recessed portion being so formed that centrifugal force acts upon said balls in directions away from the diaphragm.

20. In a device of the class described, a diaphragm, a rotary member, a diaphragm-actuating member carried by said rotary member and arranged so as to be urged away from the diaphragm by centrifugal force, and camming means for repeatedly forcing said member toward the diaphragm.

Signed at New York city in the county of New York and State of New York this 21st day of July A. D. 1915.

GEORGE C. DEAN.