

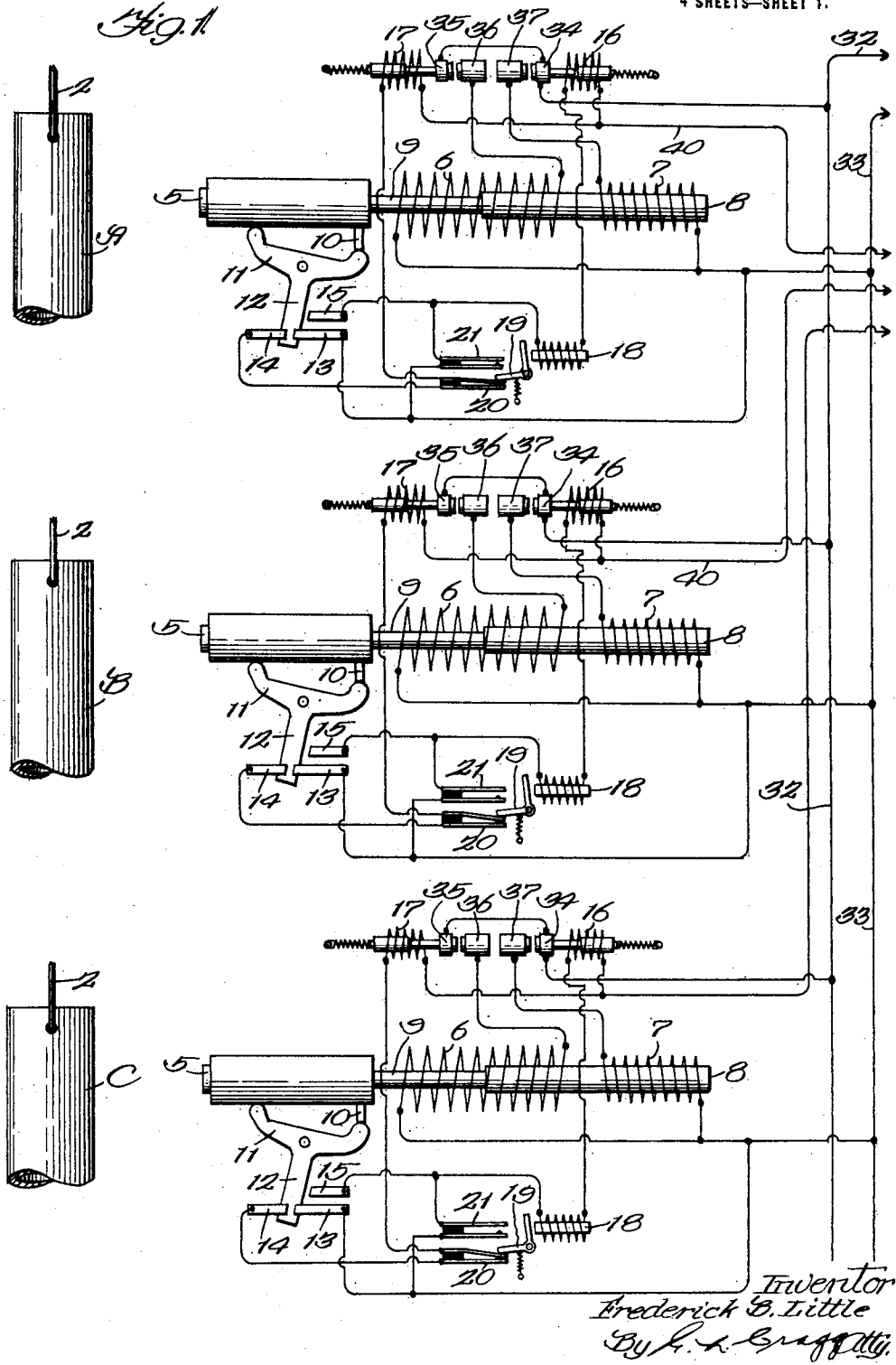
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F. B. LITTLE.
CHIME OPERATING APPARATUS.
APPLICATION FILED MAY 23, 1921.

1,398,972.

Patented Dec. 6, 1921.

4 SHEETS—SHEET 1.



Inventor
Frederick B. Little
By *H. A. Bragg*

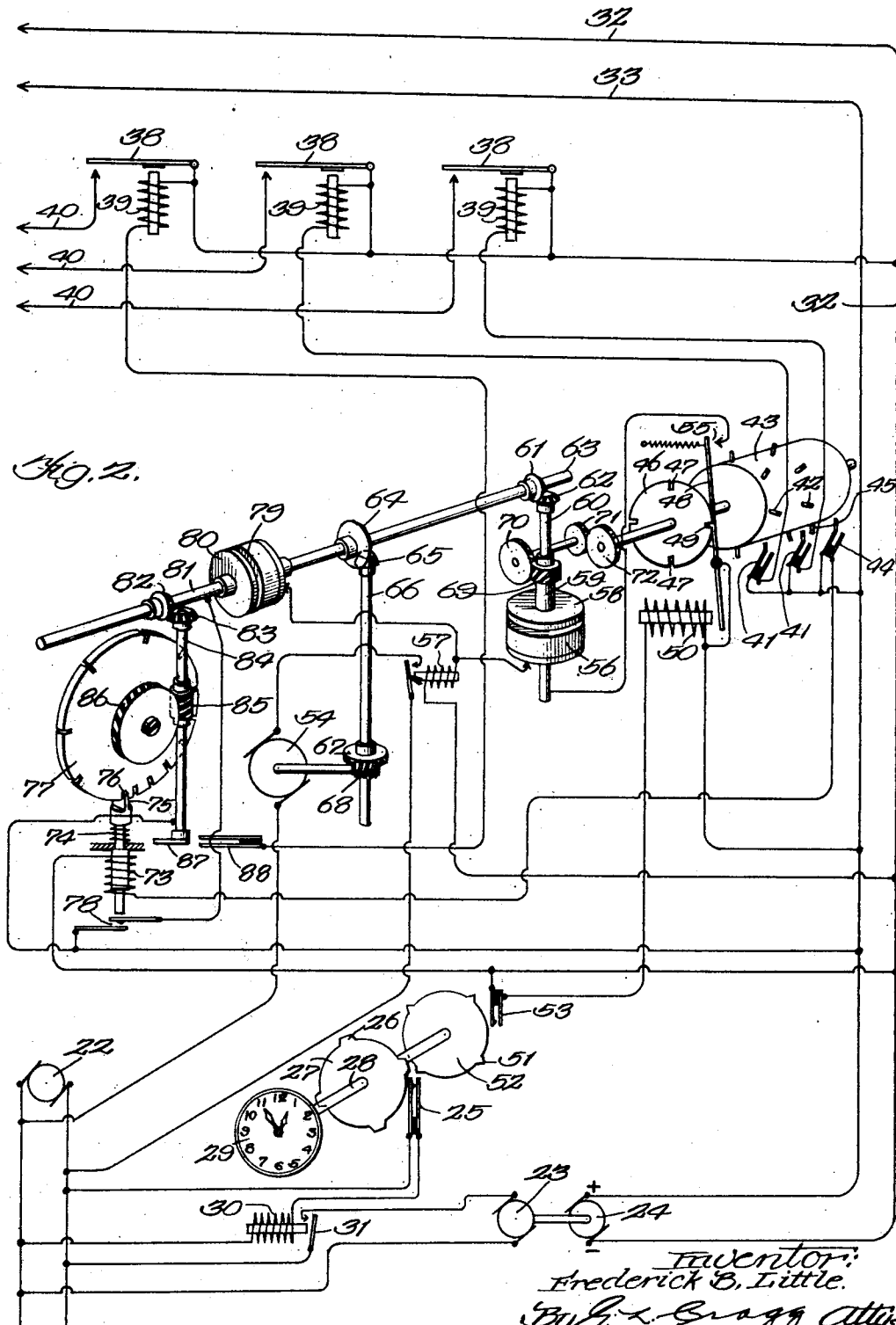
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4 SHEETS—SHEET 2.



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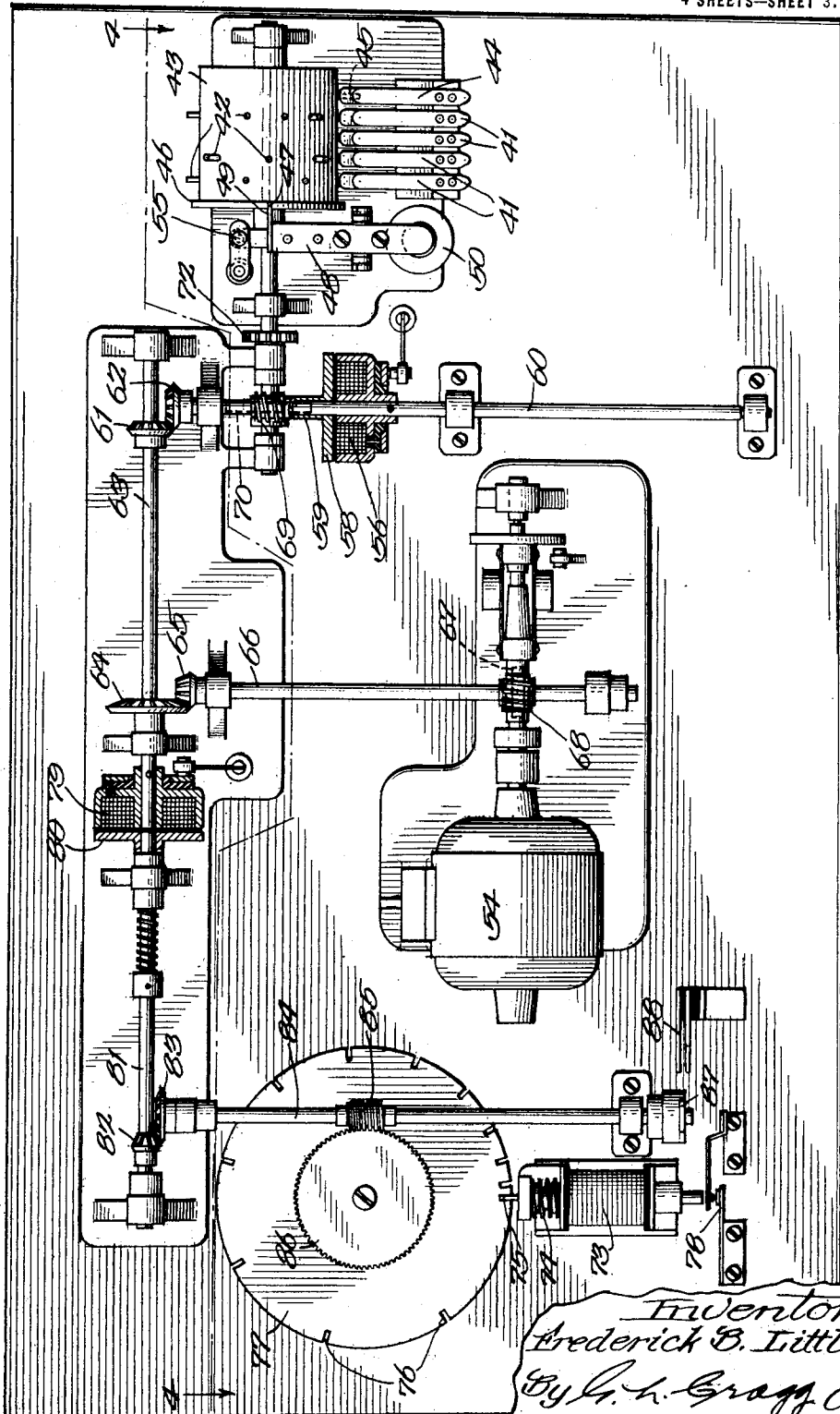
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4 SHEETS—SHEET 3.

Fig. 3.



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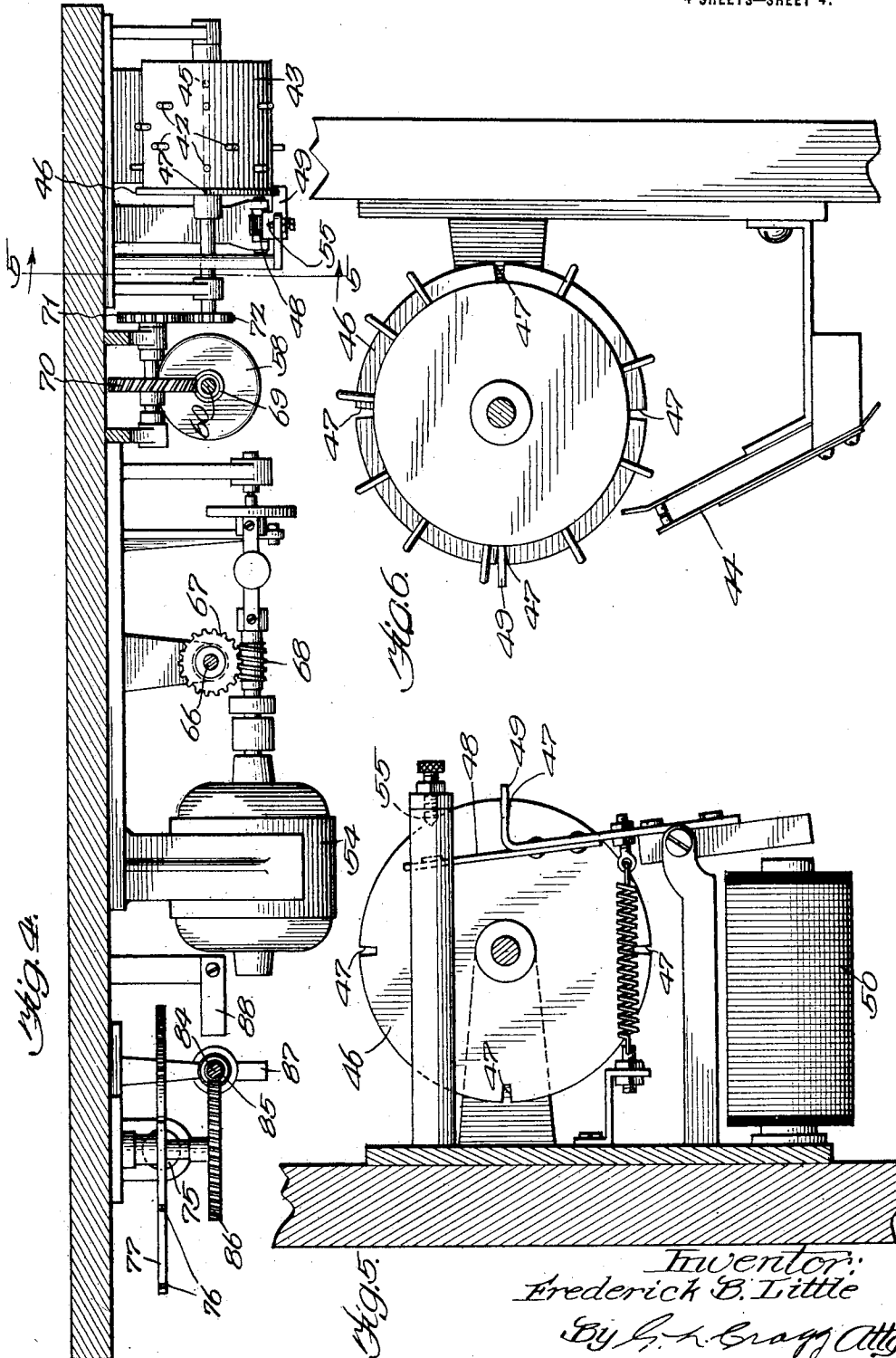
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4 SHEETS—SHEET 4.



UNITED STATES PATENT OFFICE.

FREDERICK B. LITTLE, OF CHICAGO, ILLINOIS, ASSIGNOR TO J. C. DEAGAN, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CHIME-OPERATING APPARATUS.

1,398,972.

Specification of Letters Patent.

Patented Dec. 6, 1921.

Application filed May 23, 1921. Serial No. 471,850.

To all whom it may concern:

Be it known that I, FREDERICK B. LITTLE, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Chime-Operating Apparatus, of which the following is a full, clear, concise, and exact description.

My invention relates to chimes and has for its object the provision of improved electro-magnetic mechanism for effecting the operation thereof.

In practising my invention I employ switching mechanism for selecting the electro-magnetic mechanism corresponding to the selected chimes which are to be operated, there being time controlled means for setting this switching mechanism into operation. A portion of the switching mechanism is desirably in the nature of the operating cylinder of a Swiss music box, there being prongs upon the cylinder which operate upon switches that are individual to the chimes and the chime operating electro-magnetic mechanisms. This cylinder and the switches operated thereby may be employed to sound melodies upon the quarter hour periods. There is desirably employed an electric motor for effecting the operation of the cylinder and a relay governed by the timing mechanism for bringing this motor into circuit. The switching mechanism that is employed to sound the hours desirably includes a wheel also operable by the motor and set into action by another switch controlled by the aforesaid cylinder at the conclusion of the melody, which is sounded when each full hour is reached. The wheel is formed with a portion engageable by the detent to permit the wheel to turn through varying arcs corresponding with the hour which is to be struck, the wheel serving to permit the operation of a switch once upon each unit of motion to operate the hour sounding bell. Thus the wheel is permitted to have one unit of motion when it moves from its twelve o'clock position to its one o'clock position during which the hour sounding bell is struck once; two units of motion when the wheel moves from its one o'clock position to its two o'clock position whereupon the hour sounding bell is struck twice, etc., through the circle of the wheel.

I will explain my invention more fully by reference to the accompanying drawings in

which Figures 1 and 2 taken collectively with the right hand side of Fig. 1 in registry with the left hand side of Fig. 2, diagrammatically illustrate the preferred embodiment of the invention; Fig. 3 is a view in elevation of the controlling apparatus; Fig. 4 is a sectional view on line 4—4 of Fig. 3; Fig. 5 is a sectional view on line 5—5 of Fig. 4; and Fig. 6 is an end view of some of the controlling apparatus.

Like parts are indicated by similar characters of reference throughout the different figures.

I have illustrated three bells A, B, C which belong to a group of bells preferably so arranged and tuned as to produce musical intervals or melodies when set into vibration in selected order. Each of the bells is supported in any suitable manner so as to be free to vibrate, each bell illustrated being provided with a supporting bail 2 itself held in any suitable way. Each bell may be set into sound producing vibration by a hammer 5. The force with which each hammer is applied to its bell is sufficiently reflected to effect a partial withdrawal of such hammer whereby the vibrations are not dampened thereby. Each hammer is electrically operated to effect both its striking and withdrawing movements and to this end it is provided with a striking winding 6 and restoring winding 7 desirably forming component solenoids or magnets of a double magnet or compound solenoid system having a common iron core 8 to be magnetically actuated by the windings. Each striking coil 6 operates to move its core from its rearmost position when the corresponding hammer 5 is to be applied, while the restoring coil 7 operates to place such core together with its hammer in a fully restored position. Each hammer and its hammer stem 9 that couples the hammer with its solenoid core are desirably made of brass, such hammer and its stem being coupled by a pin 10 that is downwardly projected to be in actuating relation to the intermediately pivoted rocker or switch arm 11 which is in fixed relation to a circuit closing blade 12 that is oscillated to correspond to the oscillating movements of the rocker arm. This switch blade engages one contact 13 irrespective of the position occupied by this blade. When the hammer is in its restored position the switch blade also engages another contact 14 and when such hammer is

moved forwardly to a striking position the switch blade is disengaged from the contact 14 and is engaged with the contact 15, this latter contact being out of engagement with the switch blade when the switch blade has been oscillated by the hammer when moved to strike its corresponding bell. The shifting of the contact blade 12 is concurrent with the shifting of the rocker arm 11 as these two elements are desirably in fixed relation. The rocker arm is rocked in a counter-clockwise direction by the pin 10 just before the corresponding hammer strikes the corresponding bell, the rocker being brought to reverse position when the hammer is fully retracted. Each hammer, when in striking movement, closes one gap 12, 13, 15 in a master restoring circuit and in its withdrawing movement closes another gap 12, 13, 14 in a master striking circuit, these master circuits respectively including a restoring relay 16 and a striking relay 17 which are provided to relieve master switching mechanism of the duty of carrying the heavy current that energizes the coils 6 and 7 as will more fully appear. Another relay 18 is included serially in circuit with each restoring relay 16. The armature of this relay 18 has an angular extension 19 that serves, when the armature is released, to close the switch 20 that is also included in the circuit of the striking relay 17 to keep this circuit in operable condition while the hammer is withdrawn and to prevent this circuit from being operable when the restoring relay circuit is closed. Under the latter condition the armature of relay 18 is attracted and its angular extension 19 closes the switch 21 so that the restoring circuit may remain intact by way of this switch when the switch blade 12 is separated from the contact 15, a result which occurs when the corresponding hammer has been moved to strike the corresponding bell.

In order that the chimes of my invention may be operated from a commercial lighting circuit supplied from a central generator 22, I preferably employ a motor generator whose motor portion 23 is driven by current supplied from the main source 22 and whose generator portion 24 is driven by the motor 23 and constitutes the direct source of current that is to operate the striking and restoring relays and the corresponding striking and restoring windings. The motor generator 23, 24 is to be operated at predetermined intervals, usually on the quarter hours. To this end there is a time operated switch 25 operated each fifteen minutes by one of the four equidistant cams 26 upon a cam wheel 27 that is carried upon the minute shaft 28 of a clock 29. In order that the switch 25 may be of light construction to be easily operated by the clock 29 without impairing the adjustment or operation of the clock, the switch 25 performs its function of starting the motor 23 into operation through the intermediation of a relay 30 which is closed once each fifteen minutes. This relay is connected in bridge of the mains supplied by the main generator 22, the armature switch of this relay 31 serving to establish another bridge that includes the motor. The generator 24 of the motor generator is connected by means of conductors 32 and 33 with the electrical equipment of the electro-magnetically operated hammers. The conductor 32 is connected with the contacts 34 and 35 which are respectively carried upon the cores of the selected relays 16 and 17, the striking relay contact 35 having a complemental contact 36 constituting one terminal of the striking winding 6 and the contact 34 having a complemental contact 37 constituting one terminal of the restoring winding 7, these contacts being preferably formed of carbon and serving to convey the heavy current for the windings 6 and 7. Conductor 33 is connected with remaining terminals of each of the striking and restoring windings 6 and 7. One terminal of each striking relay 17 and each restoring relay 16 is, through instrumentalities to be described, adapted for connection with the same conductor 32. The remaining terminal of each striking relay and each restoring relay is adapted for connection with the same conductor 33 through the instrumentalities previously described.

As will be understood from the foregoing description, the striking and restoring relays are individually controlled by the switch blade 12 and the contacts which relate this switch to these relays. These relays are commonly controlled by the armature switch 38 of a relay 39 individual to each pair of relays 16, 17 that pertain to each bell. Whenever any relay 39 is energized its corresponding armature switch 38 is attracted to establish one contact in the corresponding conductor 40 extending to the pair of relays 16, 17 to which such relay 39 is individual, each bell A, B, C and the striking mechanism individual thereto having a relay 39 also individual thereto. The circuit thus partially established includes connected terminals of these relays 16, 17, the conductor 40, the attracted armature switch 38, a portion of the conductor 32, the generator 24 of the motor generator 23-24, and the conductor 33 which is connected with the corresponding contact 13 and the corresponding switch 21 that function as hitherto specified.

There being as many relays 39 as there are sound producing bells A, B, C, switching mechanism is employed for closing the circuits of these relays in predetermined relation in order that the bells may be sounded in predetermined order. The relay 39 which is individual to the bell A is preferably only

employed when the bell A, which is of deepest tone, is alone struck in counting the hours. The relays 39 that are individual to the other bells are to be operated in producing the selected musical intervals or melodies. The relays 39 individual to the bells B and C are provided with switches 41 individual thereto and provided for closing the circuits thereof. There are as many of these switches as there are bells B, C, etc., that are employed to produce the selected melodies each having a switch 41 individual thereto and each of these switches 41 has one or more prongs 42 individual thereto for effecting the closure thereof in predetermined order, these prongs being mounted upon a cylinder 43 much in the fashion of the prongs on the operating cylinder of a music box. The relay 39 that is individual to the hour bell A is also provided with a switch 44 that is individual thereto, this switch being controlled by a prong 45 individual thereto. The cylinder 43 is normally held from rotation by means of the wheel 46 fixed upon the shaft of this cylinder and provided with four equidistant notches 47 upon its periphery. A spring pressed arm 48 carries a detent 49 that is normally in engagement with some one of these notches. The arm 48 desirably also constitutes the armature of a relay or magnet 50 which is energized once each fifteen minutes by means of one of the four equidistant cams 51 upon a cam wheel 52 fixed upon the minute shaft 28 of the clock 29, each cam serving to close a switch 53 that is in serial relation with the winding of said relay. Whenever this relay is energized by one of the cams 51 a circuit is established therethrough which is traceable from one terminal of the generator 24 through the switch 53, the winding of the relay 50, to the remaining terminal of said generator. The switch 53 is maintained closed just long enough to permit the relay 50 to attract its armature to withdraw the detent 49 from the notch 47 engaged thereby and to start a motor 54 into operation to turn the cylinder 43 far enough so that when the relay 50 is deenergized the detent 49 will be out of register with the notch 47 previously engaged thereby so that this detent will ride upon the portion of the disk 46 in readiness to drop into the succeeding notch 47 to stop the cylinder from rotating after it has turned a quarter of a revolution. When the armature 48 is attracted by its relay 50 it also closes a circuit at 55 which is traceable from one terminal of the generator 24, through the armature 48, the contacts at 55, the winding of the magnetic clutch 56, the relay 57, to the other terminal of the generator 24. The current from this generator serves to energize the magnetic clutch winding 56 which thereupon attracts the clutch armature 58 whereby the winding 56 and said armature may rotate together and whereby the sleeve 59 upon the armature 58 is coupled with the driving shaft 60 that is driven by the motor 54 through the intermediation of the beveled pinions 61, 62, the shaft 63 carrying the beveled pinion 61, the beveled pinion 64 upon said shaft, the beveled pinion 65 meshing with the beveled pinion 64, the shaft 66 carrying the pinion 65, the worm wheel 67 upon said shaft, and the worm 68 that is upon the shaft of the motor 54. The sleeve 59 carries a worm gear 69 that meshes with a worm wheel 70 having upon the same shaft therewith a pinion 71 that is in mesh with a pinion 72 which is fixed upon the shaft of this cylinder 43. Thus whenever the clock 29 closes the switches 25 and 53 at the conclusion of each quarter hour period the motor generator 23—24 is set into operation (by the switch 25) and the relay 50 is energized (by the switch 53), the energization of the relay 50 setting the cylinder 43 into rotation to close the switches 41 in predetermined order which is required by the relative positions of the prongs 42 with the result that, at the conclusion of each quarter hour period, the bells B, C are operated in predetermined order to produce the selected melody. Each time a full hour has been measured by the clock the prong 45 comes into service in order that the deepest toned bell A may be sounded in counting hours, this being the result which is also consequent upon the energization of the relay 50 when this relay is energized at the conclusion of the fourth quarter of each hour. The prong 45 is so related to the prongs 42 that the striking of the hour by the deepest toned bell A will not commence until the melody produced by the other bells B, C, etc., has been concluded. When the prong 45 engages the switch 44 pertaining thereto a circuit is thereby closed which is traceable from one terminal of the generator 24, through the contacts of the switch 44, the winding of the magnet 73, to the remaining terminal of said generator. The magnet 73 is desirably in the form of a solenoid whose core is upwardly pressed by a spring 74, the upper end of this core being formed to constitute a detent 75 that is engageable with one of the several notches 76 provided upon the periphery of the controlling wheel 77, these notches constituting a circular row of holding formations. Whenever the solenoid 73 is energized the detent 75 is withdrawn from the notch 76 engaged thereby to release the wheel 77 to permit it to be driven by the motor 55 in a manner to be set forth. To this latter end the lower end of the core of the solenoid closes a switch 78 whenever this core is attracted to release the wheel 77 whereby a circuit is closed through the clutch winding 79

that turns with the shaft 63 so that the armature 80 is caused to turn with this shaft to drive the shaft 81 that carries this armature. The motor 54 now turns the shaft 81 through the intermediation of the shafts 66 and 63, the beveled pinions 64 and 65, and the magnetic clutch 79—80, the circuit of the motor 54 being established by the armature switch of relay 57 as hitherto set forth. The shaft 81 is placed in driving relation with the wheel 77 through the intermediation of the beveled pinion 82 upon this shaft 81, the beveled pinion 83 in mesh with the pinion 82, the shaft 82 carrying the beveled pinion 83, the worm 85 upon shaft 84, and the worm wheel 86 fixed upon and co-axial with the wheel 77. The gearing is such that the wheel 77 is turned in a clockwise direction whereby the wheel is permitted to turn until the detent 75 is pressed into the succeeding notch 76 by the spring 74, the solenoid 73 being no longer energized as the switch 44 is no longer actuated by the prong 45 pertaining thereto. In Fig. 2 the notch 76 engaged by the detent 75 was so engaged just after the clock struck 12. When the clock strikes 1 the detent 75 is withdrawn from this twelve o'clock notch, whereupon the wheel 77 turns until the detent 75 engages a succeeding notch 76 that corresponds to one o'clock. The third notch corresponds to two o'clock, the fourth notch corresponds to three o'clock, etc., around the periphery of the wheel 77, each hour being represented by a notch 76. The spacing between the notch shown to be engaged in Fig. 2 by the detent 75 and the succeeding notch is just sufficient to permit the shaft 84 to turn one revolution; that is when the wheel 77 is released at twelve o'clock it may turn sufficiently to permit the shaft 84 to turn one revolution while the wheel is being positioned to enable the detent 75 to engage the notch 76 that corresponds to one o'clock. The spacing between this one o'clock notch and the two o'clock notch is twice as long as the spacing between the twelve o'clock notch and the one o'clock notch so that the shaft 84 may turn twice while the wheel 77 is turning to bring the two o'clock notch into register with the detent. The spacing between the two o'clock notch and the three o'clock notch is three times as long as the spacing between the twelve o'clock notch and the one o'clock notch so that the shaft 84 may turn three times while the three o'clock notch is being brought into register with the detent.

The shaft 84 is caused to occasion the striking of the gong A once during each revolution of said shaft. To this end the shaft 84 carries a wiper 87 that, once in each revolution of such shaft, or once in each unit of motion (defined by the space between the twelve o'clock notch and the one

o'clock notch) of the wheel 77, engages a waiting contact 88 and as these two contacts 87 and 88 are in serial relation with the relay 39 that is individual to the deep toned bell A such bell is struck by its hammer 5 whenever the contacts 87 and 88 are engaged. When the engagement of the detent 75 is shifted from the twelve o'clock notch to the one o'clock notch the bell A sounds once, since the shaft 84 is then permitted but one revolution. When this engagement is being shifted from the one o'clock notch to the two o'clock notch the bell A is sounded twice, since the shaft 84 is then permitted just two revolutions. When this engagement is being shifted from the two o'clock notch to the three o'clock notch the bell A is sounded three times, etc. The gearing is such that each quarter revolution of the cylinder 43 is slowly effected, it being only necessary rapidly to operate the switches 41 and 44 to effect the results consequent upon such operation of these switches. The time occupied in each quarter revolution of the cylinder 43 is sufficient to allow the playing of the melody corresponding to such quarter. The melody may take the entire time required to complete the fourth quarter revolution, three quarters of the time required to complete the third quarter revolution, a half of the time required to complete the second revolution, and a quarter of the time required to complete the first quarter revolution, the switch actuating prongs upon the cylinder being so disposed as to procure these results.

While I have herein shown and particularly described the preferred embodiment of my invention I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention, but having thus described my invention I claim as new and desire to secure by Letters Patent the following:

1. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; an electro-magnet governing said detaining means; and a timing device governing the latter electro-magnet.

2. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a

switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying
 5 the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means
 10 to define the extent of each operation of the switch actuating mechanism; a motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch
 15 actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; and a timing device governing the latter electro-magnet and the switch
 20 that governs the electro-magnetic clutch.

3. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of
 25 operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; an electric
 30 motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing
 35 said detaining means; a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch; and a relay for opening and closing the motor circuit also governed by said timing
 40 device.

4. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a
 50 switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device varying numbers of times according to the extents of operation of said actuating mechanism to
 55 strike the bell in accordance with the hour being struck; and time controlled mechanism for varying the extent of operation of said actuating mechanism.

5. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a cir-
 60 cular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; and a timing device governing the latter electro-magnet.

6. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a
 80 switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; an electro-magnet governing said detaining means; and a timing device governing the latter electro-magnet.

7. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; and a timing device governing said detaining means.

8. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; and a timing device governing said detaining means.

9. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; and a timing device governing said detaining means.

10. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a

switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; and a timing device governing said detaining means.

10. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; a motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; and a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch.

11. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; an electric motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch; and a relay for opening

and closing the motor circuit also governed by said timing device.

12. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

13. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; a motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

14. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in varying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; an electric motor for operating said switch

actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch; a relay for opening and closing the motor circuit also governed by said timing device; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

15 15. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device varying numbers of times according to the extents of operation of said actuating mechanism to strike the bell in accordance with the hour being struck; time controlled mechanism for varying the extent of operation of said actuating mechanism; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

30 16. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

50 17. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating

with said formations to define the extent of each operation of the switch actuating mechanism; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

18. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with means that take part in carrying the extent of operation of such actuating mechanism to vary the number of times of operation of the switching device according to the hour which is sounded; detaining means cooperating with the aforesaid means to define the extent of each operation of the switch actuating mechanism; a timing device governing said detaining means; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

19. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; a timing device governing said detaining means; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

20. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; a timing device governing

said detaining means; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

21. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; a motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

22. The combination with a bell; of a hammer for striking the bell; electro-magnetic mechanism for operating the hammer; a switching device controlling said electro-magnetic mechanism; actuating mechanism for operating the switching device and provided with a controlling wheel having a circular row of formations with the spaces therebetween increasing to define a single unit of motion corresponding to the single hour to be struck and multiples of this unit of motion respectively corresponding with the succeeding hours to be struck; detaining means cooperating with said formations to define the extent of each operation of the switch actuating mechanism; an electric motor for operating said switch actuating mechanism; an electro-magnetic clutch through which the motor is adapted to drive said switch actuating mechanism; a switch for governing the circuit of said electro-magnetic clutch; an electro-magnet governing said detaining means; a timing device governing the latter electro-magnet and the switch that governs the electro-magnetic clutch; a relay for opening and closing the motor circuit also governed by said timing device; and a relay operated by the aforesaid switching device and serving itself to control the operation of the electro-magnetic hammer operating mechanism.

23. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; timing mechanism enabling the operation of said switch actuating means at the conclusion of fractional hour periods; a motor for driving the switch actuating means; and an electro-magnetic clutch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour period by the aforesaid timing mechanism.

24. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; electro-magnetic means enabling the operation of the actuating means; timing mechanism effecting the operation of the electro-magnetic means at the conclusion of fractional hour periods; a motor for driving the switch actuating means; and an electro-magnetic switch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour periods by the aforesaid timing mechanism.

25. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; timing mechanism enabling the operation of said switch actuating means at the conclusion of fractional hour periods; an electric motor for driving the switch actuating means; an electro-magnetic clutch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour period by the aforesaid timing mechanism; and a relay governing the motor circuit and itself also governed by said timing mechanism.

26. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the con-

clution of fractional hour periods; electro-magnetic means enabling the operation of the actuating means; timing mechanism effecting the operation of the electro-magnetic means at the conclusion of fractional hour periods; an electric motor for driving the switch actuating means; an electro-magnetic switch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour periods by the aforesaid timing mechanism; and a relay governing the motor circuit and itself also governed by said timing mechanism.

27. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; timing mechanism enabling the operation of said switch actuating means at the conclusion of fractional hour periods; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

28. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; electro-magnetic means enabling the operation of the actuating means; timing mechanism effecting the operation of the electro-magnetic means at the conclusion of fractional hour periods; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

29. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; timing mechanism enabling the operation of said switch actuating means at the conclusion of fractional hour periods; a motor for driving the switch actuating means; an electro-magnetic clutch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour period by the aforesaid timing mechanism; a relay governing the motor circuit and itself governed by said timing mechanism; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

32. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch

motor with said switch actuating means and made effective at the conclusion of said fractional hour period by the aforesaid timing mechanism; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

30. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; electro-magnetic means enabling the operation of the actuating means; timing mechanism effecting the operation of the electro-magnetic means at the conclusion of fractional hour periods; a motor for driving the switch actuating means; an electro-magnetic switch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour periods by the aforesaid timing mechanism; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

31. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch actuating means serving to operate said switches in predetermined order, this switch actuating means ceasing this function at the conclusion of fractional hour periods; timing mechanism enabling the operation of said switch actuating means at the conclusion of fractional hour periods; an electric motor for driving the switch actuating means; an electro-magnetic clutch for coupling the motor with said switch actuating means and made effective at the conclusion of said fractional hour period by the aforesaid timing mechanism; a relay governing the motor circuit and itself governed by said timing mechanism; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

32. The combination with a plurality of bells each having electro-magnetic operating mechanism; of switches individual to said bells for controlling the electro-magnetic operating mechanisms thereof; switch

actuating means serving to operate said hour periods by the aforesaid timing mechanism; a relay governing the motor circuit and itself also governed by said timing mechanism; and a relay individual to each of the aforesaid bells and the aforesaid switches and serving to control the circuits of the electro-magnetic mechanisms of the bells and themselves respectively controlled by the aforesaid switches.

10. In witness whereof I hereunto subscribe my name this fifth day of May, A. D., 1921.

FREDERICK B. LITTLE