SELECTORS AND TIMERS FOR ELECTROCARDIOGRAPHS

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SIGNAL LIGHT

13

FUSE

25

LEAD I

16

II

17

III

20

SWITCH

18

SIGNAL LIGHT

FIG. 1

FIG. 2

PLUG SOCKET

FIG. 3

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SELECTORS AND TIMERS FOR ELECTROCARDIOGRAPHS

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This application relates to electrocardiographs and more particularly to means for rendering electrocardiographs fully automatic in that it provides for automatic serial connection or rotation at preselected and variable time intervals of all standard electrocardiograph leads (i.e.) limb, augmented and precordial, including the rejection of unwanted leads as well.

An object of this invention is to provide an automatic serial rotation selector and variable time interval controller as above stated that may be manufactured as a separate unit for use with existing electrocardiographs or which may be embodied in an electrocardiograph assembly as a component part thereof.

Electrocardiographs as presently constructed and used require the technician, on the usual tracing, to reset the preordial leads on the patient six different times, and return to the machine for its operation each time. In the use of such equipment it has been necessary for the technician to be with the patient and the machine throughout its entire cycle.

It is an object of this invention to provide a device which makes it possible for the technician to connect all the preordial leads to the patient at one time, set the machine for automatic operation for serial rotation or connection of the leads at a preselected and variable time intervals through all the electrocardiographic positions established by the leads, namely, limb, augmented, and preordial. It is also an object of the invention to provide for the rejection of any unwanted leads.

By means of the invention, the technician may plug the left and right arm leads of an existing electrocardiograph machine into the automatic selector and timer of this invention. The technician also plugs the power input cable of the existing electrocardiograph machine into a power receptacle of the automatic device embodying the invention. The technician then turns on the present or existing cardiograph to a lead called lead 1. The input cable of the automatic selector and timer is then connected to the patient. The electrocardiograph machine is then left in the on-position so that it is ready for operation. As soon as the technician turns on the automatic selector and timing device, the electrocardiograph is activated and the various limb, augmented, and preordial leads are connected to the cardiograph in serial order.

In the operation of the machine, the lead selector of the machine is turned to the off-position. The rejector selector which is provided with control devices such as toggle switches is set to connect into circuit whatever leads are wanted. The machine also includes a start and reject button which is depressed and held momentarily until the selector switch is connected to lead 1. From this point on, the machine will connect the leads which have been selected to the electrocardiograph for selected time intervals. When the last lead has been connected and been on for the time required, the machine shuts off.

During the period when the machine is in operation the technician is able to take the electrocardiographic record as it emerges from the machine and should be able to mount it by the time the machine has completed its operation. As an alternative, the technician could be attaching a separate input cable to a second patient. Means could be provided for switching over from one patient to another automatically, allowing the technician freedom in attaching a cable to one patient while another electrocardiogram is being run on another patient.

It is therefore an object of the invention to provide a selector and timing device which will control the operation of an electrocardiograph in such manner that all of the leads which normally are separately attached to a patient and the machine, may be selected in sequence, or any unwanted leads may be rejected, and the length of time a particular lead is in circuit can be automatically controlled from start to finish, thereby leaving the operator free to attend to other patients who are waiting for electrocardiograms. Such a device makes for efficiency and lowers the cost of electrocardiograms. The invention also decidedly limits the possibility of error by the technician in the making of erroneous lead connections.

The above and other objects of the invention will be apparent to those of ordinary skill in the art to which the invention pertains from the following description taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a view in perspective of a device for automatically and serially connecting limb, augmented, and preordial leads which have already been attached to a patient to an electrocardiograph, the connections being made in a predetermined sequence and for predetermined and controlled time intervals;

FIG. 2 is a view in elevation of the hidden or rear end of the assembly shown in FIG. 1;

FIG. 3 is a more or less diagrammatic view of an electrocardiograph provided with an automatic selector and timer embodying the invention showing the limb, augmented, and preordial leads connected to a patient;

FIGS. 4, 5 and 6 are views in section taken on line 4—4, 5—5 and 6—6 of FIG. 1;

FIG. 7 is a view in section taken on line 7—7 of FIG. 6;

FIG. 8 is a partial enlarged view of the pawl and ratchet wheel shown in FIGS. 5 and 6;

FIG. 9 is a top plan view of a gang switch embodied in the device shown in the preceding views and which is shown in side elevation in FIG. 7; and

FIG. 10 is a more or less exploded diagrammatic view of the automatic selector and timer.

Throughout the drawings and the specification like reference characters indicate like parts.

The general arrangement in which the invention is used is illustrated by FIG. 3 in which a man patient 10 is shown to which the following leads have been connected: right and left arms, RA, LA, respectively, left leg LL and preordial VT—V6, respectively. These leads may be encased in a cable as shown and provided with a multiple point plug 11 by which they may be connected into a female receptacle 12 of the selector and timer 13 embody-
The selector timer 13 is provided with a plurality of pairs of output jacks 14a and 14b and 14c and 14d. The output jacks 14a and 14b may be used to connect the output of the selector to another electrocardiograph not shown. In other words, the timer selector 13 may serve one or more machines as desired. In such a case, the selector 13 would be provided with means whereby the leads from several patients may be connected into the selector and sequentially connected to the electrocardiograph as the cardograms of the respective patients have been completed.

As shown in FIG. 1, the selector timer 13 is provided with a knob 16 having a pointer 17 registering with a dial which may be called the lead selector dial. As shown in FIG. 1, the limb leads are designated I, II, and III. Provision is also made to accommodate augmented leads designated AVR, AVL, and AVF. The dial also shows the precordial leads V1 through V6. There is one open position in the lead selector dial and an off-position. When normally rotated automatically, the ead selector switch may be rotated manually in a clockwise direction.

At the opposite end of the assembly shown in FIG. 1, there is a timer knob 18 provided with a pointer 19 that registers with a dial graduated in units of time varying from 5 to 60 seconds for example. The timer controls the length of time a given lead is connected through the selector to the electrocardiograph.

Also shown in FIG. 1 there are a plurality of toggle switches 20-23 by means of which leads from the patient may be connected into circuit with the electrocardiograph or rejected. For example, the toggle switch 20 controls the limb leads I, IIA and IIB at positions I-III, switch 21 controls augmented leads indicated at positions AVR, AVL and AVF, switch 22 controls the precordial leads V1-V4 and switch 23 the precordial leads V5-V6.

The selector and timer 13 may also be provided with a toggle switch 24 by means of which the device may be turned on or off. Indicated on the top panel of the device 13 is a fuse 25, a flashing signal light 26 that goes on when the switch 24 is turned to on-position and a signal light 27 that flashes on and off as each lead is connected to or disconnected from the patient as the lead selector progresses in a clockwise direction from off to on and to off-positions.

The device is also provided with a start-select button switch 28. This switch, when momentarily depressed, starts the timer selector. If it is held down, the timer advances from one position to another rapidly until it is released, thereby making it possible to pass or reject, so to speak, a number of leads in the clockwise travel of the lead selector.

The construction of the timer selector illustrated in FIG. 1 is shown by the exploded schematic view of FIG. 17.

As there illustrated, the timer 30, which occupies the position of knob 18 in FIG. 1, includes a multi-contact, time-selecting switch 31 having, for example, 13 different timing positions 1-13 (31), respectively. This timer is set manually and controls the rate at which the selector progresses from one lead to another and therefore controls the length of time that a given lead, limb or precordial, is connected from the body of the patient to the electrocardiograph. The timer switch 31 is set manually.

The timer selector also includes a gang selector switch assembly 32 having multi-contact switches 33, 34, 35, 36 and 37, respectively, mounted on a common shaft 38.

The switch 33 comprises a stationary member 40 through which the shaft 38 extends and a wiper contact member 41 that is fixed to and insulated from the shaft and rotates therewith. Switch 33 is shown as having 13 stationary contacts 1-13 mounted on member 40. Contact 13 is open and the switch has an off-position. Contacts 1, 2, and 3 (33) are connected to a jumper 42, contacts 4, 5, and 6 (33) are connected to a jumper 43, contacts 7, 8, 9, and 10 (33) are connected together by a jumper 44 and contacts 11 and 12 (33) are connected by a jumper 45. Contact 13 is open.

The wiper contact 41 is connected by a conductor 46 to the circuit of timer 30, wherein jumpers 42, 43, 44, and 45 are connected, respectively, to the toggle switches 20-23, as shown. By means of the switches 20-23 connected as shown, the causes the gang switch 32 to move rapidly without pause at each contact so that as switch is depressed. The manner in which the switches 20-23 and switch 28 remove the timing feature of the timer circuit for such time as is necessary to accomplish the rejection of the leads desired.

The start reject switch 28 is provided to cut out the timing feature of the timer so long as it is kept closed, whereby the gang switch shaft 38 may be driven rapidly without pausing at a contact so long as that switch is depressed. The manner in which the switches 20-23 and switch 28 remove the timing feature of the timer will be described infra.

The gang switch 34 has the same number of contacts as gang switch 33. Contacts 1-6 (34) are open, while contacts 7-12 (34) constitute the means of connecting the precordial leads V1-V6 to the electrocardiograph. The stationary contacts 1-13 of switch 34 are mounted on a stationary member 52, while the wiper arm contact 52 thereof is secured to and insulated from the shaft 38.

The gang switch 35 comprises a stationary member 54 on which contacts 1-13 thereof are mounted and a wiper contact arm 55 that is secured to and insulated from the shaft 38. The wiper contact 55 is disposed for connection to limb lead LL. Contacts 1 and 13 of switch 35 are open; contacts 2 and 3 thereof are connected to each other by a jumper 56 and a conductor 57 to a conductor 58 leading to the output jack 14b which leads to the electrocardiograph 15. Contacts 4, 5, and 7-12 (35) are connected by a jumper 59 through a resistor 60 to the conductor 58 and thence to the output jack 14b. Contact 6 of switch 35 is connected by a conductor 62 to a conductor 63 which leads to the output jack 14a.

Thus, limb lead LL is connected to output jack 14b when wiper contact 55 makes contact with contacts 2 and 3; it is also connected to the output jack 14b through the resistor 60 when the wiper contact arm 55 makes contact with contacts 4, 5, and 7-12 of switch 35. When the wiper contact arm 55 makes contact with contact 6, the limb lead LL is connected through conductors 62 and 63 to the output jack 14a, thereby reversing the connection of limb lead LL with respect to the output jacks.

Switch 36 comprises a base 64 on which are mounted contacts 1-13, and a wiper contact arm 65 that is secured to and insulated from the shaft 38. Contact member 2 (36) is open, while contact 1 (36) is connected to the output jack 14b directly. Contact members 3 and 5 are connected by a jumper 67 and a conductor 68 to the output jack 14c; contact 4 (36) is connected through a resistor 69 to the output jack 14c; while contacts 6-12 are connected to a jumper 70 and by that jumper through resistor 69 to the output jack 14b.

The left arm lead LA is connected to the wiper contact arm 65. Thus, as the wiper contact arm 65 advances clockwise, the left arm lead is connected through contact 1 to the output jack 14b. When the arm 65 engages contact 3 (36), the left arm lead is connected to the output jack 14a. When contact 4 is made with contact 4 (36), the left arm lead is connected through resistor 69 to the output jack 14b which is a reversal of its connection to the output jacks with respect to contacts 1 and 3. When the contact arm 65 engages contact 5, the left arm lead LA is connected to the output jack 14a, and when it makes contact with contacts 6-12
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5 (36), there is a reversal and the left arm lead LA is connected through resistor 69 to the output jack 14a. The base 73 comprises a base 73 on which are mounted the stationary contacts 1-13 and a wiper contact arm 73 secured to the shaft 38 and insulated therefrom. Contacts 1 and 2 (37) are connected when engaged by wiper contact 73 to the output jack 14a. Contacts 3 and 13 (37) are open. Contact 4 is connected to output jack 14a when the wiper contact 73 engages it. Contacts 5-12 are connected by a jumper 74 through a resistor 75 to the output jack 14b. The right arm lead RA is connected to the wiper contact 73. Thus, the right arm lead is connected to the output jack 14a by the wiper contact 73 and contacts 1, 2, and 4, and it is connected to the jack 14b when the wiper contact 73 makes contact with contacts 5-12.

The shaft 38 may be driven in the manner intended by any suitable means. The means illustrated comprises a ratchet wheel 78 secured to the shaft 38 and a pawl 79 having an armature 88 disposed in an operating solenoid 81. The solenoid 81 is controlled by the timer 30. Each time the solenoid 81 is energized, the ratchet wheel 78 is advanced a distance corresponding to the distance between adjacent contact members on the gang switches 33-37.

The timer circuit may take various forms but the one illustrated is an electronic circuit employing a transistor. The timing circuit comprises a transformer 82 having a primary winding 83 and an output winding 84. The transformer may be connected to an A.C. power supply by means of a plug 85 and the toggle switch 24. In circuit with the toggle switch 34 is the fuse 25 and the indicator light 26 which may be a neon tube, for example. The output winding 84 of the transformer is provided with a diode or rectifier 85 and a condenser 86 which is connected to the negative terminal of the rectifier and the opposite terminal of the transformer winding 84. The negative terminal of the rectifier 85 is connected to the switch 31 which determines the rate of advance of the gang switch shaft 38, or, in other words, at the rate at which the solenoid 81 is energized. The solenoid 81 is connected to the power supply through a solenoid-operated switch 88, the solenoid 89 of which is energized by the timer. When the solenoid is energized, the relay 88 closes connecting the solenoid 81 to the power supply conductors 90 and 91.

The timer switch 31 may comprise a multi-contact switch having a base 92 on which a plurality of contacts, for example, 13 contacts, are mounted as shown. It also includes a wiper contact arm 93 connected to a condenser 94, that jumper being connected to one terminal of the solenoid 89 by a conductor 95. The wiper contact 93 is connected to one terminal of a series resistance-capacitor circuit comprising resistors 100, 101, and a condenser 102. The condenser is connected to voltage supply line 98.

In circuit with the resistors 100 and 101 is a transistor 103. The base contact of the transistor 103 is connected to supply conductor 90 and to one terminal of the transformer 89. The input terminal of the transistor is connected to the junction of the resistors 100 and 101. Thus, as the voltage builds up on the transistor, it passes current, energizing the solenoid 89 and closing the switch 88 whereby the solenoid 81 is energized and the ratchet 78 advanced one tooth.

The timer is so arranged that the resistances 1a-13a are graduated so as to control the time of firing of the transistor 103 and the frequency with which the switch 88 is closed and consequently the frequency with which the selector switch assembly 32 is advanced from one contact to another. Thus, if the wiper contact arm 93 is set in the position to engage contact 1 and thereby connect resistor 1a in circuit with the transistor circuit, the switch 88 will close and then reopen. It will close again after the lapse of a predetermined length of time determined by the value of resistance 1a. The time at which the switch 88 closes may be modified by moving the wiper contact arm 93 to contact 2 or any one of the other contacts having different resistance values.

Connected in parallel with the input winding 83 of the transformer is a plug socket 110 by means of which the electrocardiograph may be plugged into the power supply, the socket 110 being mounted to the timer selector a assembly 13 shown in FIG. 1.

Assuming that the body leads, such as the limb and precordial leads, have been connected to the patient and to the timer selector and it is desired to obtain an electrocardiogram, the selector switch assembly 32 is turned to the off-position, the timer switch 31 is set to a position that will give the desired length of time that any lead is connected to the electrocardiograph writing mechanism. The toggle switch 24 is then thrown to on-position and the switch 28 is momentarily depressed whereby the transistor 103 is caused to fire immediately thereby closing the relay switch 88 and energizing the solenoid 81. The ratchet wheel 78 is then moved or advanced one tooth so that the wiper contacts of the switches 33-37 will engage contacts 1 thereof. In that position, right arm lead RA is connected to output jack 14a and the left leg lead LL is connected to the output jack 14b. Switches 34 and 35 are open at contact 1 position.

After a lapse of time determined by the resistance in circuit with the contact to which the wiper contact 93 has been set, the solenoid 81 is energized to advance the ratchet wheel 78 another tooth, whereby the switches 33-37 are advanced to contact 2 thereof. The selector switch assembly 32 remains at rest in that position for the period of time fixed by the timer and in that position, right arm lead RA is connected to output jack 14a and the left leg lead LL is connected to the output jack 14b, contacts 2 of switches 34 and 36 being open. When the time interval has expired, the solenoid 81 is energized to advance the ratchet wheel 78 another tooth, whereby the switches of the selector 32 are advanced to the position where the wiper contacts thereof make contact with contacts 3. In that position, the left arm lead LA is connected to output jack 14a, and the left leg lead LL is connected to output jack 14b, contacts 3 of switches 34 and 37 being open.

When the time interval has expired, the solenoid 81 is energized, again advancing the ratchet wheel 78 another tooth and actuating the wiper contacts of the switches 33-37 into engagement with contacts 4 thereof. In that position, the right arm lead RA is connected to output jack 14a and the left arm and left leg leads LA and LL, respectively, are connected to the output jack 14b through resistors 69 and 60, respectively, contact 4 of switch 34 being open.

The time interval having expired for the switch contacts 4, the solenoid is again energized and advanced one tooth so that the contact arms of the switches 33-37 engage contacts 5 thereof. In that position, the right arm lead RA is connected through resistor 75 to the output jack 14b, the left arm lead LA is connected to the output jack 14a, and the left leg lead LL is connected through resistor 60 to the output jack 14b.

The solenoid 81 on its next energization, advances the selector 32 one step whereby the wiper contact arms 41, 53, 55, 56, 65 and 73 engage contacts 6 thereof. In that position, the right arm lead RA is connected through resistor 75 to the output jack 14b, the left arm lead LA is connected to the output jack 14b through jumper 70, resistor 69 and conductor 58 and the left limb lead LL is connected to output jack 14a through conductors 62 and 63. When the selector 32 has reached the position just described, all of the limb lead combinations have been completed and the tracings effected by the writer of the electrocardiograph. However, the limb lead con-
nections are made to jack 14b as the switches 33-37 progress through the remaining contact positions.

When the selector 32 is moved to the position where the wiper contact arms of the switches 33-37 engage contact 14a thereof, the limb leads are connected, as above stated, to output jack 14b, but the preconditional lead V1 is connected to the output jack 14a. As the selector 32 is advanced from contacts 7 of the switches 33-37 through the positions of contacts 8, 9, 10, 11 and 12 thereof, the preconditional leads V2-V6 are connected in sequence to output jack 14a. Thus, the readings for the preconditional lead connections are made in sequence and recorded by the writer of the electrocardiograph.

When the selector 32 makes one more advance, the wiper arm contacts thereof reach the contact positions represented by contacts 13 thereof and the machine is disconnected from the writer. The selector 32 continues to advance step by step and would pass the off-position unless the switch 24 has been thrown to off-position.

It is to be understood that the shaft 38 of the selector 32 may be provided with a limit switch which turns the machine off when it reaches the off-position.

The switches 20, 21, 22 and 23 are provided for the purpose of rejecting limb leads or preconditional leads as desired. For example, if the switch 20 is closed, the solenoid 81 is freed of the time delay feature of the timer circuit so that the solenoid 81 is energized rapidly to cause the wiper contact arm 41 and the corresponding arms of the switches 34-37 to move quickly past the contacts 1, 2 and 3 and come to rest at contact 4 for the length of time fixed by the time interval of the timing circuit. Thus, switch 20 provides for the rejection of all of the limb leads. The limb leads may be rejected one by one by proper momentary operation of switch 28.

If switch 21 is closed, the selector 32 is moved rapidly over the contacts 4, 5 and 6 of all the switch assemblies and comes to rest at contact members 7 thereof. The contacts 4, 5 and 6 may be utilized to accommodate the augmented leads AVR, AVL and AVF of FIG. 1. The augmented electrocardiograph positions provide for special combinations of other leads through resistors in the machine and do not necessitate further connections to the patient; they are a part of this machine as indicated. For example, the augmented lead AVR uses the right arm lead as the exploratory electrode and the left arm lead and left leg leads are grounded each through a 5,000 ohm resistor.

When switch 22 is closed, the preconditional leads V1-V4 are rejected in that the selector 32 moves rapidly past the contacts 7, 8, 9 and 10 of all the switch assemblies and comes to rest at contacts 11 thereof. Thus, the machine will record the voltages conducted by the preconditional leads V5 and V6 to the electrocardiograph but the leads V1-V4 will have been rejected. Switch 23 when closed rejects the preconditional leads V5 and V6. By connecting contact 13 of switch 33 to switch 23, as shown, the rejection of contact position 13 of the switches is made automatic. Thus, by closing any one of switches 20-23, particular leads may be rejected. It is also possible to reject leads by closing switch 28 independently of the switches 20-23. In other words, so long as switch 28 is closed, the timer will activate the solenoid 81 repeatedly and cause the selector 32 to keep stepping along at a rapid pace until the switch 28 has been released to open position.

FIGS. 4-9 illustrate details of the selector timer 13 and the arrangement and location of various components thereof. In FIGURE 4, which is a view in section looking upwardly from the underside of the top panel of the device shown in FIG. 1, the lead selector 32 is shown. The particular selector illustrated is a multi-contact, multigang switch of the type used in radio and similar applications. It is to be understood that any type of switch suitable for making the lead selections illustrated in FIG. 1 and described in connection therewith may be employed. The radio gang switch was one which was conveniently available and easily modified, as indicated in FIG. 10, to perform the purpose intended. The timer switch 31, that is the switch that determines the length of time that the wiper contacts of the selector switch 32 are made, and the leads controlled thereby connected to the electrocardiograph, is illustrated as being at the opposite end of the housing. That switch also is a single-gang, multi-point switch frequently used in radio work and was modified by the provision of the resistors 13-14, 13-15 of FIG. 10. The location of the switches 20-24 and the fuse 25, the signal light 26, and the momentary make and break switch 28 are illustrated in their respective locations.

FIG. 5 is a view showing the location of the ratchet wheel 78 and the pawl 79 and the manner in which they are mounted in the lower half of the housing of the device 13. It also shows the location of the time interval controlling switch 31, the relay 88 and other components. FIGS. 6, 7 and 8 show the manner in which the lead selector 32 is connected to the ratchet wheel 78 and the construction of the solenoid 81 and the pawl 79 operated by it.

The multi-gang switch selector 32 is so mounted that its shaft 38 extends into the lower compartment of the housing of the device 13. The shaft is guided in a bearing bracket 110. The pawl 79, as shown, is a curved member having at one end a pair of spaced lips 111 and at the other end a curved member 112 between which the edge of the ratchet wheel 78 is received. The pawl is guided in its travel by means of a pin 113 operating in a slot 114 of a bracket 115 secured to the housing as shown. The opposite end of the pawl 79 is connected to the armature 80 which, as shown, is disposed within the bracket 116. The member 81 with its iron circuit member 116 is secured to a bracket 117 which in turn is secured to the housing of the device 13 by suitable screws as shown.

The pawl 79 is provided with a cam 118 for operating a micro switch 119 through a lever 120 having a roller 121 disposed to engage the cam. The micro switch flashes a signal or performs any desirable function.

Components of the device not specifically mentioned in connection with FIGS. 4 to 9 inclusive but which have been described in connection with FIG. 10 are designated by the reference numerals of FIG. 10. Having thus described the invention, it will be apparent to those of ordinary skill in the art to which the invention pertains that various modifications and changes may be made in the illustrated embodiment without departing from either the spirit or the scope of the invention.

Therefore, what is claimed as new and desired to be secured by Letters Patent is:

1. A device for automatically connecting in sequence: a plurality of limb, augmented, and preconditional leads attached to a human patient to an electrocardiograph, comprising an output adapted to be connected to an electrocardiograph, a plurality of switches connected between certain of said leads and said output, each of said switches having a plurality of spaced contacts and a wiper contact movable relative thereto arranged to establish any one of the following combinations of lead-connecting positions to an electrocardiograph in a predetermined sequence: right arm and left arm; right arm and left leg; left arm and left leg; said switches being adapted to connect any one of said plurality of limb, augmented and preconditional leads to the electrocardiograph, said wiper contacts being fixed to a common shaft for movement in unison, said switches being connected with said common shaft for incrementally moving said common shaft to move said wiper contacts of each switch from one spaced contact to another, electrical operating means for operating said driving means upon energization of the operating means, and an electrical network connected with said op-
operating means for energizing said operating means and comprising timing means including selectively adjustable timer switch means having a plurality of spaced timer contacts and a movable wiper contact arranged to engage different ones of said spaced timer contacts, a plurality of impedances of different values, each of said timer contacts being connected with one of said impedances so as to connect various ones of said impedances in circuit with said operating means to thereby control the length of time between successive energization of said operating means, thereby controlling the length of time said first-mentioned plurality of switches remain in a lead-connecting position.

2. A device as defined in claim 1, including means for selectively by-passing said timer switch means to cause rapid energization of said operating means for rejecting one or more of the leads.

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