Feb. 6, 1951 W. G. HOLMES 2,540,671

BELL ACTUATING MECHANISM

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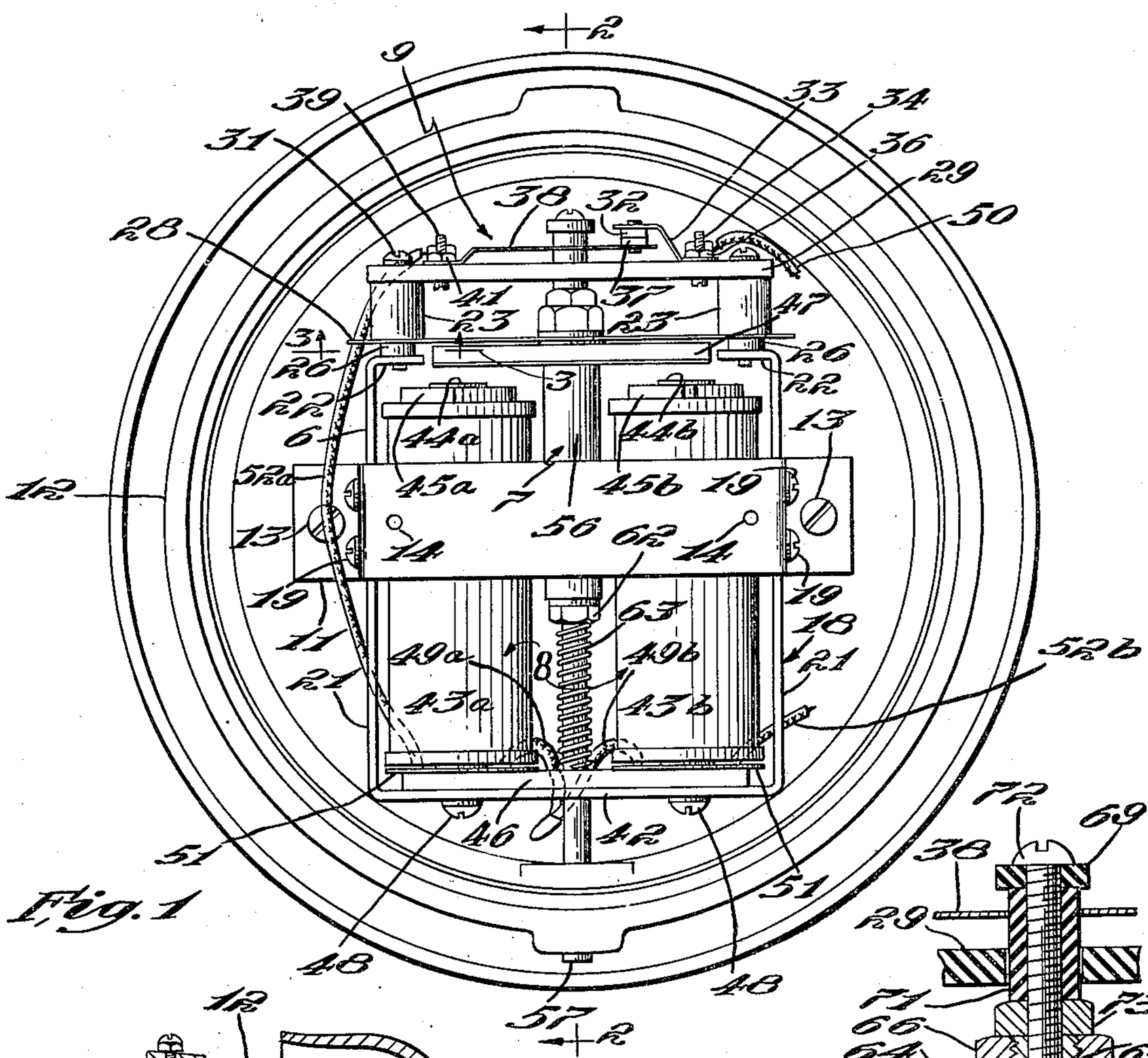

Fig. 1

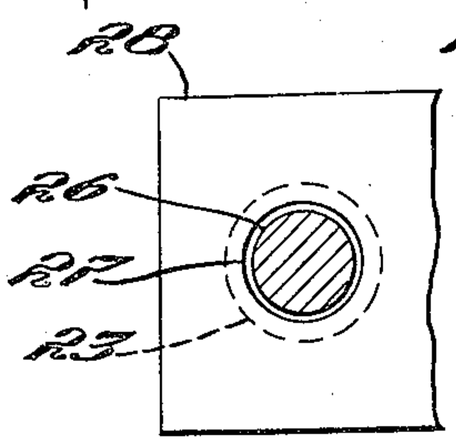

Fig. 3

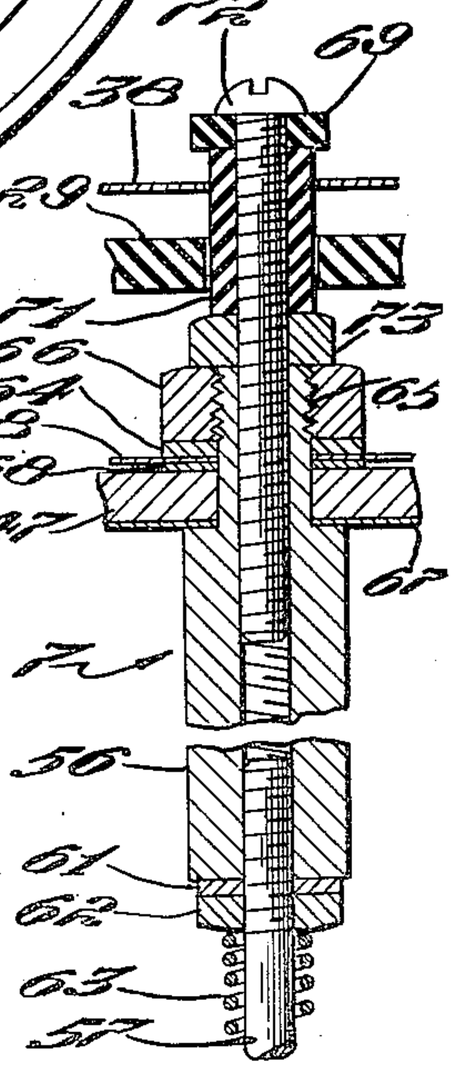

Fig. 4

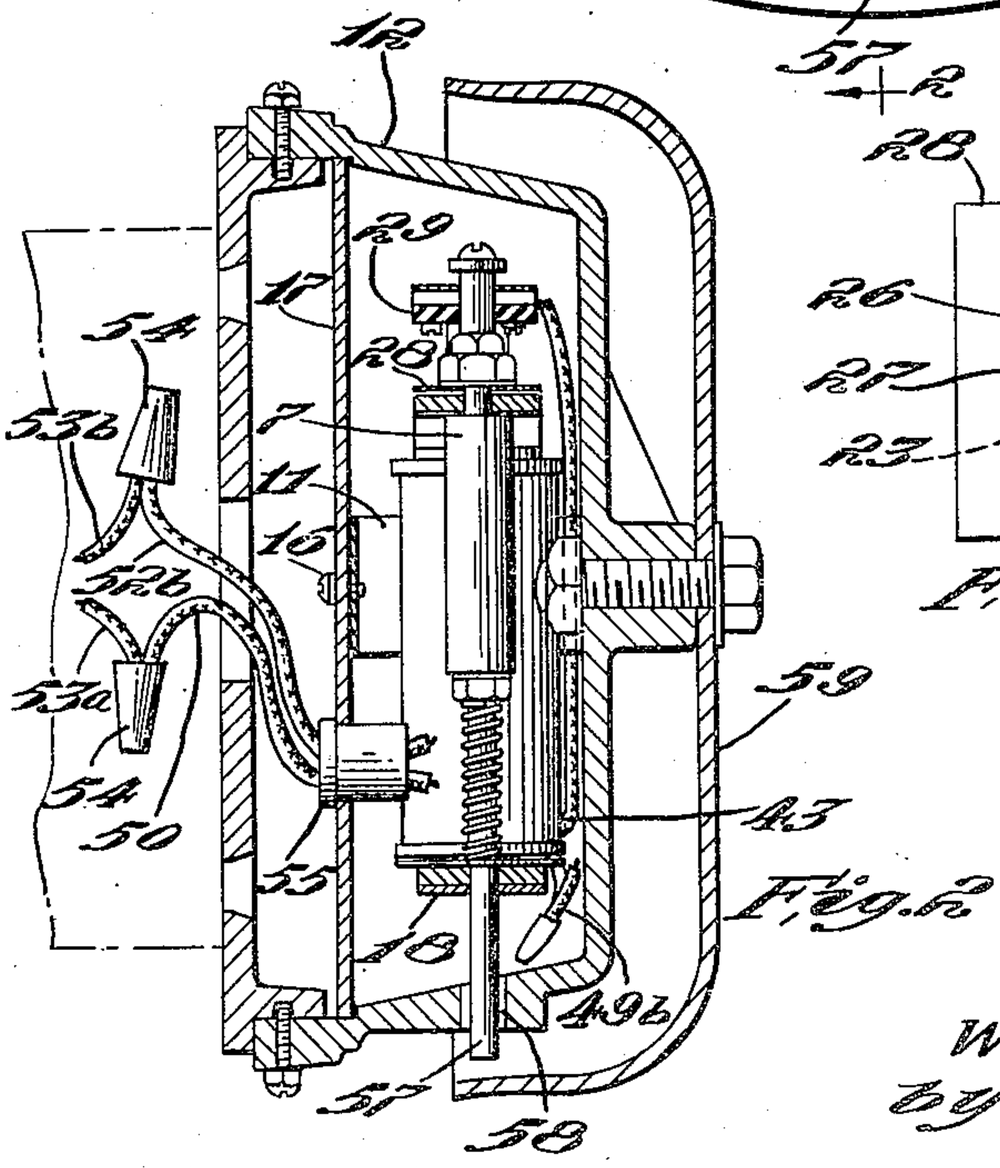

Fig. 2

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BELL ACTUATING MECHANISM

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8 Claims. (Cl. 177—7)

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To obtain the maximum of sonic energy from an alarm bell, it is desirable to have the striker contact the gong at the end of a long stroke and substantially simultaneously to interrupt the electrical circuit of the driving electromagnets so that the striker will not be retained in contact with the gong after completion of its stroke. The length of the stroke is largely determined by the bell design; whereas adjustments are usually provided permitting compensation of each individual bell for dimensional variations in the component parts.

Objects of this invention are to provide an alarm bell which has an exceptionally long striker movement, which has a striker readily adjustable to contact the gong at the end of its stroke, which has electrical contacts adjustable to open at the most advantageous point in the striker movement, in which such adjustments can be made after the bell has been assembled and without removing the actuating mechanism from its housing, which is simple and rugged in construction, and which advances the art of bell manufacture generally.

In one aspect the invention contemplates an alarm bell actuating mechanism having a supporting frame to which two guide pieces are affixed. A plunger assembly slidably supported by the frame includes a striker with an armature fastened thereto so that the assembly moves parallel to its longitudinal axis upon the energization of an electromagnet. To obtain a large axial movement of the striker, a restraining member is fixed at its center to the plunger assembly and with its ends sliding on the respective guide pieces.

In another aspect a normally closed switching element is located upon the frame and electrically connected in series with the electromagnet. The plunger assembly has a switch operating member mounted coaxially adjustable on one end of the plunger and a striker mounted coaxially adjustable on the other end of the plunger whereby the time of opening of the switching element and the effective stroke of the striker can be independently varied.

In a specific aspect the bell actuating mechanism comprises a pair of cylindrical guide pieces, two electromagnets and a normally closed switching element affixed to a supporting frame. This frame also slidably supports a plunger assembly between the electromagnets which moves parallel to its longitudinal axis upon the energization of the electromagnets.

The plunger assembly includes an internally

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threaded plunger with a shoulder on one end thereof, an armature member, and a restraining member fastened at their respective centers to the shoulder end of the plunger by a nut. The restraining member has an aperture on each end thereof for engaging the respective guide pieces affixed to the supporting frame so that the striker has a long axial movement. Adjustment of the time of opening at the switching element is obtained by varying the engagement of a switch operating member with the internal threads of the shouldered end of the plunger. The movement of the striker is adjusted in analogous manner by the threading thereof into the opposite end of the plunger.

These and other objects and aspects of the invention will be apparent from the following detailed explanation illustrating the invention with reference to a concrete embodiment thereof. The description refers to the drawings in which:

Fig. 1 is a side elevation view of the actuating mechanism with one side of its housing removed;

Fig. 2 is a cross sectional view on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary cross sectional view on line 3—3 of Fig. 1; and

Fig. 4 is a fragmentary cross sectional view on line 2—2 of Fig. 1.

As is thus illustrated in Fig. 1 the bell actuating mechanism comprises a supporting frame 6 of brass or other non-magnetic material carrying a plunger assembly 7, an electromagnet assembly 8, and a switching element 9.

The frame 6 includes a bracket 11 fastened to a bell housing 12 by the screws 13. Two threaded holes 14 are provided in the bracket 11 to engage the screws 16 (Fig. 2) for securing a cover 17 to the housing 12. A U-shaped frame member 18 is also fastened to the bracket 11 by the screws 19, two of which pass through clearance holes in each of the respective sides of the bracket 11 to thread into holes tapped in the adjoining legs 21 of the U-shaped bracket 18.

The end of each leg 21 is bent inwardly to form a lip 22 upon the top of which is carried a cylindrical guide piece 23 of brass or other material preferably nonmagnetic. The end of each piece 23 adjacent the lip 22 is reduced in diameter as at 26 so that it engages an aperture 27 (Fig. 3) in a leaf spring which acts as a restraining member 28 whose function will be described in detail hereinafter. The opposite end of each guide piece 23 supports a plastic cross member 29 upon which is mounted the switching element 9. The guide pieces 23 and the cross member 29 are fas-

tened in position by screws 31, each of which projects through a hole near one of the respective ends of the cross member 29 and the axial hole in the corresponding guide piece 23 to engage the threads of a hole tapped in the adjacent lip 22.

The switching element 9 includes a stationary contact 32 riveted to one end of an arm 33. The other end of the arm 33 is secured to the cross member 29 by two cap screws 34 and their engaging nuts 36. The movable contact 37 is riveted to the free end of a cantilever leaf spring 38 constructed of phosphor bronze or other elastic material which readily conducts an electrical current but which is preferably nonmagnetic. The opposite end of the spring 38 is joined to the cross member 29 by means of two cap screws 39 and the mating nuts 41.

The bottom connecting member 42 between the frame legs 21 also acts as a support for two electromagnets 43*a* and 43*b* and their associated magnetic circuit. This magnetic circuit includes the pole pieces 44*a* and 44*b* of the electromagnets 43*a* and 43*b* respectively, and a strap 46 of low reluctance material juxtaposed with the connecting member 42 so that the bottoms of the respective pole pieces 44*a* and 44*b* are magnetically linked. The top of the magnetic circuit is completed by an armature member 47 which is part of the plunger assembly 7 to be described in detail below. To prevent "chattering" when the electromagnets 43*a* and 43*b* are energized by an alternating current, the pole piece 44*a* is shaded in the conventional manner by a short circuited winding such as the split copper disk 45*a* which has a diametrical piece resting in a slot in the end of the pole piece. The pole piece 44*b* is similarly shaded by the disk 45*b*. The screws 48 project upwardly through the connecting member 42 and the strap 46 to engage a threaded hole in the bottom of the respective pole pieces 44*a* and 44*b* thereby securing the electromagnets 43*a* and 43*b* to the supporting frame 18.

The electromagnets 43*a* and 43*b* and the normally closed contacts 32 and 37 are series connected by interconnecting the leads 49*a* and 49*b* which are taken off at the bottom of the respective magnet windings. A fiber washer 51 is inserted between the strap 46 and the respective electromagnets 43*a* and 43*b* so that the leads are protected from abrasion. The second lead 52*a* from the electromagnet 43*a* is fastened under one of the nuts 41 securing the cantilever spring 38 to the cross member 29. The stationary contact arm 33 is similarly connected to one end of a lead 50, the other end of which is joined to a conductor 53*a* of an energizing source of either alternating or direct current (not shown), for example, by the solderless connector 54. The lead 52*b* is directly coupled to the other source conductor 53*b* in an analogous manner. To prevent any strain on the mechanism the leads 50 and 53*b* pass through an insulating block 55 fastened to the cover 17.

The plunger assembly 7 is slidably mounted in holes located in the cross member 29 and the frame connecting member 42 so that the assembly is positioned between the electromagnets 43. The assembly 7 comprises a hollow plunger 56 with an internal thread and a striker 57 with one end threaded into the lower end of the plunger. The other end of the striker 57 projects through an aperture 58 (Fig. 2) in the casing 12 to contact the inner surface of a gong 59 upon the

energization of the electromagnets 43. The effective length of the striker 57 is adjusted by varying the number of threads engaged in the internal threads of the plunger 56. The adjusted position is maintained by a lock washer 61 and a check nut 62 (Fig. 4). A coil spring 63 is located between the strap 46 and the nut 62 to furnish a restoring movement to the plunger assembly 7.

A shoulder is provided upon the upper end of the plunger 56 to carry the armature member 47, the leaf spring restraining member 28 and a thin separating washer 68. These members are maintained in position by a lock washer 64 and a check nut 66 which engages external threads 65 upon the surface of the plunger 56 having a reduced cross sectional area. A thin leaf 67 of bronze or other nonmagnetic material is inserted between the armature member 47 and the plunger shoulder.

The switch operating member comprises a fiber washer 69 supported by a fiber sleeve 71 which passes through a clearance hole in the leaf spring 38. The sleeve 71 and the washer 69 are secured to the plunger 56 by means of a round headed cap screw 72 and a check nut 73. As the plunger assembly 7 descends, the washer 69 contacts the switch leaf spring 38 and deflects it downwardly so that the contacts 32 and 37 open thereby to interrupt the power supply to the electromagnets 43. Adjustments of the time of opening of the contacts is made by varying the engagement of the screw 72 and shimming the sleeve 71 as required.

In the deenergized position shown in Fig. 1, the spring 63 forces the plunger assembly 7 upwardly so that the washer 69 is not in contact with the leaf spring 38, and the contacts 32 and 37 are therefore in the closed position. When a current is supplied by the source via the conductors 53, a series circuit is completed through the switching element 9 and the electromagnets 43 whereby the resulting flux in the magnetic circuit attracts the armature member 47 towards the pole pieces 44. This moves the attached plunger assembly 7 downwardly until the striker 57 contacts the gong 59, the leaf spring restraining member 28 sliding along the guide pieces 23. The striker 57 is adjusted, as described in detail heretofore, so that the restraining member 28 comes in contact with the top of the frame lips 22 just before the striker 57 contacts the gong 59, the follow through being provided by the elasticity of the restraining member 28. The opening of the contacts 32 and 37 is regulated to take place substantially at the time the striker 57 contacts the gong 59.

It is apparent from the above that both of these adjustments can be readily made after the actuating mechanism has been mounted in the casing 12 thereby permitting the optimum settings for each bell to be obtained by actual tests. Another distinct advantage is the possibility of using the same mechanism and casing for several sizes of bells, only the striker 57 and the gong 59 being changed in each case.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. An electrical actuating mechanism for a bell comprising a supporting frame having two guide pieces affixed thereto, an electromagnet

fastened to said frame, and a plunger assembly slidably supported by said frame including a striker, an armature fastened to said striker and movable parallel to the longitudinal axis thereof upon the energization of said electromagnet, and a yieldable restraining member fixed at its center to said plunger assembly and having ends sliding on the respective guide pieces, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, thereby to provide large axial movement of said striker.

2. An electrical actuating mechanism for a bell comprising a supporting frame, a pair of parallel cylindrical guide pieces affixed thereto, two electromagnets fastened to said frame, and a plunger assembly slidably supported between said electromagnets by said frame including a striker, an armature fastened to said striker and movable parallel to the longitudinal axis thereof upon the energization of said electromagnets, and a yieldable restraining member fixed at the center to said plunger assembly and having an aperture in each end thereof for engaging the respective guide pieces, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, thereby to provide large axial movement of said striker.

3. An electrical actuating mechanism for a bell comprising a supporting frame having two guide pieces affixed thereto, an electromagnet fastened to said frame, and a movable assembly including a plunger slidably supported by said frame, an armature member movable parallel to the longitudinal axis of said plunger assembly, a yieldable restraining member having ends sliding on the respective guide pieces, the center of both of said members being fastened to one end of said plunger, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, and a striker mounted for axial adjustment on the other end of said plunger whereby the stroke of said striker can be readily varied.

4. An electrical actuating mechanism for a bell comprising a supporting frame, a pair of cylindrical guide pieces affixed thereto, two electromagnets fastened to said frame, and a movable assembly slidably supported between said electromagnets by said frame and including an internally threaded plunger with a shoulder upon one end thereof having external threads, a nut engaging the external threads, an armature fastened upon said shoulder by said nut and movable parallel to the longitudinal axis of said assembly, a yieldable restraining member having an aperture in each end thereof for engaging the respective guide pieces, the center of said member also being fastened upon said plunger shoulder by said nut, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, and a striker threaded into the other end of said plunger whereby the stroke of said striker can be readily varied.

5. An electrical actuating mechanism for a bell comprising a supporting frame having two guide pieces affixed thereto, an electromagnet fastened to said frame, a normally closed switching element located upon said frame and electrically connected in series with said electromagnet, and a plunger assembly slidably supported by said frame and including a striker, an armature member movable parallel to the longitudinal axis of

said assembly, a yieldable restraining member having its ends sliding on the respective guide pieces, the center of both of said members being fastened to one end of said plunger assembly, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, and a switch operating member mounted for axial adjustment on said assembly whereby the time of opening of said switching element can be readily varied.

6. An electrical actuating mechanism for a bell comprising a supporting frame, a pair of parallel cylindrical guide pieces affixed thereto, two electromagnets fastened to said frame, a normally closed switching element located upon said frame and electrically connected in series with said electromagnets, and a plunger assembly slidably supported between said electromagnets by said frame and including an internally threaded plunger with a shoulder upon one end thereof having external threads, a nut engaging the external threads, an armature member fastened upon said shoulder by said nut and movable parallel to the longitudinal axis of said assembly by the energization of said electromagnets, a yieldable restraining member having an aperture in each end thereof for engaging the respective guide pieces, the center of both of said members being fastened to the plunger shoulder by said nut, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, a switch operating member threaded into the shouldered end of said plunger, and a striker engaging the plunger whereby the time of opening of said switching element can be readily varied.

7. An electrical actuating mechanism for a bell comprising a supporting frame having two guide pieces affixed thereto, an electromagnet fastened to said frame, a normally closed switching element located upon said frame and electrically connected in series with said electromagnet, and a plunger assembly slidably supported by said frame and including a plunger, an armature member movable parallel to the longitudinal axis of said assembly by the energization of said electromagnet, a yieldable restraining member having its ends sliding on the respective guide pieces, the centers of both of said members being fastened to one end of said plunger, the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, an adjustable switch operating member mounted for axial adjustment on said end of said plunger and an adjustable striker mounted for axial adjustment on the other end of said plunger whereby the time of opening of said switching element and the effective stroke of said striker can be independently varied.

8. An electrical actuating mechanism for a bell comprising a supporting frame having a pair of parallel cylindrical guide pieces affixed thereto, two electromagnets fastened to said frame, a normally closed switching element located upon said frame and electrically connected in series with said electromagnets, and a plunger assembly slidably supported between said electromagnets by said frame and including an internally threaded plunger with a shoulder upon one end thereof, a nut, an armature member movable parallel to the longitudinal axis of said assembly by the energization of said electromagnets, a

yieldable restraining member having an aperture in each end thereof for engagement with the respective guide pieces, the center of both of said members being fastened to the shouldered end of said plunger by said nut the travel of the ends of the restraining member between limits in opposite directions being determined by the lengths of the guide pieces, a switch operating member threaded into the shouldered end of said plunger, and a striker threaded into the opposite end of said plunger whereby the time of opening of said switching element and the effective stroke of said striker can be independently varied.

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