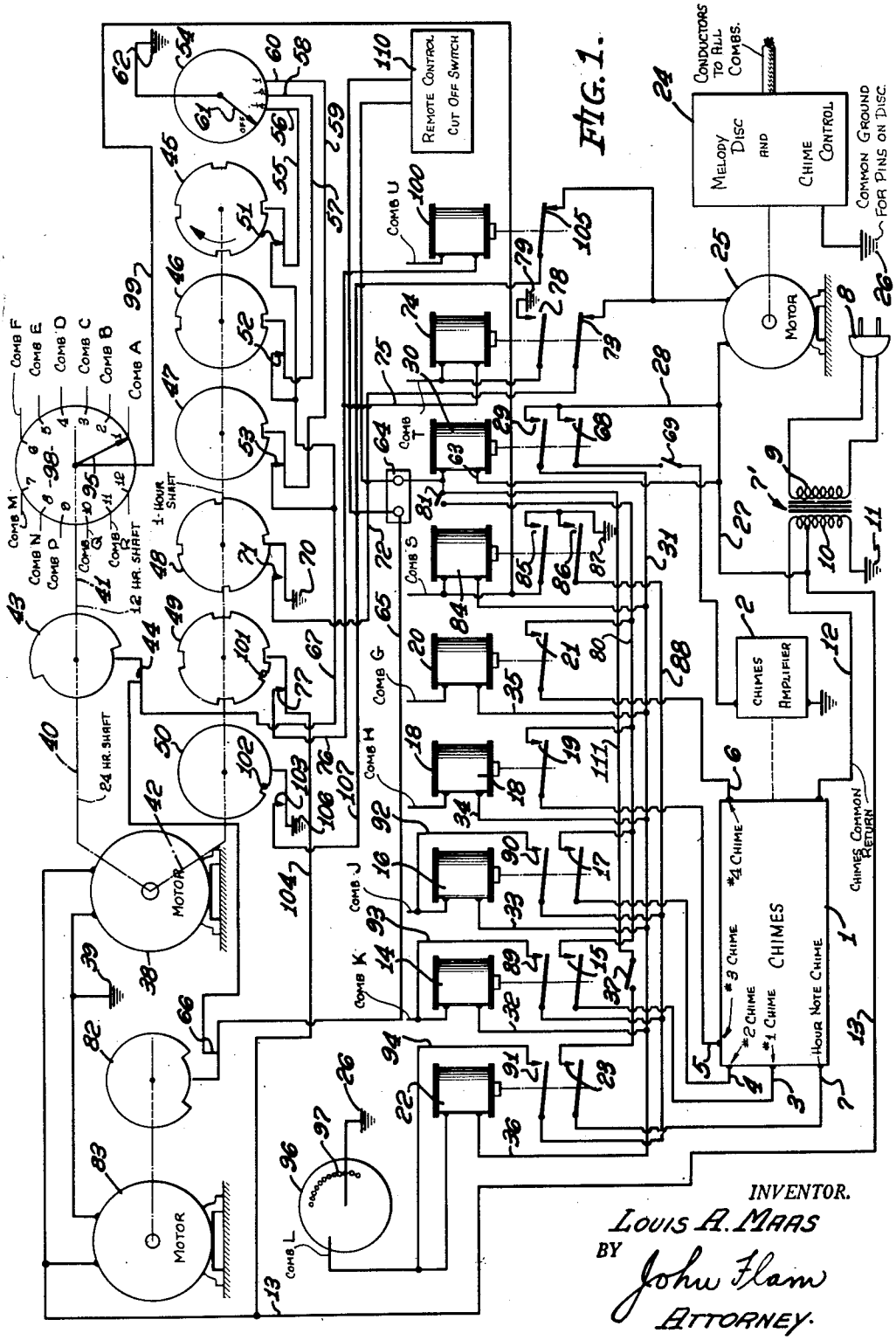
June 16, 1953 L. A. MAAS 2,641,897

CHIME CLOCK CONTROL MECHANISM

Filed Dec. 8, 1947 2 Sheets-Sheet 1



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FIG. 2.

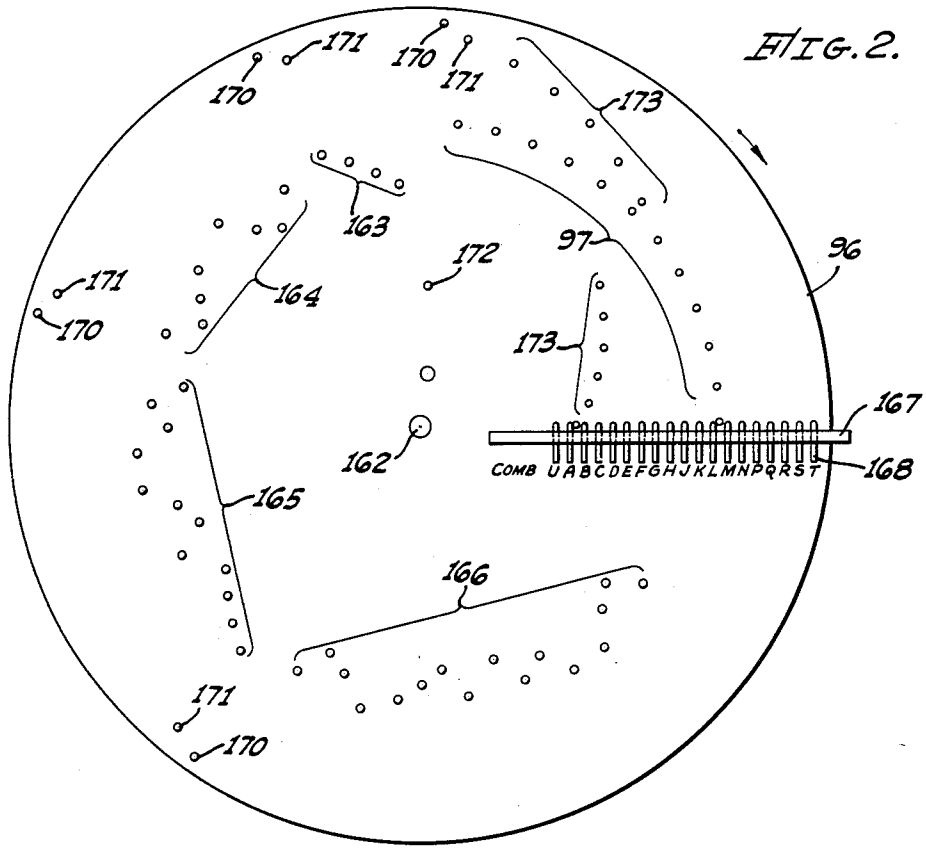
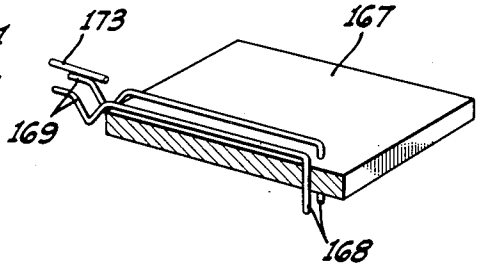


FIG. 3.



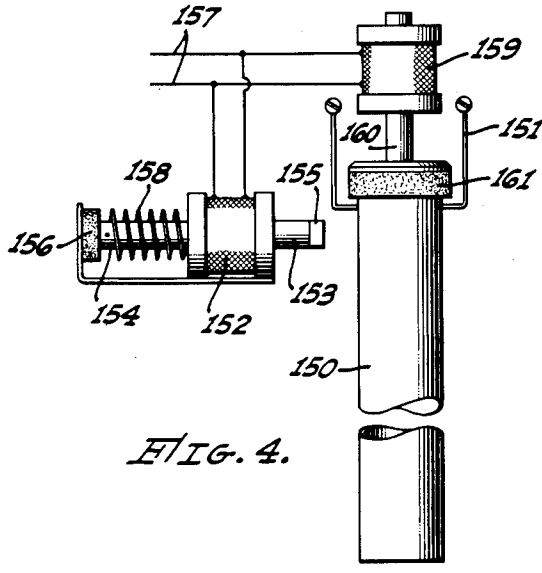


FIG. 4.

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CHIME CLOCK CONTROL MECHANISM

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Application December 8, 1947, Serial No. 790,410

21 Claims. (Cl. 58—38)

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This invention relates to a control system for an electrically actuated musical instrument which requires the initial actuating impulse to be sustained in order to sustain the tone or note sounded. Such a musical instrument usually consists of an electrically struck and electrically damped set of chimes or bells.

One of the most common melodies used for striking clocks is the "Westminster Chimes," which are usually sounded by strikers operating on bells or other musically resonant devices such as metal tubes or pipes. However, other melodies may be used. At the conclusion of the melody, an hour toll is usually made on the hour. The strikers, as commonly used, are often mechanically operated in periodic fashion, by the aid of clock-controlled mechanical elements, including gears, cams and springs. Often, such time controlled chimes are installed to produce a large volume of sound, as for churches, schools, civic buildings, or in exterior belfries. Accordingly sturdy mechanisms are essential. Such mechanically actuated devices are apt to break down or to function improperly. If such mechanical devices operate chimes or bells which are electrically damped, no means is provided to sustain the last note struck so that it can die away as an undamped chime or bell.

It is one of the objects of this invention to make it possible to avoid this disadvantage, and particularly by the aid of simple electrical controls.

It is another object of the invention to make it possible, by a simple adjustment, as by aid of an electric switch, to determine whether the chimes will be played each quarter hour, each half-hour, or each hour.

It is still another object of this invention to provide a system in which the automatic control can be entirely disconnected when desired, to keep the chimes inoperative.

It is still another object of this invention to make it possible optionally to prevent sounding of the hour strike, or playing of the melody.

It is still another object of this invention to provide electrical energy only when the melody or the hour strike is to be sounded, as by preconditioning the system just before the clock control is to function.

It is still another object of this invention to ensure against continuous supply of energy in the event the clock mechanism should be stalled during an operating interval.

In a control system of this character, a periodically operated circuit controller is used, to provide proper sequences of operation of the melody

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and the hour strike. It is another object of this invention to ensure that this circuit controller will be maintained in synchronism with the clock.

It is still another object of this invention to provide a chime control system that is simple and safe in operation, and accurate in the periods of timing.

It is another object of this invention to make it possible to sustain the last note of a melody, or of the hour strike, in electrically damped chimes or bells.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. The form will now be described in detail illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a diagram of a system incorporating the invention;

Fig. 2 is an elevation of one form of circuit controller that may be utilized in connection with the invention;

Fig. 3 is a fragmentary pictorial view, partly in section, of some of the elements of the circuit controller shown in Fig. 2; and

Fig. 4 is a diagram of one form of chime striker mechanism.

The particular features of the circuit controller shown in Figs. 2 and 3, and of the chime striker mechanism shown in Fig. 4, in themselves form no part of applicant's invention; they are merely illustrative of devices of this character.

The devices producing the musical sounds are indicated as being included in the apparatus 1 which bears the legend "chimes." The sound from these chimes may, if desired, be amplified by the aid of an amplifier system 2.

These chimes are electrically struck and electrically damped. Hence, when voltage is applied to a chime, a striker strikes the chime and, at the same time, removes the damper from the chime. The damper is prevented from damping the chime only so long as the initial voltage is applied. Hence, a chime will sound only so long as the voltage is impressed on the chime.

These chimes are electrically operated. Thus, in the apparatus 1 are included devices for producing and damping five distinct tones or musical

sounds, and one of them may also be used as an hour chime. Electrical connections to these five chimes are indicated respectively by the conductors 3, 4, 5, 6, and 7. When any of the chime operating circuits in which these conductors are placed is completed to a source of electrical energy, the chime will be struck. Upon de-energization of the corresponding circuit, the chimes or bells will be damped in the usual manner. Accordingly, to sustain a note, the circuit corresponding to the note to be sustained is kept energized for an interval.

The striker and damper mechanism may be of the character shown, for example, in Patent No. 2,434,745, issued to Paul H. Rowe. Figs. 4 and 6 of this issued patent show an electromagnet operating a striker, as well as a damper that serves to damp the vibrations of the vibratory bar as soon as the electromagnet is deenergized.

A simpler form of device that may be utilized for chime operation is illustrated in Fig. 4 hereof.

Thus, a chime bar 150 is shown as suspended by the aid of a suspension member 151. An extension 153 is provided for the core 154 of an electromagnet 152. This member 153 carries a felt cap 155 arranged, when the electromagnet is energized, to strike the chime bar 150 near its top.

In the deenergized position indicated, the left-hand end of the core 154 rests against a felt pad 156. When the electromagnet 152 is energized, by completing the circuit through the conductors 157, the core 154 is pulled rapidly toward the right to hit the bar 150 against the action of the compression spring 158. The normal position of the core 154 when it has been energized is such that the striker cap 155 is out of contact with the bar 150. But when the electromagnet 152 is first energized, the core 154 is momentarily pulled to the right beyond this equilibrium position to strike the bar 150. This mode of operation is set forth in full in said prior patent.

Simultaneously with the energizing of electromagnet 152, another electromagnet 159 is energized. These two electromagnets are supplied for this purpose in parallel from the common conductors 157.

Electromagnet 159 has a core 160 carrying at its lower end a felt damper 161. While the electromagnets 152 and 159 are deenergized, the damper 161 rests on top of the bar 150. However, when the electromagnets are simultaneously energized, the damper 16 is lifted and the chime bar 150 can vibrate and thereby sustain its note until circuit 157 is deenergized. When this happens, the damper 161 drops and the vibrations of the bar 150 terminate.

Accordingly, upon energizing the circuit 157, the chime bar 150 is struck and will continue to vibrate while the electromagnets 152 and 150 are energized. Deenergization of the circuit immediately damps the vibrations.

In order to provide an appropriately reduced electromotive force for these chime operating circuits, as well as for the other control circuits of the system, use is made of a step-down transformer T'. The primary winding 9 of this transformer is connected, as by a plug 8, to an appropriate source of alternating current electrical energy. The secondary winding 10 has one terminal grounded, as at 11. It has two taps, one tap 12 providing twenty-nine volts for the operation of the chimes. The other tap 13 provides twenty-four volts for the remainder of the control circuits.

The tap 12 forms a common return for the chime controlling circuits.

The chime operating circuit for chime No. 1 is controlled by the aid of a relay 14. When relay 14 is energized, the circuit for the chime No. 1 is completed through the front contacts 15 and conductor 3. Similarly, the circuit through conductor 4 for operating chime No. 2 is completed when relay 16 is energized, thereby closing front contacts 17. In the same manner, chime No. 3 is sounded when relay 18 is energized, closing the front contacts 19 that complete the circuit through conductor 5 for chime 3. The complete circuits for operating these chimes will be traced hereinafter. Actuation of chime 4 is effected by the aid of relay 20. When this relay is energized, the front contacts 21 close, completing the circuit through conductor 6 for this chime.

The hour toll chime is sounded when relay 22 is energized, closing the front contacts 23. These front contacts 23 complete the circuit through conductor 7 for the hour note chime. These circuits will be traced in detail hereinafter. The circuits for the relays 14, 16, 18, 20, and 22 are arranged to be completed by the aid of a melody disc, or drum, or other form of mechanism, preferably in the form of a rotary circuit controller. This rotary circuit controller apparatus is indicated generally by the rectangle 24. A small electric motor 25 is energized at the proper interval to operate the circuit controller 24. The melody disc is arranged to be rotated for a short time at prescribed fifteen-minute intervals. The disc is so arranged that an entire hour must elapse in order to rotate the disc through one complete revolution. In other words, intermittent rotation of the disc, at quarter-hour intervals, causes advancement of the disc by an average of 90° for each intermittent energization.

The disc or drum may be of the conventional type often encountered in connection with music boxes, or the like. A simple form is illustrated in Figs. 2 and 3. Here, a disc 96 is shown as mounted on the horizontal shaft 162. This disc is metallic, serving as a common ground for a number of pins which are supported on the disc. These pins are indicated generally by small circles. One group of pins 163 corresponds to the quarter hour melody; another group 164 corresponds to the half hour melody; another group 165 corresponds to the three-quarter hour melody; and still another group 166 corresponds to the melody played hourly.

The pins cooperate with combs A, B, C, D, E, F, G, H, J, K, L, M, N, P, Q, R, S, T, and U. These combs are in the form of spring conducting wires mounted on an insulation base 167 arranged generally radially of the disc 96, and in front of it. Each comb, such as comb A shown in Fig. 3, has an extension 168 by the aid of which it is anchored in the base 167. It extends beyond the bottom of the base in order to provide a means for making an electrical connection to the comb. The comb A has a free end 169 which is V-shaped, projecting beyond the front edge of the block or base 167. These free ends 169 lie in the path of the pins as disc 96 is rotated in a clockwise direction. As the pins progress past these combs, they wipe along the ends 169. Since the combs are supported at their opposite ends by the aid of the projections 168, considerable flexure is permitted during the movement of the pins past the ends 169.

Circuit controller 24 provides a common ground 26 for all of the circuit control pins mounted on the rotary circuit controller. When a pin on the melody disc 96 makes contact with a comb, that comb is grounded and a circuit is completed to perform a controlling action.

Thus, for example, when comb K, connected to one of the terminals of relay 14, contacts a pin on the melody disc during the course of its rotation, the relay 14 is energized as follows: from ground 11, secondary winding 10 of transformer 7, conductors 27 and 28, front contacts 29 of a master relay 30, conductors 31 and 32, relay 14, comb K, the pin on the melody disc, back to ground 26.

That portion of this circuit included from ground 11 to conductor 31 forms a part of the energizing circuits for all of the relays 16, 18, 20, and 22.

Thus, from conductor 31, conductors 33, 34, 35, and 36 lead respectively to one terminal of the relays 16, 18, 20, and 22. The other terminals of these relays are connected respectively to combs J, H, G, and L and, when any of the appropriate pins on the melody disc ground these combs, the melody circuits are completed through the front contacts 15, 17, 19, 21 or 23 operated by relays 14, 16, 18, 20, and 22 respectively, through circuits to be hereinafter described. In connection with the front contacts 23 of relay 22, a disconnecting switch 37 is included to render the hour note optionally ineffective. In connection with front contacts 15, 17, 19, 21 of relays 14, 16, 18, and 20 respectively, a disconnecting switch 81 is included to render the melody notes optionally ineffective.

The motor 25 for operating the melody disc mechanism 24 is operated periodically at definite times to play the melody and to strike the hour note as required. The manner in which this motor is controlled will now be set forth.

In order to provide the timing functions, a timer mechanism is provided including a clock motor 38. This clock motor 38 is arranged to be continuously driven through the following circuit: ground 11, transformer winding 10, conductor 13, motor 38, and ground 39. This motor 38 is provided with a twenty-four hour shaft 40, a twelve hour shaft 41, and an hour shaft 42. Each of these shafts carries circuit controllers for the cyclic operation of the melody disc motor 25 and other elements of the control system.

Thus, for example, the twenty-four hour shaft, rotating once in twenty-four hours, carries a cam disc 43, which rotates once in twenty-four hours. It is arranged as to cut out the chime mechanism for a period corresponding to the angular extent of the active arcuate portions of the disc. It is shown diagrammatically in the drawings as controlling contacts 44. The disc 43 may be angularly set so that these contacts 44 are engaged only during a specified period of the day.

On the hour shaft 42 are mounted a number of cam discs 45, 46, 47, 48, 49, and 50. Disc 45 has, at quarter-hour intervals, cut-out portions which permit contacts 51 to close for a period of about three minutes. Similarly, disc 46 has at half-hour intervals, cut-out portions arranged so that at half-hour intervals contacts 52 are closed for a period of about three minutes. Similarly, disc 47 has one cut-out portion permitting contacts 53 to close once in an hour for a period of about three minutes. The contacts 51, 52, and 53 are opened by the disc periphery as soon as these cut-out portions move out of contact operating position.

By the aid of a switch mechanism 54, it is possible to determine whether the melody will be sounded quarter-hourly, half-hourly, or on the hour. For this purpose, contacts 51 are connected by a conductor 55 to a contact 56. Similarly, contacts 52 are connected by conductor 57 to a contact 58. Contacts 53 are connected, as by conductor 59, to a contact 60. An adjustable arm 61, connected to ground 62, can make a connection with any one of the contact members 56, 58 or 60. This arm 61 may have an off-position, as indicated on the drawings.

When contact arm 61 engages contact 56, then disc 45 is active as a control. Similarly, when arm 61 engages contact member 58, disc 46 is active; likewise, when contact arm 61 engages contact member 60, the hour disc 47 is active.

Assuming that disc 45, corresponding to quarter-hourly playing of the melody, is active, the disc 45, at one minute prior to the time the melody is to sound, causes contacts 51 to close. This closes a circuit for a master relay 30 through the following connections: ground 11, transformer winding 10, conductor 27, conductor 63, relay 30, junction 64, conductor 65, set of contacts 66, contacts 44, conductor 67, contacts 51, contacts 56, and 61, back to ground 62. The purpose of contacts 66 will be explained hereinafter. These must be closed or otherwise the melody control is inactive.

Junction 64 provides means for rendering the melody control entirely inactive by aid of a remote control switch 110.

Since contacts 52 and 53 are in parallel with contacts 51, it is apparent that the circuit for master relay 30 will be closed at half-hour intervals when disc 46 is active, or at hour intervals when disc 47 is active.

Relay 30, being now energized, will cause closing of the front contacts 29; and, by aid of conductors 27, 28, and 31, the chime relays 14, 16, 18, 20, and 22 are energized as pins engage combs G, H, J, K, and L of the melody disc as follows: ground 11, secondary winding 10, connections 27 and 28, front contacts 29, connection 31, any one of relays 14, 16, 18, 20 or 22, the corresponding comb G, H, J, K, or L, a pin on the melody disc, to ground 26.

The group of pins 163, 164, 165, and 166, as shown in Fig. 2, are the pins that cooperate with combs G, H, J, and K, in definite pre-arranged sequence to produce the desired melody.

The corresponding chime operating circuit (as for example chime #1) is then energized as follows: ground 11, winding 10, connection 12, chime #1, connection 3, contacts 15, connection 80, chime disconnecting switch 81, junction 64, connection 65, contacts 66, 44, connection 67, one of the sets of contacts 51, 52 or 53, the corresponding connection 55, 57 or 59, the corresponding contact 56, 58 or 60, arm 61 and ground 62. Should the hour note chime relay 22 be the one that is energized, the circuit is the same except that it includes switch 37 and connection 111 instead of connection 80 and switch 81. By operation of switches 37 and 81, the sounding of the hour note or of the melody notes can be rendered ineffective.

At the same time, the master relay 30 closes another set of front contacts 68, which causes energization of the chimes amplifier 2 through a manually operated switch 69. This switch 69

may be used to connect or disconnect the chimes amplifier 2.

The motor 25, which operates the melody disc 96, has its circuit completed at quarter-hourly periods by the aid of the disc 48. The cut-out portions of this disc 48 are so arranged that, at the exact quarter-hour, a ground connection 70 is established through contacts 71; in other words, the contacts 71 close one minute after the master relay 30 is operated.

Establishment of ground 70 causes motor 25 to rotate. The circuit for the motor can be traced as follows: ground 70, contacts 71, conductor 72, back contacts 73 of a relay 74, motor 25, conductor 27, secondary winding 10, and ground 11.

This motor operates every quarter-hour even when the half-hour disc 46 or the hour disc 47 is active. However, the master relay 30 then closes only half-hourly or hourly, and the melody is not sounded except on the half-hour or hour, since only then are the front contacts 29 closed by operation of disc 46 or 47. Thus, it is assured that the melody disc will be rotated nevertheless to the proper control position for each active operation.

The back contact 73 of relay 74 is provided in order to stop the rotation of motor 25 after the melody disc reaches a definite angular position.

Accordingly, when the melody is completed, comb T, connected to one terminal of the relay 74, is grounded by the aid of a pin on the melody disc. There are four pins 170 near the periphery of the disc 96 (Fig. 2) which cooperate with the comb T to ground this comb. These pins are angularly spaced to correspond to the termination of the quarter hour melody, the half hour melody, the three quarter hour melody, and the termination of the hour toll. When any pin 170 grounds comb T, relay 74 is energized to open the contacts 73 and to stop the melody disc. The relay 74 is energized through the following circuit: common ground 26 of the melody disc mechanism 24, comb T, relay 74, connection 75, connection 76, contacts 77, conductor 104 and 13, secondary winding 10, and ground 11. Contacts 77 are completed quarter-hourly by disc 49 mounted on the hour shaft 42. This disc is provided to permit the relay 74 to operate every quarter-hour.

Just as soon as relay 74 is energized, the ground connection 26 and comb T are by-passed through the holding front contacts 78 and ground 79. Accordingly, relay 74 remains energized until contacts 77 open at the end of the operative period.

Relay 74 is energized only after the last note has been sounded, including the hour toll. Shortly after contact 70 opens by operation of disc 48, the contacts 77 open, releasing relay 74 and placing it in operative condition for the next cycle of melody disc operation.

The mode of energization of relays 14, 16, 18, 20, and 22 has already been set forth. As heretofore stated, when these relays are energized, the front contacts 15, 17, 19, 21, and 23 operate to cause actuation of the chimes in sequence as their respective combs are grounded. The complete connections for the chime operating circuits, including the front contacts of these relays, have already been set forth. Contacts 66 are operated by a safety disc 82 rotated by a timer motor 83. This disc 82 rotates once in fifteen minutes. The cut-out portion on this disc 82 is such as to maintain the main control circuits closed only for three minutes out of every fifteen minutes. This is necessary to ensure that, in the event the melody mechanism is stalled during an operative period, the supply of power to the entire system can occur only for three minutes out of every fifteen minutes. Thereby, injury to the mechanism is prevented.

The motor 83 is energized from the same source as, and is in parallel with, motor 38.

Arrangements are made to sustain the last note of the melody by locking relay 14, 16, or 22 at the conclusion of the melody playing period. This is accomplished by the aid of comb S, connected to one terminal of a note sustaining relay 84. This note sustaining relay is energized when a pin on melody disc makes contact with comb S. The pins 171 disposed around the periphery of the disc 96 (Fig. 2) cooperate with the comb S for completing the sustaining circuit. Under such circumstances, this relay is energized through the following circuit: ground 26, comb S, relay 84, connection 31, front contacts 29 of master relay 30, connections 28 and 27, transformer winding 10, and ground 11.

As soon as this circuit is completed, front contacts 85 and 86 close. Contacts 85 serve to lock the relay, since it forms a by-pass for the comb S and its pin through ground 87.

Front contacts 86 similarly serve to lock relay 14, 16 or 22, depending upon which one has been energized, through the following circuit: ground 87, contacts 86, connection 88, front contacts 89, or 90, or 91, depending upon which one of the relays 14, 16, or 22 is energized, connection 92, or 93, or 94, through relay 14, 16, or 22, common connection 31, front contacts 29 of master relay 30, connections 28, and 27, transformer winding 10, and ground 11.

The relay 22, in addition to its function of controlling a chime, is also used to produce the hour strike. The hour strike is produced on the hour, after the last note of the melody has been sounded, by appropriate spacing of pins on the melody disc. Commonly, the hour strike corresponds to the hour of the day, there being one stroke for one o'clock and a correspondingly greater number of strokes for succeeding hours.

In order that the manner in which this function is produced may be clarified, a diagrammatic illustration of the melody disc is indicated adjacent comb L by the aid of the circle 96 (see also Fig. 2). Twelve pins 97 are illustrated on the melody disc, and which are intended to cooperate with comb L so as to give ground each time one of the pins passes comb L. These twelve pins 97 are supplemental to all of the other pins that cooperate with the various combs to produce the melody, and for performing the other control functions of the melody disc.

A rotary switch arm 95 is mounted upon the twelve-hour shaft 41. This arm 95 is arranged successively to make contact with the hour contacts numbered from one to twelve on the stationary support 98. These hour contacts are intended to be spaced apart by 30° corresponding to the hourly travel of the hour hand. Each of these hour contacts, accordingly, is closed in succession on the hour. Connections from the hour contacts from one to eleven proceed to the combs numbered as illustrated in the diagram.

The twelve pins 97 contact comb L in succession. As a pin of this series makes and breaks contacts with the comb, a circuit is made and broken for the relay 22. This relay circuit is traced as follows: from ground 26, one of the

pins 97, comb L, relay 22, connections 36 and 31, front contacts 29 of master relay 30, connections 28 and 27, transformer winding 10, to ground 11.

This successive energization and deenergization of relay 22 would cause the front contacts 23 correspondingly to close and open in succession; and the hour note chime would be struck twelve times, via the connection 7. However, the circuits controlled by the switch arm 95 are so arranged that, at the hours of one to eleven, the relay 22 is maintained energized after the appropriate number of pins 97 has contacted comb L. This locking-in of the relay 22 thus causes the last hour note to be sustained.

Let us assume that the time is one o'clock. In this position, the contact arm 95, as indicated in Fig. 1, is connected to comb A. The first of the series of contact pins 173 (Fig. 2) is in contact with comb A when contact arm 95 is connected to comb A. Accordingly, the contact arm 95 is grounded by the first pin 173, as indicated in Fig. 2. The first of the pins 97 is, at the same time, in contact with comb L, and ground is given to that comb.

The first of these pins 97 causes relay 22 to be energized through the following circuit: common ground 26, the lowermost of the pins 97, comb L, relay 22, connections 36 and 31, front contacts 29 of master relay 30, connections 28 and 27, secondary winding 10, to ground 11.

Accordingly, at the hour of one o'clock, the hour note chime is struck by energization of this relay, and through a circuit including the front contacts 23 of relay 22 as hereinbefore traced.

A circuit is also completed through relay 84 at this instant (corresponding to one o'clock) as follows: from common ground 26, the first of the pins 173, comb A, contact arm 95, connection 99, relay 84, connection 31, front contacts 29 of master relay 30, connections 28 and 27, secondary winding 10, and ground 11. Just as soon as this occurs, the relay 84 is locked in energized position through its front contacts 85. The relay holding circuit may be traced from ground 87, front contacts 85, relay 84, connection 31, front contacts 29, connections 28 and 27, secondary winding 10, and ground 11. In this way, the relay 84 remains energized until the master relay 30 is deenergized at the end of the playing interval.

Relay 84 has an additional set of front contacts 86. These front contacts maintain relay 22 continuously energized through the following circuit: ground 87, front contacts 86, connection 88, front contacts 91 of relay 22, connection 94, relay 22, connection 36, front contacts 29 of master relay 30, connections 28 and 27, secondary winding 10 of transformer 7', and ground 11.

Accordingly, the hour note chime is struck once for this position of the switch arm 95; and, thereafter, the relay 22 is maintained energized until the end of the playing period. Successive contacting of pins 97 with comb L has no effect upon the chime circuits. The relay 22 being thus energized but once, only one hour note is sounded.

Now, let us assume that the hour is two o'clock. In this position, the switch arm 95 is connected to comb B. The second of the series of pins 173 is then grounded by comb B so as to provide an energizing circuit for relay 84, as hereinabove traced in connection with comb A. However, this grounding is not effective until the second of the pins 97 has arrived at comb L. In other words, the relay 22 was energized and deenergized by the passage of the first pin 97, and it was again energized when the second of the pins 97 reaches the comb L. At this second stroke of the hour chime, the relays 84 and 22 are locked in energized position, and no further sounding of the hour note can take place.

At three o'clock, the third of the pins 173 is in contact with comb C, and the third of the pins 97 is in contact with comb L. In that position, corresponding to the movement of the third pin 97 into contact with comb L, the arm 95 completes the holding circuit for the relay 84.

This proceeds continuously except that, at the hour of twelve, the relay 22 is locked after all twelve pins 97 are effective to toll the hour, by aid of a melody disc pin 171 that contacts comb S, causing energization of relay 84.

It is essential that the melody disc 96 be kept in synchronism with the hour shaft 42. In this way, the melody will be played and the tolling of the hour will be consistent with the movement of the hour shaft 42.

For this purpose use is made of a synchronizing circuit effective once an hour preliminarily to the energization of master relay 30. The cam discs 49 and 50 are arranged for this synchronizing function, as well as a relay 100 shown at the extreme right of the diagram.

Both the discs 49 and 50 are provided with cut-out portions 101 and 102. Cut-out portion 101 is arranged to permit contacts 77 to close six minutes before the hour and to open three minutes before the hour. In this way, this cut-out portion does not interfere with the operation of the other cut-out portions on this disc.

The cut-out portion 102 on disc 50 is arranged to cause closing of the contacts 103 shortly after contacts 77 close, that is, at about five and one-half minutes before the hour. This cut-out portion 102 opens the contacts 103 at three and one-half minutes before the hour.

At the end of a complete revolution of the melody disc mechanism 24, a pin 172 on the melody disc is at the proper position to ground comb U, provided the disc is in synchronism. Nothing happens, however, until contacts 77 engage at each hour period. This causes energization of the relay 100 once each hour, through the following circuit: common ground 26, comb U, relay 100, connection 76, contacts 77, connection 104, connection 13, secondary winding 10, and ground 11. If the melody disc is in synchronism at the end of an hour period, the pin 172 on the melody disc and comb U serves to complete this circuit, and relay 100 is energized, at six minutes before the hour, when disc 49 permits contacts 77 to close. Under such circumstances, the relay 100 is energized, and its back contacts 105 are opened.

However, if the disc is not in synchronism, this circuit is open at comb U, even after contacts 77 close. A half-minute later, when contacts 103 are engaged, the motor 25 of the melody disc apparatus 24 is energized through the following circuit: ground 106, contacts 103, connection 107, back contacts 105, motor 25, connection 27, secondary winding 10, to ground 11. The melody disc is then rotated until comb U is contacted by the pin on the melody disc. When this occurs, the relay 100 is energized as hereinabove set forth, and the motor circuit is opened at back contacts 105.

This synchronizing function, of course, is completed about three minutes before the hour so as not to interfere with the succeeding playing of the melody and the tolling of the hour. This is

accomplished by making the cut-out portions 101 and 102 of appropriate angular extent.

The complete cycle of operations may now be set forth. When the mechanism is to function, one or the other of a set of contacts 51, 52, and 53 is engaged, by operation of the disc 45, 46, or 47; as well as the contacts 77 associated with the melody rotor disc 49. Then the master relay 30 is energized through ground 62, switching mechanism 54, contacts 44 and 66, relay 30, and conductor 63.

The front contacts 29 of master relay 30 then makes appropriate connections to control relays 14, 16, 18, 20, and 22 which are to be operated by the rotation of the melody disc. The melody disc at this time is still stationary. However, exactly on the quarter-hour, contacts 71 are permitted to close by movement of disc 48. This starts the melody disc through energization of motor 25 through ground 70, contacts 71, connection 72, back contacts 73, motor 25, and connection 27. The melody disc then gives appropriate ground in the proper desired sequence to combs G, H, J, K, and L, playing the melody, on the quarter, half and three-quarter hour. At the conclusion of the melody, comb S, associated with relay 84, is grounded and the last note is sustained. Now, on the hour after the hour melody is played, the hour chime becomes effective by giving ground to comb L in succession, corresponding to the hour as determined by the position of arm 95. After this is accomplished, comb T of relay 74 is given ground, and this relay is energized to stop the rotation of the melody disc by opening of contacts 73. This relay locks itself in energized position by front contacts 78. Relay 74 remains closed until after the disc 49 causes opening of contacts 77, and any one of discs 45, 46, and 47 causes opening of one of the sets of contacts associated with the discs to de-energize the master relay 30.

The system is now ready for the next cycle of operation.

The inventor claims:

1. In a chime control system: a series of circuits, each of which includes an electrically operated circuit controller, said circuit controller being operable in proper sequence to energize said circuits in said sequence to actuate chimes for producing a melody; a master circuit controller controlling all of said circuits; a timing device for periodically energizing said master circuit controller; and means operated by the timing device for completing the energizing circuits of said series of circuit controllers in a desired order.

2. In a chime control system: a timer; an hour note controller having a contact carrying member moved by the timer; a series of circuits closed by said member in succession at hourly intervals; means for transmitting a succession of electrical impulses on the hour; and means limiting the number of effective impulses in accordance with the position of the contact carrying member.

3. In a chime control system: a plurality of chime members; a timer; an hour note controller having a contact carrying member moved by the timer; a series of circuits closed by said member in succession at hourly intervals; a progressively movable switching device having provisions for hourly transmitting twelve impulses in succession; a relay circuit energized by said impulses for causing a chime member to be sounded whenever the relay in the relay circuit is energized; and means operated by said contact carrying member to determine the number of energizations of the relay.

4. In a chime control system: a timer; an hour note controller having a contact carrying member moved by the timer; a series of circuits closed by said member in succession at hourly intervals; a rotary circuit controller for transmitting a series of impulses, said series being repeated at hourly intervals; and means operated by the contact carrying member to limit the number of effective impulses of the series.

5. In a chime control system: a timer; an hour note controller having a contact carrying member moved by the timer; a series of circuits closed by said member in succession at hourly intervals; a rotary circuit controller for transmitting a series of impulses, said series being repeated at hourly intervals; and means operated by the contact carrying member to limit the number of effective impulses of the series, comprising a relay adapted to be energized and deenergized in accordance with said series of impulses; and a circuit for maintaining said relay energized by said contact carrying member.

6. In a chime control system: a rotary circuit controller; a chime actuating mechanism; a circuit controlled by said controller for energizing said mechanism through said controller, said controller having spaced contacts for producing the desired succession of musical sounds; a timer for periodically moving said circuit controller; and means periodically operated by said timer just prior to an active period of the circuit controller for moving the circuit controller to a position in synchronism with the timer.

7. In a chime control system: a rotary circuit controller; a chime actuating mechanism; an energizing circuit for operating said mechanism and controlled by said controller, said controller having spaced contacts for producing the desired succession of musical sounds; a timer for periodically moving said circuit controller; and means periodically operated by said timer just prior to an active period of the circuit controller for ensuring that the circuit controller position is in synchronism with the timer, comprising a circuit for controlling movement of the circuit controller; and a synchronizing circuit having a pair of sets of contacts in series that must both be closed to prevent energization of said movement controlling circuit, one of said sets being operated by the timer prior to the normal actuation of the rotary circuit controller, and the other set being operated by the rotary controller only when the rotary controller is in synchronized position.

8. In a chime control system: a rotary circuit controller; a chime actuating mechanism energizing circuit for operating said mechanism and controlled by said controller, said controller having spaced contacts for producing the desired succession of musical sounds; a timer for periodically operating said circuit controller; and means periodically operated by said timer just prior to an active period of the circuit controller for ensuring that the circuit controller position is in synchronism with the timer, comprising a synchronizing circuit that controls movement of the circuit controller, and including a pair of sets of contacts in series with said synchronizing circuit that must both be closed to prevent energization of said movement controlling circuit, one of said sets being operated by the timer prior to the normal actuation of the rotary circuit controller, and the other set being operated by the rotary controller only when the rotary controller is in synchronized position; and another set of contacts operated by the timer just before the normal ac-

tuation of the rotary controller for energizing the circuit that operates the rotary controller for causing rotation of said rotary controller until both of said pair of sets of contacts close.

9. In a chime control system: chimes having electrically energized strikers; circuits for said strikers; a rotary circuit controller for operating the strikers circuits; a timer; a circuit for operating the rotary controller, said circuit having contacts that are operated to active position for a limited period by the timer to start movement of the rotary controller; and means actuated by the rotary controller for stopping movement thereof upon completion of a cycle of operation.

10. In a chime control system: chimes having electrically energized strikers; one of said chimes being operable for an hour strike; circuits for said strikers; a rotary circuit controller for operating the striker circuits; a timer; a circuit for operating the rotary controller; said circuit having contacts that are operated to active position for a limited period by the timer to start movement of the rotary controller; said rotary controller having contact means operating the striker circuits; a relay operated by the rotary controller to energize the hour strike for sustaining the last note of the melody; and means actuated by the rotary controller for deenergizing the circuit that operates the controller for stopping movement thereof upon completion of a cycle of operations.

11. In a musical instrument control mechanism for striking tones: a first circuit including electrically operated means for striking a tone when energized and for stopping the tone when deenergized; movable circuit control means for energizing said circuit; a second circuit including means for maintaining said first circuit energized for an interval; and a circuit controller operated by movement of said control means sequentially to energize said second circuit after the first circuit is energized.

12. In a musical instrument control mechanism for striking tones: a first circuit; movable control means for cyclically energizing said circuit; said first circuit including means causing the tone to be struck when the first circuit is energized and to be stopped when the circuit is deenergized; a second circuit for maintaining said first circuit energized for an interval when the last tone is sounded; and a circuit controller operated by movement of said control means sequentially to energize said circuit after the first circuit is energized.

13. In a musical instrument control mechanism for striking tones: a circuit including a tone-producing means which, when energized, produces a tone, and which, when deenergized, stops the sounding of the tone; a movable circuit controller including a first series of contacts for successively energizing and deenergizing said circuit; another circuit controller having a second series of contacts; said other circuit controller having an adjustable contact member for contacting any one of said second series of contacts; and a tone sustaining circuit energized through said contact member and any one of said second series for independently energizing said first mentioned circuit.

14. In a musical instrument control mechanism for striking tones: a rotary controller; motor means for intermittently advancing said controller; a first circuit including an electrically operated tone sounding mechanism controlled by said controller; and means for causing the controller to assume an initial starting position after a complete cycle of operations of the rotary controller, comprising a second circuit for energizing the motor means; a circuit controller in said second circuit, and operative for an interval in advance of a new cycle of operation for energizing the motor means; and means interrupting said second circuit upon arrival of the rotary controller to said initial starting position.

15. In a musical instrument control mechanism for striking tones: a rotary controller; motor means for intermittently advancing said controller; a first circuit including an electrically operated tone sounding mechanism controlled by said controller; a constant speed mechanism for periodically energizing said motor means; and means for causing the controller to assume an initial starting position after a complete cycle of operations of the rotary controller, comprising a second circuit for energizing the motor means; a circuit controller in said second circuit and operated by said constant speed mechanism for energizing said second circuit for an interval in advance of a new cycle of operation; and means interrupting said second circuit upon arrival of the controller to said initial starting position.

16. In an electrically operated musical instrument of the type in which a series of tones, including an hour tone, may be sounded by energization of appropriate operating circuits including electrically operated tone-producers, by aid of a movable circuit controller for said circuits, and in which deenergization of an operating circuit causes the tone to be damped, the combination therewith of: a series of contacts carried by said circuit controller; a relay energized by said series of contacts for successively sounding the hour tone; and means limiting the number of hour tones to be sounded and for sustaining the last hour tone sounded, comprising a sustaining circuit for the relay; and a rotary member active at each hour to complete the sustaining circuit.

17. In an electrically operated musical instrument of the type in which a series of tones may be sounded by energization of appropriate operating circuits including electrically operated tone-producers, by aid of a circuit controller having a motor for moving the controller, said controller having a plurality of sets of contacts for controlling said circuits, the sets being successively operative, the contacts in each set being operated through a cycle; the combination therewith of: a constant speed mechanism for periodically energizing the motor; a circuit controller operated by the motor for deenergizing the motor upon completion of a cycle; and a plurality of constant speed contact mechanisms for independently rendering the operating circuits effective; said contact mechanisms progressively controlling said operating circuits at longer intervals, the shortest interval mechanism corresponding to the period between motor energizations.

18. In an electrically operated musical instrument of the type in which a series of tones may be sounded by energization of appropriate operating circuits including electrically operated tone-producers, by aid of a circuit controller for said circuits, and having a motor for moving the controller, said controller having four sets of contacts successively operative as the controller is moved; the combination therewith of: a constant speed mechanism for energizing the motor once each quarter-hour for a playing in-

terval; a second energizing circuit including a circuit controller operated by the motor for de-energizing the motor upon completion of a cycle corresponding to a set of contacts; and a plurality of constant speed contact mechanisms, respectively operative each quarter-hour, each half-hour, and each hour, for independently rendering the operating circuits effective.

19. In an electrically operated hour toll system: an hour chime; electric means for striking the chime; a relay having contacts for energizing said electric means; a circuit for energizing said relay; means forming a series of contacts and a cooperating contact relatively movable with respect to the series of contacts to make and break the relay energizing circuit a number of times corresponding to the number of contacts in the series; means causing said relative movement at hourly intervals; and independent means for maintaining the relay circuit energized, comprising: a constant speed device; a switch arm actuated by the device; a second series of contacts successively engaged by the arm in substantially hourly intervals; and a circuit for energizing said relay completed by the switch arm and any of the second series of contacts, the said second series of contacts being so spaced that they maintain the relay energized after the chime has been struck as often as required to correspond to the hour position of the switch arm.

20. In an electrically operated clock chime apparatus: a constant speed mechanism; contacts periodically closed for an interval by said mechanism; a master relay having front contacts and energized when said contacts are closed; electrically energized chime strikers; energizing circuits respectively for said strikers and controlled by said periodically closed contacts; and relays respectively for the striker circuits, each striker relay having front contacts for controlling the striker circuits; and an energizing circuit for each of said striker relays, including a pair of front contacts of said master relay, a motor-driven circuit controller, and means operated by the constant speed mechanism for periodically energizing the motor for a period corresponding to the closing of the contacts that control the striker circuits.

21. In an electrically operated clock chime apparatus: electrically energized chime strikers; energizing circuits respectively for said chime strikers; relays respectively controlling said circuits; a periodically actuated circuit controller for energizing said relays in a desired sequence; and means for maintaining at least one of said relays energized beyond the period effected by the circuit controller, comprising an energizing circuit for the relay independent of the circuit controller, and including a pair of contacts, a sustain note relay closing the contacts when energized, and means cooperating with the circuit controller for energizing said sustain note relay.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
760,895	Mayer	May 24, 1904
1,398,972	Little	Dec. 6, 1921
1,783,375	Butler	Dec. 2, 1930
1,924,395	Bossard	Aug. 29, 1933
1,958,053	Little	May 8, 1934
1,983,236	Little	Dec. 4, 1934
2,177,515	Bossard	Oct. 24, 1939
2,250,919	Skelly	July 29, 1941