

D. S. WILSON.
POLARIZED SIGNALING MECHANISM.
APPLICATION FILED MAY 25, 1917.

1,309,750.

Patented July 15, 1919.

3 SHEETS—SHEET 1.

Fig.1.

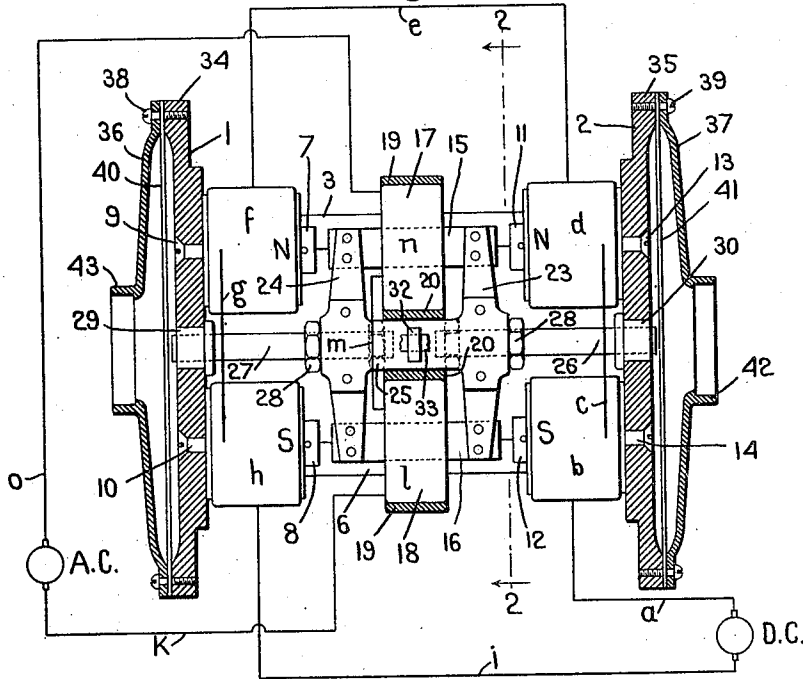
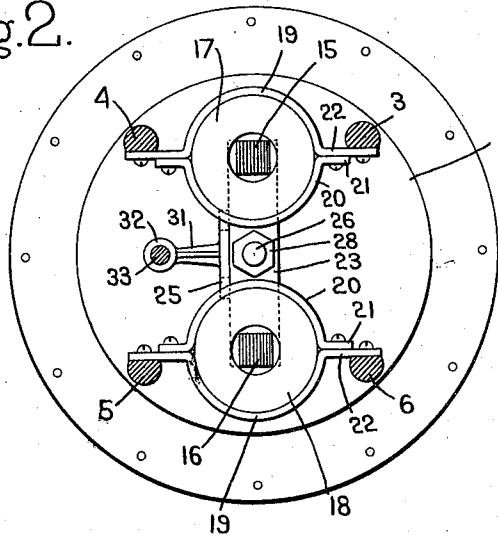


Fig.2.



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3 SHEETS—SHEET 2.

Fig. 3.

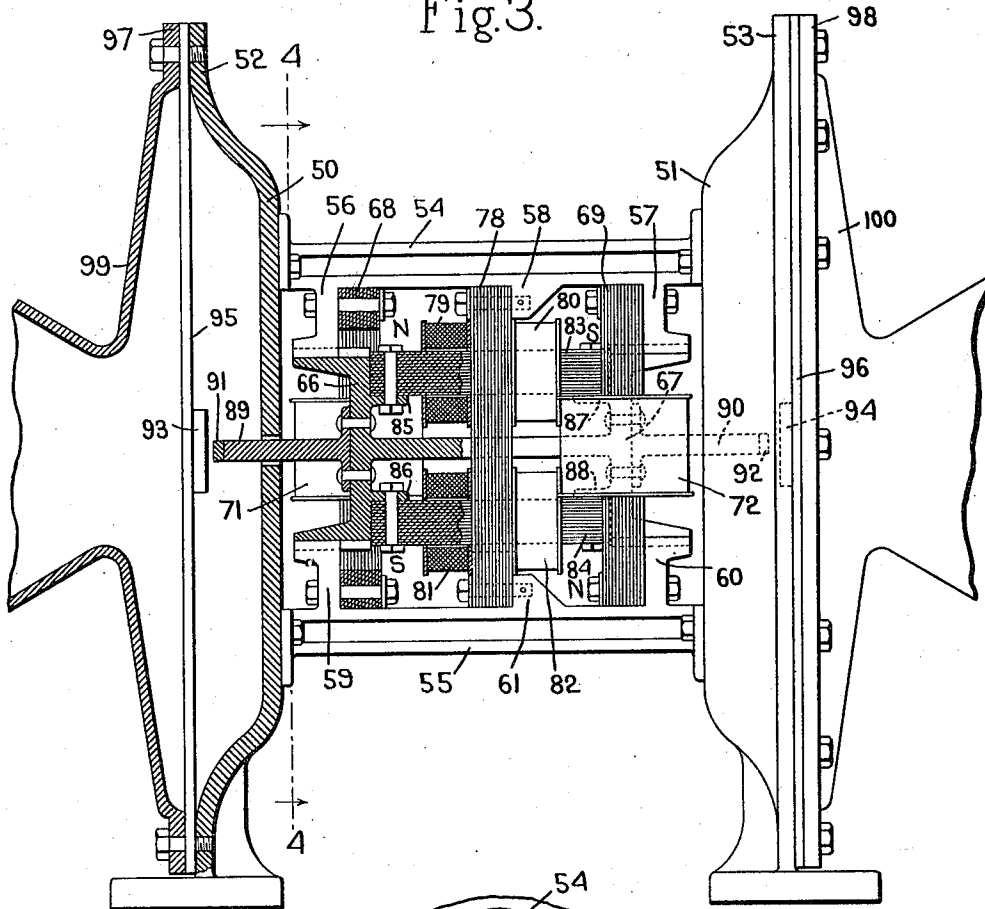
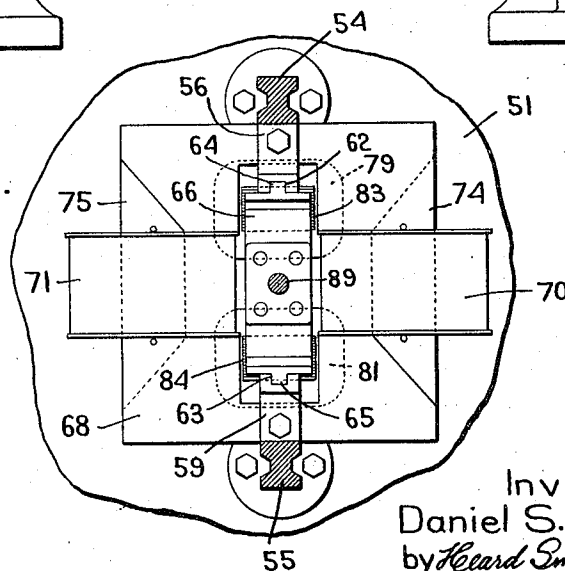


Fig. 4.



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Fig. 5.

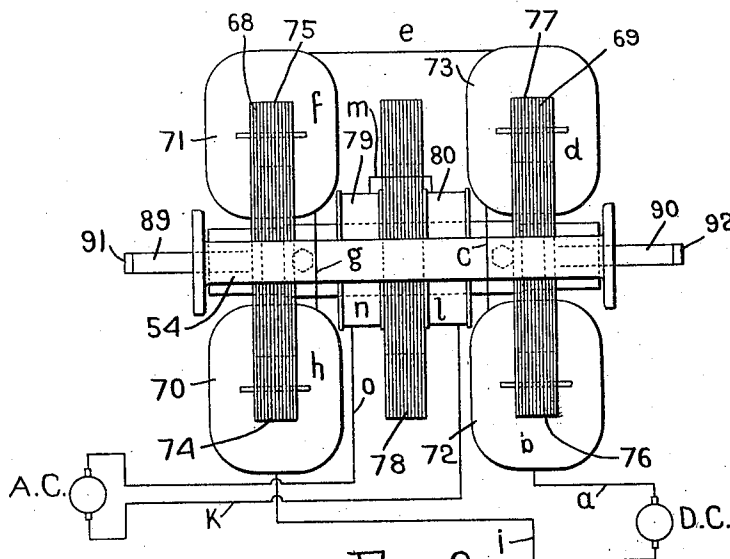
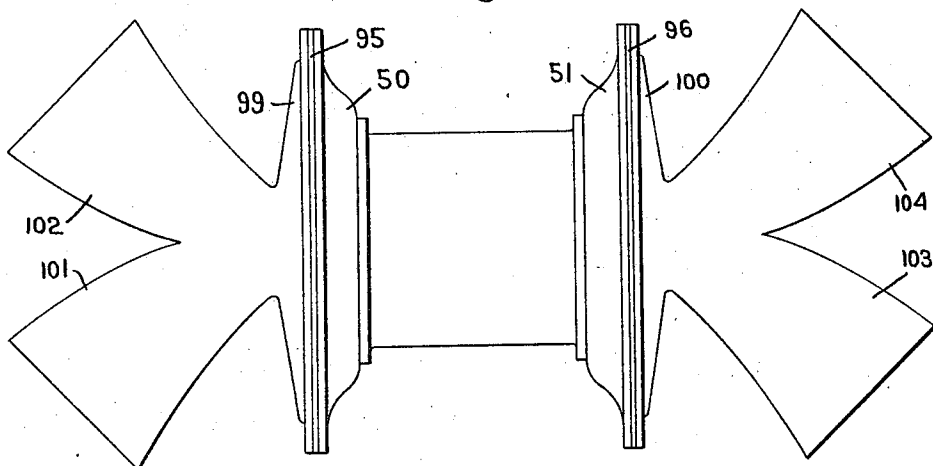


Fig. 6.



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POLARIZED SIGNALING MECHANISM.

1,309,750.

Specification of Letters Patent.

Patented July 15, 1919.

Application filed May 25, 1917. Serial No. 170,870.

To all whom it may concern:

Be it known that I, DANIEL S. WILSON, a citizen of the United States, residing at West Somerville, county of Middlesex, State of Massachusetts, have invented an Improvement in Polarized Signaling Mechanism, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to improvements in mechanisms for causing a synchronous vibration of a movable member adapted to transmit its motion to other instrumentalities such as signaling mechanisms and in which the action of the reciprocating member may be instantly started to its full vibration by means of an alternating electric current. More specifically the principal object of the invention is to produce a powerful signaling device, preferably a horn, operable by an alternating current which will be adapted for general or code signaling and which will instantly produce a tone of maximum volume without the preliminary "picking up" which usually attends the operation of signaling horns.

Another object of the invention is to produce a polarized synchronous vibrating signaling mechanism comprising a pair of complementary exciting magnets having their poles facing one another combined with a solenoid having a core located intermediate of said magnet poles, said solenoid being adapted when an alternating current is passed through it to cause a reciprocation of the core which may be utilized to transmit its reciprocation to a suitable signaling mechanism or other device which it is desired to operate in synchronism with the alternations of the current.

Another object of the invention is to provide a device of the character described in which the exciting magnets are in the form of electro-magnets and consequently may be made of any desirable strength and in co-operation with a solenoid carrying a suitable alternating current may impart a reciprocation of any desired amount of energy to the core of the solenoids so that an exceedingly powerful signaling mechanism such as a horn for fire alarms and like uses may be operated.

Another object of the invention is to pro-

vide a device of the character described in which all springs or other easily breakable parts are eliminated and which will be reliable in operation and instantly operative when the alternating current is impressed upon the coil or coils of the solenoid.

Another object of the invention is to provide a vibrating mechanism of the character described in which the magnetic flux in the respective ends of the solenoid introduced by the alternating current will follow a relatively short course and in the normal direction of the flux of the electro-magnets.

Another object of the invention is to produce a polarized synchronous vibrating horn mechanism operable by the reciprocation of the cores of one or more solenoids of the character above described in which the reciprocating means will operate directly upon the diaphragms of two horns, thereby providing a duplex horn capable of delivering double the volume of tone of a single horn at approximately the same current consumption required for one.

Another object of the invention is to provide a signaling horn having a plurality of sound projectors positioned in diverging directions, preferably at right angles to one another, so as to distribute the sound over a wider area. For example in the use of duplex horns with sound projecting mechanism of the character described, arranged to project a sound from each of the diaphragms in directions at right angles to each other, the sound may be distributed to the four points of the compass with substantially equal volume and intensity, thus adapting the horn for general use in fire signals for cities and towns in which it is desired to give a general alarm to the inhabitants.

Other objects and features of the invention will more fully appear from the following description and the accompanying drawing and will be pointed out in the annexed claims.

The drawings illustrate two of the preferred embodiments of my invention as applied to signaling horns but it is to be understood that the actuating mechanism for the horns is adapted for other uses within the meaning and scope of the sub-joined claims.

In the drawings;

Figure 1 is a longitudinal central sectional view of one of the preferred embodiments of

my invention, certain parts being shown in elevation, the horns and part of the casing being omitted,

Fig. 2 is a sectional view on the line 2—2 Fig. 1,

Fig. 3 is a view of a modified form of signaling horn mechanism, part of the mechanism being shown in longitudinal central section and the remainder in elevation,

Fig. 4 is a sectional view on the line 4—4, Fig. 3,

Fig. 5 is a plan view of the operating mechanism, the casing and horns being omitted and,

Fig. 6 is an elevation of a duplex horn having diverging sound projectors for each of the horns shown in position to distribute the sound to the four directions of the compass.

The preferred embodiments of my invention illustrated in the accompanying drawing comprise polarized synchronous vibrating horn mechanism having complementary exciting magnets, preferably electro-magnets with their poles facing one another, combined with a solenoid having a core located intermediate the poles of said complementary magnets, means being provided for passing an alternating current through said solenoid to polarize the core in such a manner as to cause attraction between the magnet and one end of said core and repulsion between the complementary magnet and the opposite end of said core, thereby producing a reciprocation of the core with means operable by said reciprocation to strike a blow upon the diaphragm of a horn or the diaphragms of a plurality of horns.

The mechanism illustrated in Figs. 1 and 2 of the drawing comprises a frame-work consisting of soft iron end plates 1, 2 preferably circular in form and connected by posts or struts 3, 4, 5 and 6. The operating mechanism may be inclosed in a suitable sheet metal casing, not shown, secured to the end plates 1, 2. These end plates form yokes for the pole pieces of the electro-magnets, the poles 7, 8 of one of said magnets being connected to the plate 1 by suitable screws 9, 10 and the pole pieces 11 and 12 of the complementary magnet being secured to the plate 2 by screws 13, 14.

The poles of the complementary magnets are arranged to face one another so that poles 7 and 8 of one electro-magnet are directly opposite respectively the poles 11 and 12 of the complementary electro-magnet.

The cores of one or more solenoids are reciprocally mounted between the poles of the complementary magnets which face each other and means are provided for passing an alternating current through the solenoid to cause the magnetic flux in the solenoid core in cooperation with the fields of the magnet to impart a reciprocation to the core as the

current alternately reverses the direction of flux.

As illustrated in the accompanying drawings the solenoid cores 15 and 16 are in the form of rectangular preferably laminated soft iron bars, the core 15 being in axial alinement with the cores 7 and 11 of the electro magnets and the core 16 being in axial alinement with the other poles 8, 12 of said magnets.

The coils 17 and 18 of the solenoids are retained in clamping rings having complementary sections 19, 20 which are provided with suitable extensions 21, 22 for securing the sections of the clamping ring together and for attaching the same to the posts 3, 4 and 5, 6.

As illustrated herein the cores 15 and 16 are connected together at their ends by yokes 23, 24 which are united by a cross piece 25. Rods 26, 27 screwed respectively into the central portions of the yokes 23, 24 and retained therein by nuts 28, project laterally through bushings 29, 30 in the end plates 1 and 2 and provide means for reciprocally supporting the cores of the solenoids. In order to prevent rotation of the frame supporting the cores of the solenoids about the axis of the rods 26, 27 a bracket 31 is secured to or formed integral with the plate 25 and provided with an apertured boss 32 surrounding and slidably mounted upon a rod 33 fixed in the ends 1 and 2 of the frame.

The end plates 1 and 2 are provided with thickened annular peripheral portions 34, 35 to which cover plates 36, 37 are connected by suitable screws 38, 39, the diaphragms 40, 41 of the respective horns being clamped respectively between the thickened annular portions of the heads 1, 2 and the cover plates 36, 37. The cover plates 36, 37 are provided centrally with annular flanges 42, 43 to which the usual projectors may be fixedly or rotatably secured in any well known manner.

The direct current may be supplied to the coils of the magnets and the alternating current to the coils of the solenoids in any suitable manner, either from separate sources of energy as diagrammatically illustrated in the drawings, or preferably from a single source of energy from which the alternating current is supplied directly to the solenoid coils, while a portion of said alternating current is transformed to direct by a suitable rectifier such as one of the well known chemical rectifiers or a mechanical polarized rectifier such as is disclosed in my prior application No. 167,895, filed May 11, 1917, or by the "Tungar" rectifier.

As illustrated herein the direct current is supplied to the coils of the magnets from a suitable battery or generator D—C through the lines *a* to the coil *b*, thence through the connecting bar *c* to the coil *d*, thence

through the line *e* to the coil *b*, thence through the bar *g* to the coil *h*, the return circuit of the generator being through the line *i*. The alternating current is supplied from a suitable alternating generator A—C through the line *k* to the solenoid *l*, thence through the line *m* to the solenoid *n*, the return circuit to the generator passing through a line *o*. By supplying the direct current through the coils of the magnets in series a supervising current may be maintained so that any break in the circuit in either of the coils or their connections may be at once detected at the central station which would be impossible if the magnets were supplied by currents disposed in multiple, although for the purpose of magnetization the latter system may be equally well used.

The coils are so wound that the opposing poles 7 and 11 are of like polarity and consequently the other opposing poles 8, 12 are of like polarity. The alternating current is passed through the coils 17, 18 which are wound in such a manner that the south pole of one core will be opposed to the north pole of one of the magnets and the same end of the other core will present a north opposite a south pole of the same magnet. When an alternating current, therefore, is impressed upon the solenoids an attraction will be produced between the same ends of the solenoid cores and the poles of one of the magnets and a repulsion produced between the other ends of the cores of the solenoids and the complementary magnet. This condition being of course, reversed upon each alternation of the current.

The flux thus alternately produced in the cores of the solenoids coöperates with the fields of the respective magnets to produce a reciprocation of the solenoid cores and this reciprocation is transmitted through the yokes 23, 24 to bars 26, 27 which are slidably mounted in the bushings 29 and 30 and cause the ends of the rods 26, 27 to impinge alternately upon the diaphragms 40 and 41 of the horns.

By this construction a simple and effective vibrating mechanism for operating horns or any other suitable signaling device is produced. The structure is without springs or other easily breakable parts and without bearings which are likely to become worn in such a manner as to destroy the effectiveness of the instrument. The structure is such that it can be made in any desirable size but preferably is used for relatively small horns.

The structure illustrated in Figs. 3, 4 and 5 is preferably employed in horns and other signaling mechanism of greater capacity. In the horn mechanism illustrated in Figs. 3, 4 and 5 the framework consists of two end plates 50, 51 which have concaved outer surfaces provided with flanges 52, 53 to which the diaphragms of the horn or other suitable

signaling mechanism may be secured, said end plates 51, 52 being connected by two or more bars 54, 55 having respectively inwardly extending preferably integral brackets 56, 57, 58, and 59, 60 and 61. The brackets 56, 57, 59, 60 have grooves or ways 62, 63 to receive ribs 64, 65 on the end piece 66, 67 of a reciprocating frame which is actuated in the manner hereinafter to be described.

The magnets in this construction are in the form of hollow rectangular laminated plates 68, 69 bolted respectively to the brackets 56, 59 and 57, 60. Coils 70, 71 and 72, 73 being wound around the sides 74, 75 and 76, 77 of the plates 68 and 69 so that when a direct current is passed through said coils the plates 68 and 69 will be energized and polarized in the manner hereinafter set forth. A hollow rectangular laminated plate 78 is secured to the brackets 58, 61 intermediate of the plates 68 and 69 and serves to furnish a conducting medium for short magnetic circuits, as will hereinafter more fully appear.

Pairs of solenoids 79, 80 and 81, 82 are secured to the plate 78 and their cores 83 and 84, which are of laminated soft iron plates, are secured respectively to brackets 85, 86 and 87, 88 on the yokes 66, 67, the ends of said cores being located within the fields of the complementary magnets 68 and 69. Any suitable means may be utilized for supplying the magnet coils and the coils of the solenoid respectively with a direct and alternating current as heretofore described and as diagrammatically illustrated in Fig. 5.

In the operation of the vibrating mechanism a direct current is impressed upon the coils 70, 71 and 72, 73 to energize the pair of complementary magnets and these coils are preferably so wound that their opposing poles are of opposite polarity. The solenoids 79, 80, 81 and 82 are so wound that when the current is impressed in one direction the magnetic flux produced in the cores passes in the normal direction of one of the magnets and causes an attraction between that of the solenoid cores and its adjacent magnet while the flux of the opposite end of said cores produces a repellent effect upon the field of the other magnet so that the solenoid core is forced strongly in the direction of the attracting magnet.

Upon the reversal of the direction of the current the opposite effect takes place, thereby causing a reciprocation of the solenoid cores within the magnets. By reason of the interposition of the neutral laminated plate 78 intermediate of the plates 68, 69 which form the pole pieces of the complementary magnets, a short magnetic circuit is provided through which the lines of force flow from the magnets the half length of the solenoid cores and the neutral plate 78.

The reciprocating frame to which the

solenoid cores 83, 84 are connected may be utilized to actuate any suitable mechanism to which it may be desired to impart a vibration synchronous with the alternations of the current. In the horn mechanism illustrated herein strikers 89, 90 are riveted to the end pieces 66, 67 of the frame, the ends of said strikers being provided with hardened plates 91, 92 adapted to impinge upon hardened disks 93, 94 which are secured to the diaphragms 95, 96 of the horns. The diaphragms 95, 96 may conveniently be clamped at their periphery between the flanges 52, 53 of the end pieces and similar flanges 97, 98 upon cover plates 99, 100 of the respective horns.

Any form of sound projecting device may be used in connection with the invention herein disclosed. Preferably, however, a special mechanism is provided for distributing the sound. A preferred means which is illustrated in Fig. 6, comprises a duplex sound projector secured to each of the end plates of the mechanism herein described. The sound projector illustrated in Fig. 6 comprises a pair of communicating funnel shaped projectors, or megaphones 101, 102 and 103, 104 secured to the cover plates for the diaphragm of the horn, the axes of said projecting devices being disposed at right angles to each other so that the sound produced by the vibration of the diaphragms is projected to the four points of the compass.

Of course the projectors may be otherwise arranged or a greater number of projectors utilized.

This construction provides a very powerful vibrating mechanism which is adapted, for example, to vibrate a horn diaphragm of very large dimensions. In order to obtain a maximum efficiency in the use of the same for vibrating horn mechanisms the diaphragm of the horn should be constructed of such dimensions, thickness and material having such modulus of elasticity that the normal vibration of the diaphragm corresponds or is equal to the number of alternations of the current or a multiple thereof.

When the vibration of the diaphragm is thus synchronized with the frequency of the current the highest possible efficiency is attained. Furthermore the duplex arrangement of the horn illustrated in Figs. 3, 4 and 5 provides a mechanism, as in that illustrated in Figs. 1 and 2, which will produce twice the volume of sound for approximately the same current consumption which will be required for a single horn.

It is to be understood that the embodiment of the invention disclosed herein is of an illustrative character and is not restrictive and that various modifications therein may be made. It is also to be understood that while the invention herein described is applied to a signaling horn mechanism it

may be used in other forms of signaling mechanism and for various other purposes in which it is desired to produce a vibration in synchronism with an alternating current, for example the vibration of the cores of the solenoid may be utilized to actuate a ring, a vertically suspended tube or a suspended plate of such area and capacity as to vibrate a sufficient area of air to transmit a sound of the desired volume and intensity.

While in the mechanism illustrated herein, the direct current is supplied to a magnet comprising a stationary core and the alternating current is supplied to a solenoid or magnet having a movable core, substantially the same results will be obtained if the direct current is supplied to the solenoids or magnets having movable cores and the alternating current to the magnets having the stationary cores.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A polarized synchronous vibrating signaling mechanism comprising complementary exciting magnets having their poles facing one another, a solenoid having a core located intermediate of and in axial alinement with said magnet poles, means for passing an alternating current through said solenoid to polarize the core thereof in such a manner as to cause attraction between the pole of one magnet and the adjacent end of the core, and repulsion between the other end of the core and the pole of the magnet adjacent to it, whereby the magnetic flux in the core in cooperation with the fields of the magnets will cause a reciprocation of the core in the axial direction of said magnets and core and means operable by said reciprocation to produce a recognizable signal.

2. A polarized synchronous vibrating signaling mechanism comprising a pair of complementary exciting magnets having their poles facing one another, solenoids having connected cores located intermediate of said magnets and presenting their ends to the facing poles of said magnets in axial alinement therewith, means for passing an alternating current through said solenoid to cause a magnetic flux in said cores in cooperation with the fields of the respective magnets to reciprocate said cores and means operable by the reciprocating cores to produce a recognizable signal.

3. A polarized synchronous vibrating signaling mechanism comprising complementary electro-magnets having their poles facing one another, a plurality of pairs of solenoids located intermediate of said magnets and having reciprocally mounted connected cores presenting their ends to the fields of the respective magnets, a soft iron plate between the members of the pairs of solenoids, means for passing an alternating current

through said solenoids in directions to produce opposite polarity in said cores whereby the magnetic flux in said cores in coöperation with the fields of the respective magnets will cause an attraction toward one of said magnets and repulsion relatively to the other magnet thereby reciprocating said cores and means operable by the reciprocating cores to produce a recognizable signal.

4. A polarized synchronous vibrating horn mechanism comprising a diaphragm and means for operating the same including a pair of complementary electro-magnets having their poles facing one another, a soft iron plate located intermediate said magnets, pairs of solenoids connected to said intermediate plate having cores presenting their ends to the fields of said magnets, yokes uniting said cores, means for passing an alternating current through said solenoids in a direction to produce opposite polarity in said cores whereby the magnetic flux in said cores in coöperation with the respective magnets will cause a reciprocation of said cores and means connected to the yoke connecting said cores to strike a succession of blows upon said diaphragm.

5. A polarized synchronous vibrating horn mechanism comprising a frame, a pair of diaphragms secured at opposite ends of said frame, a pair of electro-magnets connected to the respective ends of said frame and having their poles facing one another, a solenoid located intermediate of said magnets having a core presenting its ends to the poles of said magnets, means for passing an alternating current through said solenoid to cause the magnetic flux in said core in coöperation with the fields of said magnets to reciprocate the core and means operable by the reciprocating core alternately to strike a succession of blows upon said diaphragms.

6. A polarized synchronous vibrating horn mechanism comprising a frame, a pair of diaphragms secured at opposite ends of said frame, a pair of electro-magnets connected to the respective ends of said frame and having their opposite poles facing one another, a plurality of solenoids located intermediate of said electro-magnets and having connected and reciprocably mounted cores presenting their ends to the fields of the respective magnets, means for passing an alternating current through said solenoids to cause a magnetic flux in said cores which in coöperation with the fields of the respective magnets will reciprocate said cores in unison and means operable by the

reciprocation of said cores for alternately striking blows upon the respective diaphragms.

7. A polarized synchronous vibrating mechanism comprising a frame, a pair of electro-magnets secured at the ends of said frame and consisting of laminated plates provided with suitable energizing coils, a neutral laminated plate intermediate of said magnetic plates, solenoids secured to said intermediate plate having cores extending into the field of the respective magnets, means for passing an alternating current through said solenoids in such direction as to cause a magnetic circuit through one of said magnets, the ends of said cores adjacent said magnet and the neutral plate, whereby the magnetic flux in said cores in coöperation with the field of the magnet will cause a reciprocation of said cores and means for utilizing the energy of said reciprocating cores.

8. A polarized vibrating horn mechanism comprising a frame having ends connected by posts, a diaphragm secured to one end of said frame, a pair of electro-magnets connected to each end of said frame and having their opposite poles facing one another, solenoids supported by the posts of said frame intermediate of said ends in axial alinement with said electromagnets having connected reciprocably mounted cores presenting their ends to the fields of the respective magnets, means for passing an alternating current through said solenoids to cause a magnetic flux in said cores which in coöperation with the fields of the respective magnets will reciprocate said cores and means operable by the reciprocation of said cores for vibrating said diaphragm.

9. A polarized vibrating horn mechanism comprising a frame having ends connected by posts, guideways carried by said posts, diaphragms secured to the ends of said frame, a pair of electro-magnets connected to each end of said frame and having their opposite poles facing one another, solenoids supported by the posts of said frame intermediate of said ends in axial alinement with said electro-magnets, cores reciprocably mounted in said solenoids, means connecting the ends of said cores mounted in the guideway in said posts and means carried by said core connecting means adapted to impinge upon and vibrate said diaphragms.

In testimony whereof, I have signed my name to this specification.

DANIEL S. WILSON.