

July 6, 1943.

E. DICKTEN, JR., ET AL

2,323,803

SIGNALING DEVICE

Filed Oct. 22, 1940

2 Sheets-Sheet 1

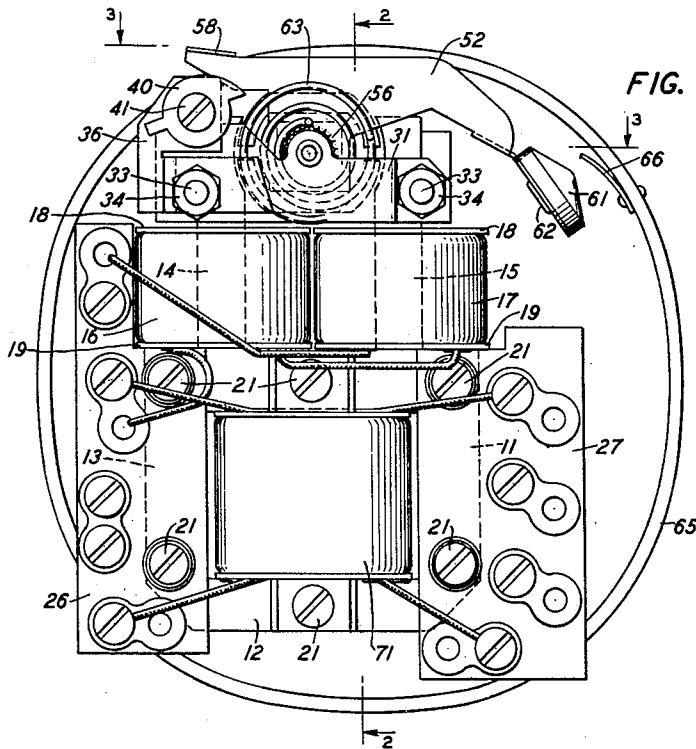


FIG. 1

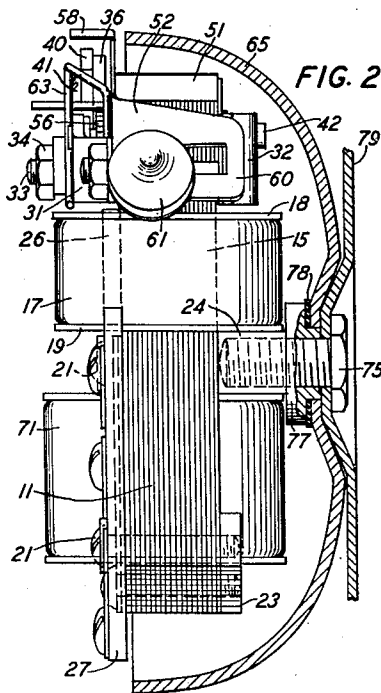


FIG. 2

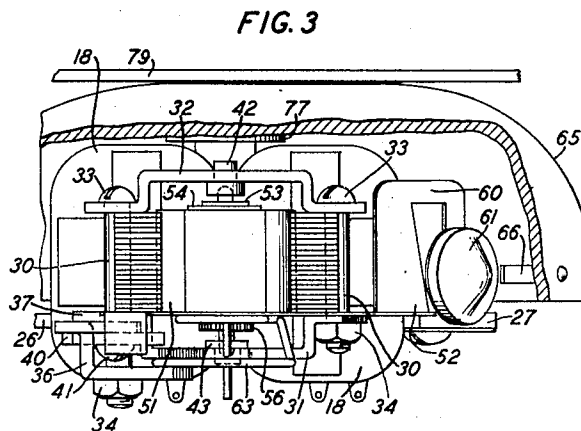


FIG. 3

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FIG. 4

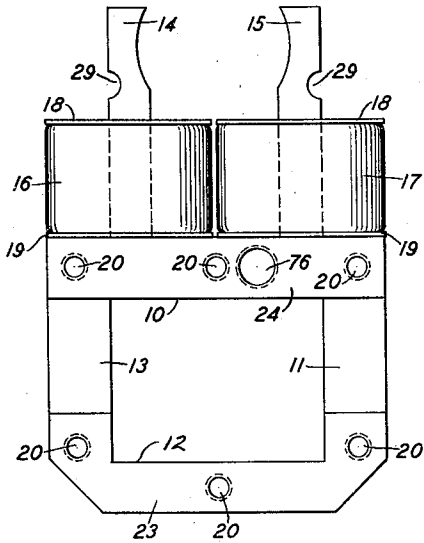


FIG. 5

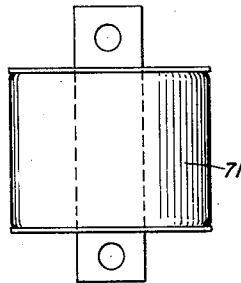


FIG. 6

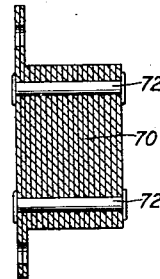


FIG. 7

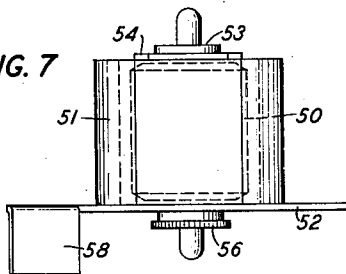


FIG. 9



FIG. 10

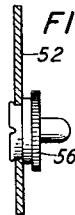
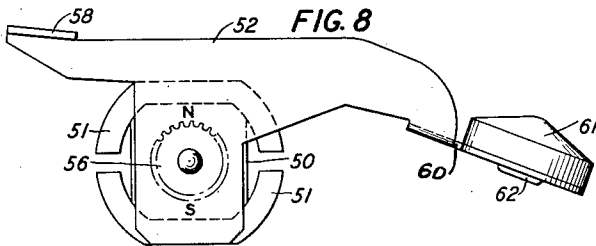


FIG. 8



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## UNITED STATES PATENT OFFICE

2,323,803

## SIGNALING DEVICE

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Application October 22, 1940, Serial No. 362,204

7 Claims. (Cl. 177—7)

This invention relates to electromagnetically operated signaling devices and particularly to telephone ringers.

It is the object of this invention to provide a simple, compact and highly efficient ringer of the type employed extensively at telephone subscriber stations for signaling purposes, and to provide a structure which permits the mounting of the substation induction coil together with the ringer structure in a single sound emitting device, or ringer gong.

This object is attained in accordance with a feature of the invention, by utilizing a simplified stator core structure which readily accommodates the ringer coils and the induction coil with a minimum of iron, thus materially reducing the space occupied by the structure and rendering it suitable for mounting in a housing comprising a single sound emitting element, or gong. The stator structure is such also that the ringer coils and the induction coil are positioned conjugate to each other so that currents in either one will not induce voltages in the other.

Another feature of the invention resides in a structure which permits the rotor, pole-shoes, rotor shaft extensions and clapper support to be assembled as a unitary assembly and thus to be readily positioned as a unit in the bearings in which the assembly functions. This feature reduces the number of parts required and materially simplifies the assembly of the ringer.

A further feature of the invention resides in the use of a single mounting screw which serves to support the combined ringer and induction coil on the gong housing.

Still another feature of the invention contemplates the use of a squared gong having secured thereto, at a point opposite the ringer clapper, a small stiff reed, and in rendering the gong, with its reed, adjustable with respect to the point of contact between the clapper and reed, whereby the sound intensity of the ringer may be regulated.

These and other features of the invention will be readily apparent from the following detailed description made with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of the combined ringer and induction coil looking into the cup-shaped housing which supports the device;

Fig. 2 is a side view of the structure shown in Fig. 1 and constitutes a section taken along the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a top view of the structure disclosed in Fig. 1 with a portion of the gong broken away;

Fig. 4 is a schematic representation illustrating the form of the stator core showing the position of the ringer coils thereon;

Fig. 5 is a view of the induction coil and its removably mountable core;

Fig. 6 is a side view of the core structure which supports the induction coil;

Fig. 7 is a view illustrating the unitary rotor assembly;

Fig. 8 is another view of the rotor assembly; and Figs. 9 and 10 illustrate fragmentary details of the rotor assembly.

Referring to the drawings, and particularly to Fig. 4, the stator element of the ringer is a laminated structure comprising a plurality of silicon steel laminae, each having the general configuration illustrated. The stator core structure consists of four legs 10, 11, 12 and 13 which define a rectangle. Extending vertically (viewing Fig. 4) from the horizontal leg 10 is a pair of spaced core extensions 14 and 15, located in the plane of the rectangular section. The extensions 14 and 15 are spaced in from the edges of the rectangular core portion with the outer edge of extension 15 in substantial alignment with the inner edge of leg 11, and the outer edge of extension 14 in substantial alignment with the inner edge of leg 13. Each of the extensions 14 and 15 carries a ringer coil 16 and 17, respectively. The coils 16 and 17 may be form-wound between the spool-heads 18 and 19 and slipped over the ends of the stator extensions 14 and 15. Preferably, each layer of winding of the coils 16 and 17 is separated by a thin layer of cellulose acetate and the entire coil encased in a vincellatate covering. The upper face portions of the horizontal leg 10 of the stator constitute shoulders upon which the coils 16 and 17 rest.

Each lamina of the stator is provided with a plurality of holes 20 which, when the laminae are assembled, are in alignment and accommodate the screws 21. The three lower screws 21 are screwed into tapped holes in a clamp plate 23 which, as illustrated in Fig. 4, extends across the rear face of the lower leg 12 of the stator core and part way up the vertical legs 11 and 13. The three upper screws 21 pass through the aligned holes 20 in the upper leg 10 of the stator and are screwed into correspondingly tapped holes in the rectangular mounting block 24 which covers the rear face of the core leg 10. Thus it will be observed that the mounting block 24 and clamp plate 23 serve to maintain the laminations of the

rectangular portion of the stator core in a unitary assembly when the screws 21 are made up tight. The screws 21 on the vertical legs 11 and 13 also serve to mount the terminal blocks 26 and 27 on the stator structure.

Near the upper end of the stator extensions 14 and 15, that is, just above the upper spool-heads 18, the laminae are cut away at 29 to provide grooves for the reception of two substantially cylindrical sleeves 30 (Fig. 3) which separate the front bearing plate 31 from the rear bearing plate 32 and through which, and through aligned holes in the plates 31 and 32, pass the screw-bolts 33. The nuts 34 are made up on the threaded ends of the bolts 33 and thus securely clamp the laminations of the stator extensions 14 and 15 together. The bearing plates 31 and 32, as will be learned from a later description, serve to mount the rotatable armature between the arcuate pole-faces of the stator extensions 14 and 15.

A metal strap 36 is also mounted on the structure by means of the left-hand (Fig. 3) bolt 33, and is so formed as to have one surface portion abutting the outer face of the bearing plate 31 at 37, and an outer portion spaced therefrom and provided with a hole through which the left-hand bolt 33 extends to receive the nut 34. To the portion of strap 36 which abuts the bearing plate 31, there is secured a clapper stop 40 by means of screw 41.

The bearing plates 31 and 32 are, in effect, bridge pieces, each consisting of a U-shaped portion, each end of which is provided with a flange portion which is bored to receive the screw bolts 33. The rear bearing plate 32 is provided with a centrally located hole into which is fitted a cylindrical T-shaped bearing 42, with the head thereof situated on the inside of the bearing plate and provided with a centrally located bore which, as will be seen from a later description, accommodates one of the rotor hubs or ends. This bearing is preferably made of brass.

A similar brass bearing 43 is supported in a centrally located aperture in the bearing plate 31 and, as will be seen from a later description, houses the other rotor hub or end.

The rotor assembly is shown in Figs. 7 and 8 and as illustrated, comprises a permanent magnet rotor 50, soft iron pole-shoes 51, clapper arm 52 and the stud shaft assemblies. The permanent magnet 50 is substantially square in cross-section and has its edges beveled. It is made of cast magnet steel and is magnetized so that the north pole is located on top, viewing Figs. 1 and 8, and the south pole at the bottom. The pole-shoes 51, two in number, are open-ended trough-like elements which are secured to the armature 50 by spot welding or by any other suitable process. The pole-shoes are positioned on the permanent magnet with the inner face of their bases abutting opposite faces of the magnet, and with their sides projecting in a slightly arcuate fashion over two opposite sides of the magnet. The pole-shoe sides are curved to conform with the general contour of the stator pole-faces.

A stud 53, preferably of stainless steel, is fixedly associated with a rectangular sheet 54 of the same material, which sheet is spot welded to the inner edges of the two pole-shoes 51. The stud 53 is centrally located on the sheet 54, and the sheet 54 is so positioned on the pole-shoe edges that the axis of the stud is in alignment with the center line of the rotor, that is, with its axis of rotation.

The clapper arm 52, clearly illustrated in Fig. 8, consists of an irregularly-shaped sheet of stainless steel having a substantially rectangular portion thereof spot welded to the front edges of the pole-shoes 51 in a manner similar to that in which the sheet 54 is secured to the rear edges of the pole-shoes. The rectangular portion of clapper arm 52 is provided with a centrally located hole into which is securely fitted a stud 56. When the sheet 54 and the clapper arm 52 have been correctly positioned and welded to opposite edges of the pole-shoes 51, the axes of studs 56 and 53 will be in alignment with each other and with the axis of rotation of the rotor 50. Each of the studs 56 and 53 terminates in a pin or shaft-like projection having a smooth rounded end. The rounded projection of stud 56 fits into the bearing 43, whereas the projection of stud 53 fits into the bearing 42. These elements fit freely in their respective bearings so that the rotor is free to rotate when the ringer coils 16 and 17 are energized.

As viewed in Fig. 8, the clapper arm 52 is provided with arm-like extensions projecting in either direction from the rectangular portion thereof which is spot welded to the rotor pole-shoes 51, as just described. At the outer edge of the left extension of the clapper arm 52 there is located a small integral, substantially rectangular piece 58, which, when the clapper arm is in position on the ringer structure, assumes a position immediately above the clapper stop 40, as clearly shown in Figs. 1 and 2. When the ringer coils are energized and the rotor functions to actuate the clapper arm 52, the projection 58 thereof strikes against the cam-like periphery of the stop 40 to arrest the motion of the clapper arm. The stop 40 may be adjusted so that the stroke of the clapper arm may be regulated to any desired length.

The end of the right-hand extension (still viewing Fig. 8) of clapper arm 52 terminates in a substantially U-shaped integral formation 60, one of the legs thereof terminating in a ring-shaped support for the dome-shaped clapper 61. The clapper 61 is provided with a small shank portion 62 which tightly fits into the opening in the ring-shaped support.

A spiral spring 63 serves to bias the rotor to a normal position, in which position the axis of the permanent magnet, passing from the north pole to the south pole, is at right angles to the center line of the stator pole-face. This is the position illustrated in Figs. 1, 2 and 3. When the stator windings 16 and 17 are energized, the permanent magnet rotor rotates in an effort to align the field of its magnet with that between the pole-faces of the stator. When this occurs the clapper arm 52, viewing Fig. 1, moves counterclockwise, causing the clapper 62 to strike the gong 65.

Though the adjustable clapper stop 40 may be employed to adjust the stroke of the ringer and thus regulate the sound output of the ringer, an auxiliary means, in the nature of a small stiff reed 66, is also illustrated which serves to adjust the volume of the ringer. This reed is shown riveted to the gong 65 in a position such that the clapper 61, when actuated, strikes it. The gong 65 is rotatable relative to the structure it houses so that the reed 66 may be moved relative to the clapper 61 and, depending upon its location, will be struck nearer or further away from its point of attachment to the gong. Simple rotation of the gong 65 brings any desired

point of the reed under the clapper and permits adjustment of the ringer to give an output appropriate to its surroundings.

Particular reference will now be made to Figs. 4, 5 and 6.

In Fig. 6 there is shown a side view of the laminated core 70 which carries the substation induction coil 71. This core structure comprises a plurality of similarly formed, rectangular laminae secured together as a unit by means of rivets 72. At one end of the assembly there are two outer laminations which are of greater length than the other laminations of which the core is formed. These two laminations extend above and below the other laminations to provide flange-like extensions which are apertured to receive those screws 21 which coast with the center holes in the horizontal legs 10 and 12 of the stator core. The core 70, with its associated coil 71, is slipped into the rectangular area defined by the stator legs 10, 11, 12 and 13 so that the apertures or holes in the two outer laminae are in alignment with the center holes 20 in the stator. The corresponding screws 21 are then fed through the aligned holes in stator legs 10 and 12, and in the extensions of the outer laminae of core 70 and their respective nuts screwed thereon. Thus the induction coil of the substation is removably mounted on the stator core and is so positioned that a condition of conjugacy exists between it and the ringer coils 16 and 17. With this construction the stator of the ringer and the core of the induction coil are combined in a manner to give a saving in the amount of iron used, and in the space it occupies, while the coils of the two units are positioned conjugate to each other so that currents in either one will not induce voltages in the other.

The gong 65 is cup-shaped and its rim contour is preferably squared. The apex of the gong is provided with a slight depression having a centrally located opening for the passage of a screw-bolt 75 which is screwed into the tapped aperture, or hole 76 in the mounting block 24, which, as hereinbefore described, is positioned on the rear face of the horizontal leg 10 of the stator. A shouldered bushing 77 is accommodated in the hole in the gong apex and a rubber washer 78 is interposed between the shoulder portion of the bushing 77 and the inner face of the gong. The inner face of the bushing 77 abuts the rear edges of the spool-head of the induction coil 71. 79 indicates a fragmentary portion of a bell-box cover, base of a combined telephone handset, or any other instrumentality upon which the ringer is to be mounted. When the screw-bolt 75 is screwed into the tapped hole 76, the entire ringer and its associated induction coil are held secured in position on the element 79. To remove the entire structure from the gong housing it is necessary only to remove the single screw-bolt 75 and lift the structure out.

The rotor assembly, as hereinbefore described, comprises the permanent magnet rotor 50, its pole-shoes 51, the clapper 61 and its supporting arm 52. The clapper is secured to the rotor as hereinbefore described, in such a way that the masses of the rotor and clapper, together with the stiffness of the retractile spring form a mechanical system which is resonant at the frequency of the current employed to energize the ringer coils 16 and 17.

The ringer structure as described above has many desirable advantages over ringers of known

design. Structurally it is compact, it occupies a minimum of space, produces a louder signal, and, because of the use of a single large gong it permits a lower pitched and more pleasant tone.

What is claimed is:

1. A telephone ringer comprising a permanent magnet rotor, a stator having a pair of spaced core legs terminating in oppositely disposed pole-faces, a gong, a clapper arm, and means for supporting said rotor between the pole-faces of said stator for rotation therebetween comprising a pair of bearing plates each of which bridges said core legs on opposite sides thereof, a projection of said clapper arm fixed to one side of said rotor and constituting a hub support, a second hub support fixed to the opposite side of said rotor, a hub mounted in a centrally located aperture in each of said hub supports, and a bearing mounted on each of said bearing plates for receiving said hubs, and means carried by said clapper arm and adapted to strike said gong when said rotor is actuated.

2. A telephone ringer comprising a permanent magnet rotor of cast magnet steel, a pair of soft iron pole shoes welded to said rotor, a stator having a pair of spaced core legs terminating in oppositely disposed pole-faces and each carrying a ringer coil, a gong, a clapper arm carrying means for striking said gong when said rotor is rotated between said stator pole-faces upon energization of said ringer coils, and means for rotatably supporting said rotor between said stator pole-faces, comprising a hub-bearing projection integrally formed with said clapper arm and affixed to one side of said rotor shoes, a second hub-bearing element affixed to the opposite side of said rotor shoes, bearings for each of said hubs and means comprising a pair of bearing plates spanning opposite sides of said core legs, and each provided with a centrally located aperture for housing one of said bearings.

3. In a telephone ringer, a permanent magnet rotor of cast magnet steel, a pair of soft iron shoes welded to said rotor, a stator having a pair of spaced core legs terminating in oppositely disposed pole-faces and each carrying a ringer coil, a gong, means for supporting said rotor between the pole-faces of said core legs comprising a hub-supporting element affixed to each of a pair of opposite sides of said rotor shoes, a pair of bearing plates bridging said core legs and each supporting a bearing, which bearings are adapted to receive the hubs carried by said hub-supporting elements, and a clapper support formed integrally with one of said hub-supporting elements and supporting a clapper adapted to strike said gong when said rotor is actuated in response to the energization of said ringer coils.

4. The combination in a combined telephone ringer and substation induction coil, a laminated core structure comprising a closed rectangular portion and a pair of spaced integral projections extending from one leg of said rectangular portion and terminating in oppositely disposed arcuate pole-faces, a ringer coil mounted on each of said spaced projections, a permanent magnet mounted for rotation between said arcuate pole-faces, a clapper carried by said armature, a sound emitting device adapted to be struck by said clapper when said rotor is rotated between said pole-faces upon the energization of said ringer coils, and an induction coil having a core spanning the leg of said rectangular core portion from which said pair of spaced integral projections extend and the opposite leg of said rectangular core

portion, whereby said ringer coils and said induction coils are positioned conjugate to each other.

5. A combined telephone ringer and telephone substation induction coil comprising a substantially rectangular laminated magnetic structure having a pair of spaced integral extensions projecting outwardly from one side thereof, a pair of ringer coils wound upon said extensions and forming with said extensions an electromagnetic stator, a rotor comprising a permanent magnet oscillatably supported between the extremities of said extensions and adapted to be operated therebetween upon the energization of said ringer coils, a clapper operated by said rotor, a gong housing said magnetic structure and adapted to be struck by said clapper upon the actuation of said rotor, and an induction coil mounted within the area defined by said rectangular magnetic structure and having a core whose longitudinal axis parallels the longitudinal axes of said extensions and is spaced substantially midway therebetween whereby said induction coil is disposed conjugate to said ringer coils to preclude the possibility of interaction between said coils.

6. A telephone ringer comprising a permanent magnet rotor of cast magnet steel, a pair of soft iron pole shoes welded to said rotor, a stator having a pair of spaced core legs terminating in oppositely disposed pole faces and each carrying a

ringer coil, a gong, a clapper arm carrying means for striking said gong when said rotor is rotated between said stator pole faces upon energization of said ringer coils, and means for rotatably supporting said rotor between said stator pole faces, comprising spindles fastened to said pole shoes, bearings for said spindles, and means comprising a pair of bearing plates spanning opposite sides of said core legs and each provided with a centrally located aperture for housing one of said bearings.

7. The combination in a telephone ringer comprising a coil bearing stator having a pair of oppositely disposed stationary pole faces and a permanent magnet rotor mounted for oscillation between the pole faces of said stator when the stator coil is energized, of a gong, means for supporting said gong on said stator, a clapper arm fixed at one point to said oscillatable rotor for oscillation therewith and extending in opposite directions from its point of association with said rotor, one of the clapper arm extensions supporting a striker for engaging said gong when said rotor is actuated, and means for limiting the stroke of said clapper arm comprising a cam adjustably mounted in substantial alignment with the other of the clapper arm extensions.

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