May 7, 1957 J. T. KUNZ 2,791,146

CHIME STRIKER

Filed May 17, 1954 3 Sheets-Sheet 1

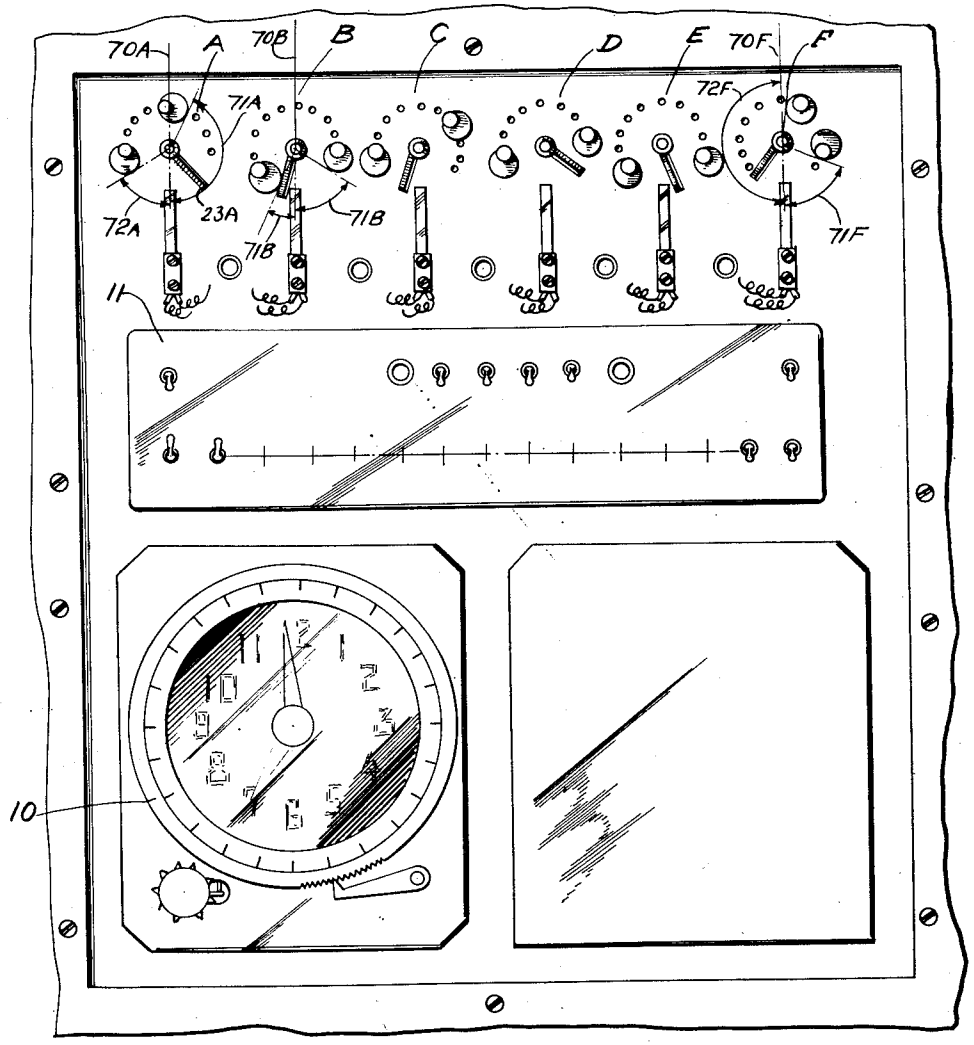


Fig. 1.

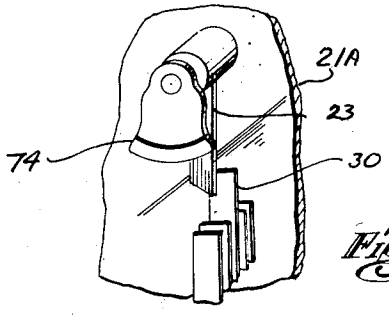


Fig. 6.

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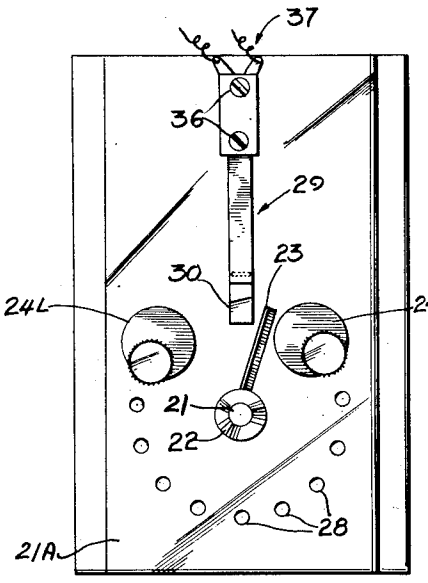


Fig. 2.

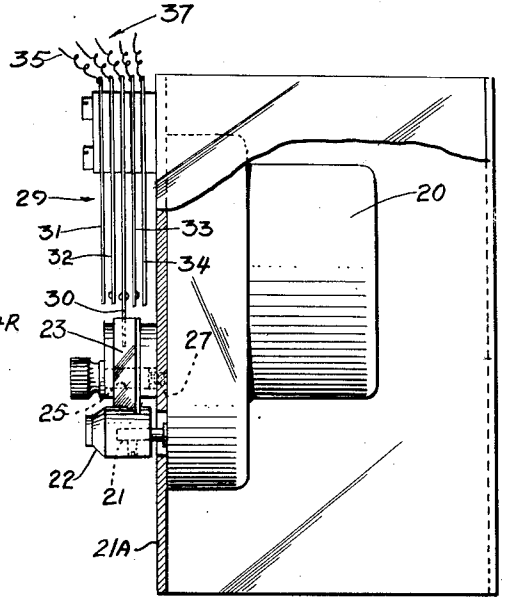


Fig. 3.

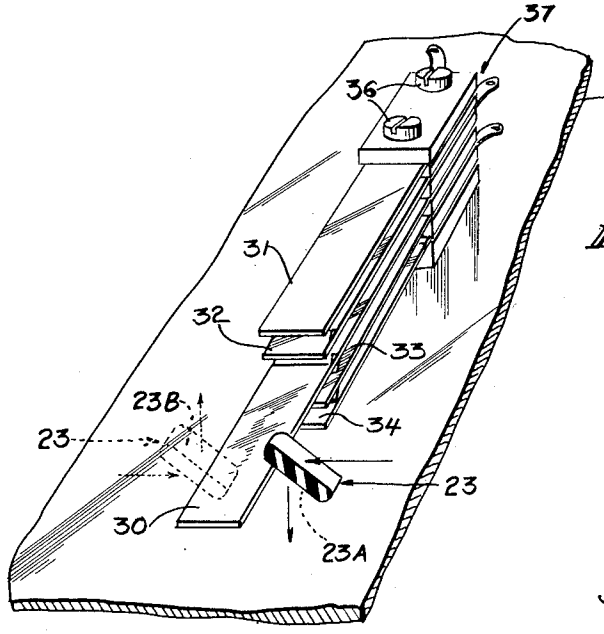


Fig. 4.

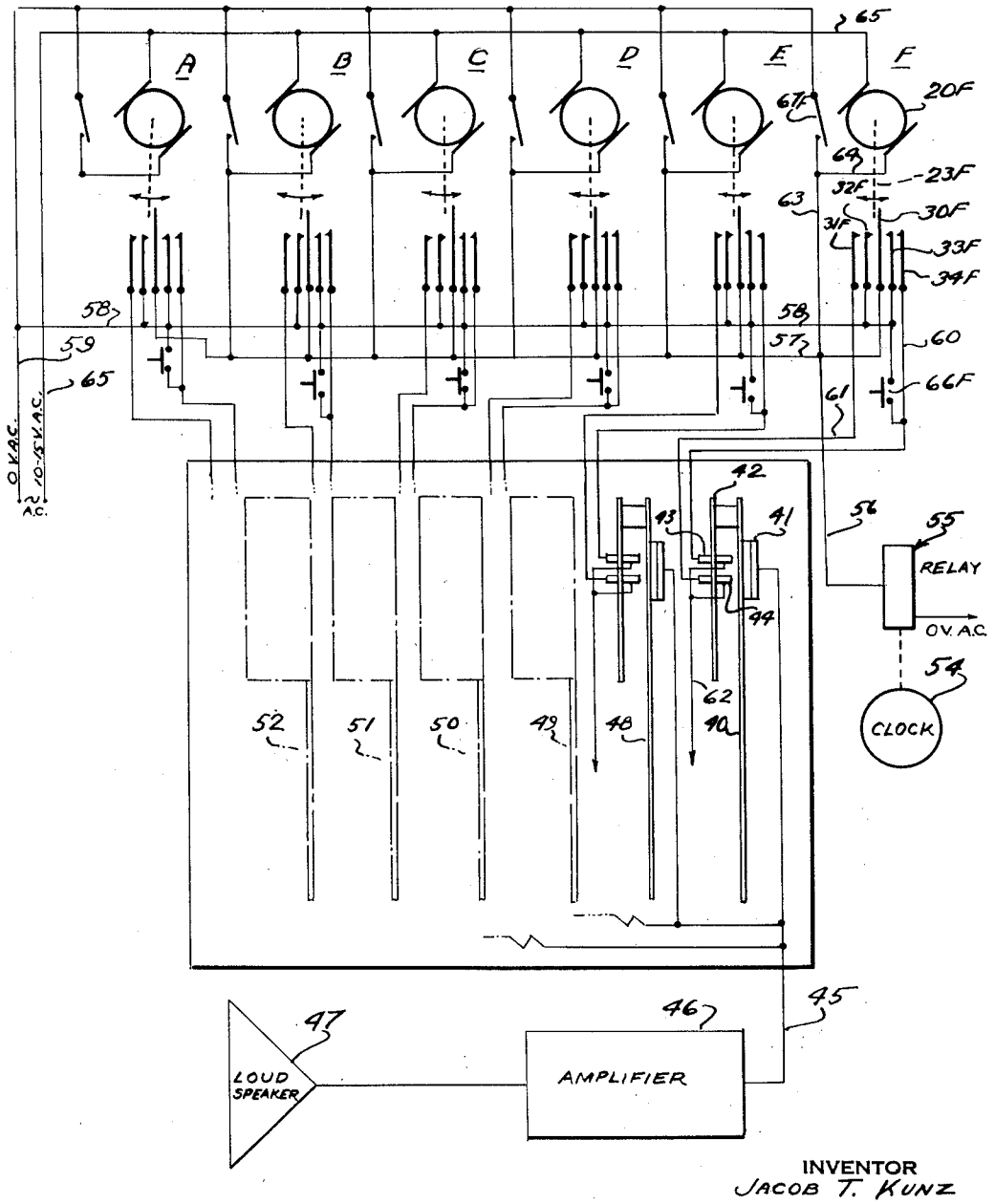
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Fig. 5.



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Application May 17, 1954, Serial No. 430,343

11 Claims. (Cl. 84—405)

This invention relates to electronic bell instruments and particularly to instruments including means for producing bell rings or a succession of bell tones.

Frequently it is desirable to ring a group of bells at variable intervals relative to each other, such being known as a bell peal. It also is desirable to ring them in this manner either as a tolling bell or as a swinging bell. A tolling bell is one which is struck slowly. When the campaniform type of bell is rung as a swinging bell, the tone and volume when the open mouth is toward the listener will be different than when the open mouth is away from the listener. A swinging bell effect can be produced by hitting the bell twice, once with a hard strike and once with a soft strike.

Various means can be employed for producing electronic bell tones, an example thereof being illustrated in applicant's Patent 2,582,441. In said patent, a bar or rod is set into vibration and then the vibrations are picked up electrically, amplified, and then reproduced by a loudspeaker to produce the bell tone or tones as desired. The vibrations generated in the vibrating element can be suitably amplified in the amplifier circuit in various manners so as to obtain the desired partials in their proper strength, relationship and direction to correctly reproduce in the speaker the desired bell tones. One manner of producing a swinging bell tone in such an instrument is to use two strikers which are spaced relative to each other so as to strike the rod at spaced points. When the spaced strikers are alternately operated, a swinging bell effect will be produced.

One of the objects of the invention is to provide a device for ringing one bell in a swinging or tolling effect, the interval between strikes being adjustable.

Another of the objects of the present invention is to provide improved devices for ringing a plurality of bells at varying intervals, the overall rate of oscillation being variable and the rate between different impulses being changeable.

In one aspect of the invention, a bell playing device including a reversing motor can be employed to actuate a switch operating arm, the switch operating arm energizing one circuit when moving in one direction and a second circuit when moving in the other direction. The arm is arranged to be stopped by abutments which are adjustable in arc length and in position relative to a central axis, the motor being reversed when it reaches an abutment so as to oscillate. In this manner, the interval between strikes is adjustable and the interval between each pair of strikes in a swinging effect is adjustable. When it is desired to employ the invention to produce a bell peal wherein more than one bell is to be operated, a plurality of the aforesaid bell playing devices may be used, each being connected to different bell tone producing arrangements.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings, which are merely exemplary.

In the drawings:

Fig. 1 is a fragmentary front view of an instrument containing the present invention.

Fig. 2 is a fragmentary view of one of the switch operating elements.

Fig. 3 is a side view of Fig. 2.

Fig. 4 is a detailed, enlarged, perspective view of the switch element of Figs. 2 and 3.

Fig. 5 is a wiring diagram showing one form of the invention.

Fig. 6 is a fragmentary view of a bell playing device with an indicator thereon.

Referring to Fig. 1, the instrument generally may comprise a time clock arrangement **10** having suitable means thereon for starting a coder mechanism as described in copending application Serial No. 193,401, filed November 1, 1950, now Patent No. 2,708,337, for actuating the various circuits to produce hour strikes, Westminster chimes, Angelus strikes, Mass bell strikes, and other desired combinations.

The bell playing devices for producing a bell peal effect are indicated generally at A, B, C, D, E, F. One or more bell playing devices can be used. The switches shown on panel **11** can be provided as desired for use in the instrument for operating the same in various manners. Each of the bell playing devices can have its switch mechanism suitably connected to a vibrator activator for producing its tone.

Describing in detail one of the bell peal playing devices, a motor **20** is seen in Figs. 2 and 3 mounted on plate **21A**, motor **20** being a synchronous motor such as the type illustrated in U. S. Patent 2,436,231 and known as a "Cramer" or synchronous motor. The motor is arranged so that when stopped as it oscillates in one direction, upon the next reversed wave of alternating current, it will start to move in the opposite direction until it is again stopped. Thus, an oscillating action will result. Motor shaft **21** may have a knob **22** thereon, said knob having a switch operating extension **23** extending therefrom. The switch operating extension is angularly disposed relative to a vertical plane passing through the axis of the motor shaft **21** for the reason which will appear hereafter.

Stop means or discs **24L** and **24R** are in the form of circular discs having eccentrically located apertures **25** therethrough for receiving a holding screw **26**, said screw having a threaded extension **27** which can be threaded into any one of the chosen threaded apertures **28** in plate **21**. Due to the eccentricity of aperture **25**, disc **24** can be turned about the axis of hole **25** to vary the distance the extension **23** must move before being stopped. Also, by selecting the particular aperture **28** in which the holding screw **26** is placed, the extent of rotation of the switch operator **23** can be further adjusted. Further, the position of each stop disc can be varied either side of the axis of operation **23** as will be described hereafter. The adjustment of the rate of striking between successive strikes in a tolling effect or between alternate strikes in a swinging effect is infinite between a maximum time approaching twice the speed of the motor as one limit and a minimum time determined by the mechanical size or width of the operator **23** and extension **30**. As an example, in a tolling bell strike, if an 8 R. P. M. motor is used, the rate can be infinitely varied between one strike approximately every 1.2 seconds to one strike approximately every 15 seconds.

The stop discs **24L** and **24R** can be placed symmetrically or can be placed asymmetrically so as to adjust the relationship in which extension **30** contacts and operates switch operator **23**. In Fig. 4, switch operator **23** is shown as a broken element to the right of the switch **29** as it moves toward the left. It is shown in dotted lines

to the left of the switch extension 30 as it is moving to the right. Switch blades 31, 32, 33, 34 and the switch extension 30 are mounted on block 35 by means of screws 36, 36. Connector elements 37 can have leads soldered thereto so as to provide suitable connections to the various circuits. As the switch operator 23 in Fig. 4 moves counterclockwise, the lower surface 23A thereof will strike the extension 30 and move the extension 30 downwardly as the operator passes thereover, thereby closing blades 30, 33 and 34. When the switch operator 23 reaches the left hand disc 24B, it will be stopped and upon the next alternating cycle will reverse, so that switch operator 23 will start a clockwise movement. This is illustrated in dotted lines in Fig. 4. As the upper face 23B of the switch operator 23 reaches the switch extension 30, it will move the same upward and close 30 and in turn 32 and 31.

As an example of the manner in which the devices can be adjusted, reference can be made to device A in Fig. 1 wherein line 70A is the axis of the switch and the operator 23A will move an angle 71A on one side thereof and a much lesser angle 72A on the other side. The other devices are shown in varying adjustments and it can be seen that the overall rate of oscillation of each can be varied which will progressively change the relationships between impulses of the various devices. Thus, in a swinging bell effect, the interval between the first and second strike can be varied by changing the arc 71A, and the interval between the first and third strike can be varied, if 71A is not changed, by varying 72A, this relation being fixed until readjusted.

Describing the circuit arrangements in Fig. 5 for one of the bell peal playing devices, reference may be made to F, wherein the parts will be given the corresponding numbers to those described for Figs. 2 and 3 with an appropriate suffix, such as F in the F bell peal device. The other devices operate in a similar manner. Motor 20F is connected to switch operator 23F illustrated in dotted lines, said switch operator cooperating with the extension 30F. For example, if 23F is moving to the right or counterclockwise in Fig. 5, it will contact 30F and move it to the right, closing it first against switch blade 33F and then in turn closing switch blade 34F therewith.

The bell tone producing arrangements operated by device F will be described, such being schematically illustrated. Vibrator 40 may be a fixed-free rod having a collector plate 41 adjacent thereto, the rod being suitably mounted on a base 42, as described, for example, in Patent 2,582,244. The strikers 43 and 44 may have solenoids which upon energization will cause a striker element associated therewith to strike vibrator 40. Striker 43 is the high or hard tone striker and 44 is the soft or low tone striker. The collector plate is suitably polarized and connected to amplifier 46. Vibrations are picked up electrically and amplified in 46 where they are suitably modified and used to actuate the electro-mechanical transducer or loudspeaker 47. The other bell tone rods 48, 49, 50, 51 and 52 are connected to their respective bell peal operating devices, the tone of each rod or vibrator being chosen as needed to produce the desired melody or tones. It is to be understood that other forms of tone producing means can be used, such as tubular chimes or free-free rods. A clock or other arrangement 54 can be used to operate suitable relays 55 for energizing the various bell peal mechanisms. As a specific manner of operation line 56 may be connected by the relays to zero volts A. C., line 56 being connected by line 57 to extension 30 F. Line 56 also is connected to motor 20F through line 63 and 64, the other side of motor 20F being connected to line 65 which in turn is connected to the "hot" side of the alternating current source, for example, 10–15 volts A. C. Thus, upon energization of lines 56, motor 20F is actuated, the motor oscillating to operate switch extension 30F in the manner described for Figs. 2 and 3. The other motors also will be operated. It is possible, however, to arrange to operate various motors as desired.

Blade 33F also is connected through line 58 with line 59, which is maintained at zero volts A. C. Upon closure of 33F and 34F by extension 30F being moved by operator 23F, zero volts A. C. will be connected to line 60 which in turn is connected to the high tone striker mechanism 43, the other side of the high tone striker mechanism 43 being connected by line 62 to the hot side of the alternating current source. As mentioned, this may be 10–15 volts A. C.

As the motor 20F reverses and operator 23F strikes extension 30F moving it in the opposite direction in the manner described for Figs. 2 and 3, switch blades 32F and 31F will be closed so as to complete a circuit through line 58, which is at zero volts A. C., line 61 with the low tone striker 44 so as to produce a low tone strike.

Thus, as the switches on either side are alternately closed there will be an alternate high and low bell tone produced which will produce a swinging bell effect.

In the event the clock turns off the relay means and thus deenergizes motor 20F, such normally being energized through line 56, line 63 and 64, which is 10–15 volts A. C., motor 20F would stop with the possibility that 31F and 32F or 33F and 34F might be closed which would leave a striker in energized condition. In order to prevent this, extension 30F, unless in a central position will still be at least in contact with 32F or 33F. By central position is ment a position where 30F is not in contact with 32F or 33F and therefore 31F will not be contacting 32F and 33F will not be contacting 34F. Then, due to the connection from line 58 to 31F and 32F, zero volts A. C. will be connected through one of these blades to the extension 30F which in turn is connected through lies 57, 63 and 64 to motor 20F so that motor 20F will continue to operate until extension 30F moves to said central position and both strikers are deenergized. By this means, deenergization of the strikers will be assured whenever the relay means 55 opens or moves to inactive position, there being no chance of the switch operator 23F stopping in a position where blades 31F and 32F are in contact or where blades 33F and 34F are in contact.

In order to individually operate any of the bells, push buttons, such as 66F, can be operated to bridge switch blades 33F and 34F and thus produce manual operation of striker 43. Also, switch 67F can be closed manually so as to cause operation of motor 20F and a continuous operation of the particular bell tone producing apparatus. If desired, switch connections (not shown) can be furnished to disconnect either the high tone or low tone strikers to produce a tolling bell effect.

The other bell peal operating mechanism may be operated in a similar manner to that described for F. A bell shape 74 (Fig. 6) can be attached to each of the knobs 22 of the motor shafts so that they will indicate the relation of the various bell operators and thus facilitate adjustment thereof to produce a particular arrangement.

It should be apparent that various details of construction can be changed without departing from the spirit of the invention as defined in the appended claims.

What is claimed:

1. In a program controlling switching circuit for producing a series of pairs of impulses, the combination comprising means actuated by said impulses, electrical circuits connected to said actuated means for producing signals each time activated, circuit activating means producing a series of pairs of signals, and means for both adjusting the interval between impulses of a pair and for adjusting the interval between a pair of impulses.

2. In a switching circuit for producing pairs of signals, the combination comprising signal producing means, electrical circuits connected to said producing means for producing signals therefrom each time activated, an oscillatable motor having a switch operator, a switch means operable by said operator for activating said circuits,

means for activating said circuits, and adjustable stop means limiting rotation of said motor in each direction, said stop means being adjustable in relation to said switch means, said motor being reversed each time stopped by said stop means.

3. In a switching circuit for producing pairs of signals, the combination comprising bell tone producing means, electrical circuits connected to said producing means for producing signals therefrom each time activated, an oscillatable motor having a switch operator, a switch means operable by said operator for activating said circuits, and adjustable stop means limiting rotation of said motor in each direction, said stop means being adjustable in relation to said switch means, said stop means comprising eccentrically mounted abutments, said motor being reversed each time stopped by said stop means.

4. In a bell playing device or the like, the combination comprising bell tone producing means, a high tone and low tone striking circuit connected to said producing means for producing high and low tone strikes therefrom, an oscillatable motor, a switch operator oscillated by said motor, timing means for activating said motor, a high tone and low tone switch means for activating said circuits, and adjustable means for both varying the rate of oscillation of said motor and for changing the interval between the strikes.

5. In a bell playing device having bell tone producing means, high and low tone electrical circuits connected to said producing means for producing strikes therefrom each time activated and timing means for actuating the same, the combination comprising an oscillatable motor having a switch operator extension with surfaces angularly disposed relative to the path of movement of said operator, a switch operating means operable by said operator in opposite directions according to the direction of movement of said surfaces, adjustable stop means limiting rotation of said motor in each direction, switch contact means on either side of said operating means and alternately closeable, connections between said high tone producing circuit and one of said contact means, connections between the low tone producing circuit and the other contact means, said stop means being adjustable in relation to said switch means.

6. In a bell playing device for producing programs and having a plurality of bell tone producing means, high and low tone electrical circuits connected to each of said producing means for producing strikes therefrom each time activated, the combination including an oscillatable motor for each producing means having a switch operator extension with surfaces angularly disposed relative to the path of movement of said operator, a switch operating means operably by said operator in opposite directions according to the direction of movement of said surfaces, adjustable stop means limiting rotation of said motor in each direction, switch contact means on either side of said operating means and alternately closeable, connections between said high tone producing circuit and one of said contact means, connections between the low tone producing circuit and the other contact means, said stop means being adjustable in relation to each of said switch means, said stop means comprising eccentrically mounted abutments locatable in any one of a plurality of positions relative to said operator, said motor being reversed each time stopped by said stop means.

7. In a program controlling switching circuit for producing signals or the like, the combination comprising signal producing means, actuating means for operating said producing means, electric circuits connected to said actuating means, an oscillatable motor having switch means operable to energize said circuits as said motor oscillates, a primary motor circuit energizable when it is desired to produce signals, a secondary motor circuit providing a path of energization to said motor whenever a signal means is energized to continue movement of the motor after the primary motor circuit is deenergized until the switch means is opened to deenergize the actuating means.

8. In a switching circuit for producing timed impulses, the combination comprising signal producing means including a vibrator and striker means for operating said vibrator to produce a tone or the like, electric circuits connected to said striker means including a pair of switch blades closeable to energize the same, a switch blade moving means, an oscillatable motor having switch operating extension means operable to contact said blade moving means, a primary motor circuit energizable to start operation of said motor, a source of energy connected to said blade moving means and to said motor furnishing energy to said motor whenever the blade moving means is in contact with a switch blade, so as to cause said motor to stop in a position in which the striker means will be deenergized and means for energizing said motor circuit.

9. In a bell tone playing device, the combination comprising a swinging bell tone producing means, striker means for operating said bell tone producing means, electric circuits connected to said striker means, an oscillatable motor having a shaft and means connected therewith operable to energize said circuits and produce bell tones, means reversing direction of said motor, activating means for energizing said circuits and motor, and bell shape indicating means connected to said motor and oscillatable thereby for showing the operation of the bell tone means.

10. In a bell tone playing device, the combination comprising a plurality of swinging bell tone producing means, high and low tone striker means for operating said bell tone producing means, electric circuits connected to each of said striker means, an oscillatable motor for each producing means, said motor having a shaft and means connected therewith operable to energize said circuits and produce bell tones, adjustable stop means limiting rotation of each motor in each direction, said stop means being adjustable in relation to each motor to adjust the rate of oscillation of each and to change the rate between different impulses, and indicating shape means mounted on each motor shaft for giving a visual indication of the relationship of the bells.

11. In a switch operating device having a plurality of signal producing means, electrical circuits connected to each of said producing means for producing pairs of signals having different characteristics therefrom each time activated, the combination including an oscillatable motor for each producing means having a switch operator extension with surfaces angularly disposed relative to the path of movement of said operator, a switch operating means operable by said operator in opposite directions according to the direction of movement of said surfaces, adjustable stop means limiting rotation of said motor in each direction, switch contact means on either side of said operating means and alternately closeable, connections between said high tone producing circuit and one of said contact means, connections between the low tone producing circuit and the other contact means, said stop means being adjustable in relation to each of said switch means.

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