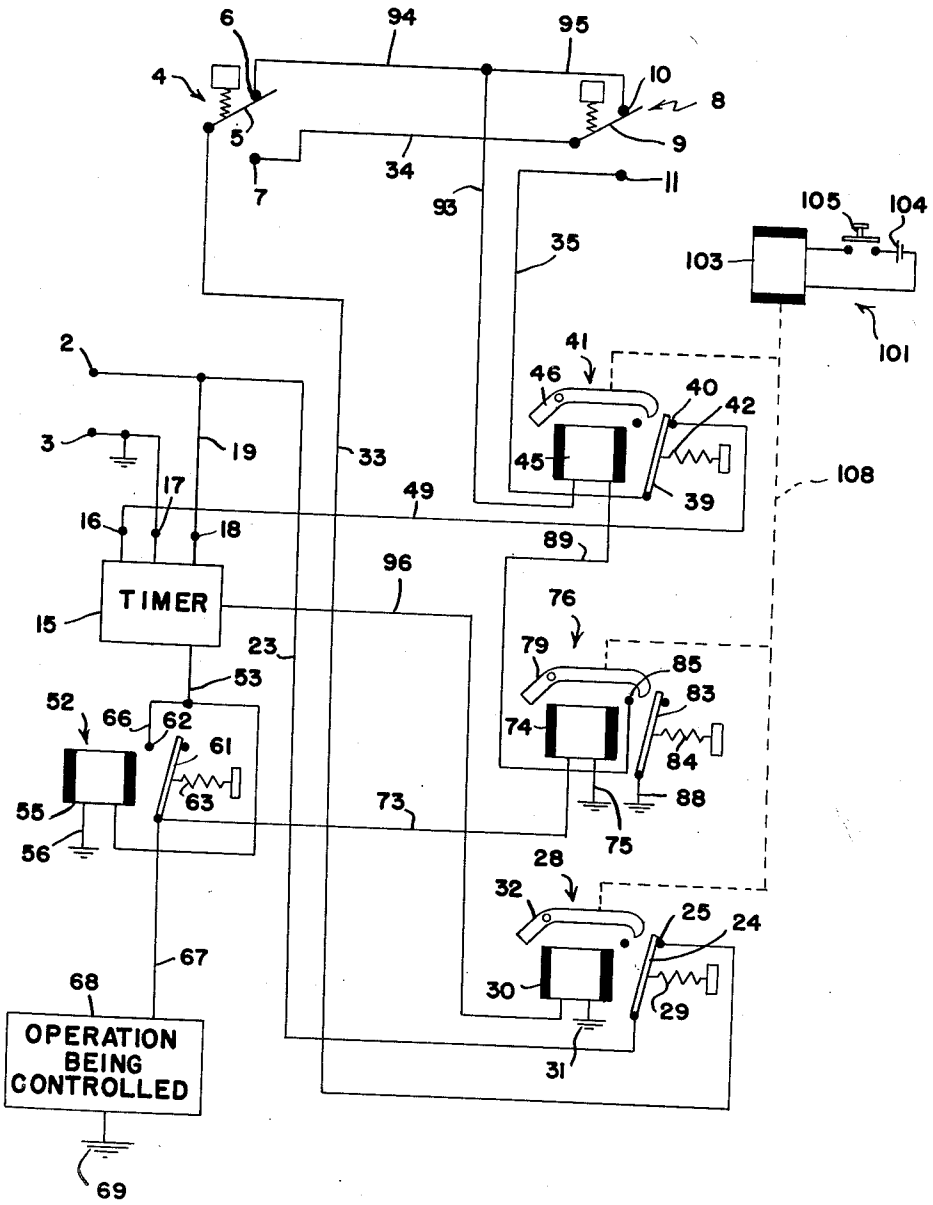
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CONTROL CIRCUIT

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CONTROL CIRCUIT

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1 Claim. (Cl. 317—135)

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The present invention relates to a time-dependent control circuit, and more particularly to a tamper-proof time-dependent control circuit for use with a device for monitoring personnel exposed to radiation.

For personnel working in an area subject to radiation there exists a need for a time-dependent monitoring circuit that can keep an accurate record of the time spent by an individual in an area subject to radiation. In some operations only a portion of the worker's body, such as his hands, are in a radiation zone. If an accurate control is to be kept a monitoring device must be so arranged that it is actuated only during the actual time of exposure of the individual's hands. Should he remove one or both of his hands, it is desirable that the monitoring operation be stopped during the period in which his hands are not subjected to the radiation.

In accordance with the invention, a pair of microswitches are arranged to be moved to a closed position by the hands of the person being monitored. A timer is actuated during the time both microswitches are closed. A counting relay is controlled by the timer, and a count-completed relay is actuated if the microswitches have been closed for a pre-set time. To make the circuit tamper-proof, a pair of latching relays are arranged in the circuit with the timer and the microswitches so that closing the circuit to the timer actuates one latching relay which in turn provides a potential at one side of the coil of the second latching relay. Opening one of the microswitches as by withdrawal of the hand of the person being monitored completes a circuit through the other side of the second relay thereby opening the timer circuit.

Accordingly it is a primary object of the invention to provide a simple tamper-proof time-dependent control circuit for a monitoring unit.

It is a further object to provide a novel time-dependent monitoring circuit which operates, adds or integrates the intervals of time that the limbs of an individual have been exposed to harmful radiation.

It is a further object of the invention to provide a timer in combination with a series of relays to actuate a monitoring device for a pre-set time.

It is a still further object to provide a time-dependent control circuit which may not be reactuated after it has once been broken until a reset operation has taken place.

Other objects and advantages of the invention will become apparent to those skilled in the art

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from the following detailed description of the preferred embodiment of the invention as illustrated in the accompanying sheet of the drawing in which the single figure illustrates a circuit diagram of the control circuit.

Referring now to the drawing, there are shown input terminals 2 and 3, which supply energy to the circuit. A microswitch 4 includes switch blade 5 coacting with either of two contact points 6 and 7. Switch blade 5 is normally biased to contact 6 until one hand of the person operating the circuit moves it adjacent contact 7. Similarly, a microswitch 8 includes blade 9 normally biased against contact 10 until moved to contact 11 by the hand of the operator.

Timer 15 is the basic element around which the circuit is built. There are three connection terminals 16, 17 and 18 for the timer. Terminal 17 is connected to input terminal 3 and to ground; terminal 18 is connected to input terminal 2 by means of conductor 19. In order to actuate the timer it is necessary that terminals 16 and 18 be short circuited. The required short circuit includes the connections through conductors 19 and 23, armature blade 24 and contact 25 of normally closed count completed relay 28. Relay 28 includes a spring 29 to hold armature blade 24 normally adjacent contact 25. There is also provided coil 30 which is grounded at 31. Latch 32 operates to hold armature 24 in the open position after the relay is actuated.

The short circuit continues through conductor 33 and switch blade 5. At such time as blade 5 is in contact with contactor 7, and switch blade 9 is in contact with contactor 11 a circuit is completed through conductor 34. Current will flow from contactor 11 through conductor 35 to armature blade 39 and contact 40 of relay 41. Relay 41 includes spring 42 to hold blade 39 in the normally closed position adjacent contact 40. There is also provided coil 45, and latch 46. Latch 46 is effective to hold armature blade 39 in the open position after the relay is actuated.

The final portion of the short circuit for timer 15 includes conductor 49. It is thus apparent that at such times as both microswitches 4 and 8 are moved to actuated position by the operator's hands a short circuit across terminals 16 and 18 of timer 15 will be provided. If only one of the microswitches is moved to actuated position no short circuit will be provided across the timer 15 since the circuit will be interrupted at hand operated switch 4 or 8.

Timer 15 controls the flow of current to relay 52. After the timer becomes actuated through

the shorting of terminals 16 and 18, current will flow through conductor 53 into coil 55 of counting relay 52. Ground 56 is provided so that a complete circuit through the coil 55 is present. When current flows through coil 55, armature blade 61 will be pulled from the normally open position into the closed position in contact with contactor 62.

Spring 63 is provided so that blade 61 is normally in the open position. At such times as 61 comes into contact with contactor 62 current will flow through conductors 53, 66, and 67 so that the monitoring operation 68, which is being controlled, is initiated. Another circuit is also completed through conductor 73 which leads to coil 74, and to ground 75 of relay 76.

Relay 76 includes armature blade 83, which is normally held in the open position by spring 84. When the current flows through coil 74, blade 83 will come into contact with contactor 85. At this time a circuit may be traced from ground 88 through blade 83, contactor 85, conductor 89, coil 45, and conductor 93. Conductor 93 is tied in to conductor 94 and conductor 95. However, since switch blades 5 and 9 are in the actuated position, that is adjacent contactors 7 and 11 respectively when the monitoring sequence is initiated the circuit through coil 45 is open. Coil 45 is energized only when the monitoring sequence is interrupted by movement of one or both microswitches 4 and 8 to unactuated position.

Coil 45, a part of relay 41, is provided so that the timer may be stopped only if the microswitches are moved to unactuated position. If the operator's hands do not so move the switches, the timer will continue to operate for a set period of time. After the period elapses a voltage will be available at the timer such that current will flow through conductor 96, into coil 30, and to ground 31 of count-completed relay 28. This will of course open relay 28, and break the short circuit across terminals 16 and 18 of the timer, since armature blade 24 was included in the short circuit. This will end the monitoring sequence, and it cannot be recommended until the relays are reset.

There is provided reset means 101 which acts to release latch members 46, 79 and 32 simultaneously. Latch means 101 includes solenoid 103, to which current is applied from battery 104 when switch 105 is closed. When current flows through coil 103, linkage 106 is actuated to unlatch the relays.

The mode of operation of the time-dependent control circuit is as follows: The operator initiates the sequence by inserting his hands in devices including microswitches 4 and 8, which are thereby actuated with blade 5 against contact 7 and blade 9 against contact 11. When this is done, a short circuit is created across terminals 16 and 18 of timer 15. This short circuit is traced through conductor 19 and 23, armature blade 24, contactor 25, conductor 33, switch blade 5, and contactor 7. The circuit continues through conductor 34, switch blade 9, contactor 11, conductor 35, armature blade 39, contactor 40, and conductor 43. The short circuit across the timer causes it to be actuated.

When timer 15 is actuated, a voltage is available at conductor 53 to energize counting relay 52. Current flows through conductor 53 into coil 55, and then to ground 56. Flux through coil 55 is effective to close the normally open relay 52, bringing armature blade 61 into contact with contactor 62. When relay 52 is closed current will flow from conductors 53 and 66 through conductor 67, and be effective to initiate the monitoring operation being controlled at 68.

Another circuit is completed at this time which may be traced through wire 53, wire 66, contactor 62, blade 61, conductor 73, coil 74, and ground 75 of relay 76. Flux through coil 74 is effective to close the normally open relay 76, bringing armature blade 83 into contact with contactor 85. At this time it is seen that one side of coil 45 of relay 41 is at ground potential since there is a connection through conductor 89, contactor 85 and armature blade 83 to ground 88. The other side of coil 45 leads to an open circuit as by means of conductors 93, 94, and 95, since the blades 5 and 8 are disengaged from the contacts 6 and 10, respectively.

The timer will continue to operate as long as the short circuit across terminals 16 and 18 is maintained by the hands of the operator inside the devices containing switches 4 and 8. After a predetermined time, timer 15 provides a voltage so that a current will flow through conductor 96 into coil 30 and to ground 31 of count-completed relay 28. This causes the normally closed relay 23 to open and pull its armature blade 24 away from contactor 25. This action breaks the short circuit across timer 15 since armature blade 24 was included in the short circuit between terminals 18 and 16. Armature blade 24 will be latched in the open position and thus end the monitoring sequence. If it is desired to begin a new sequence, switch 105 is depressed. This energizes solenoid coil 103, which results in linkage 106 being actuated to release latches 32 and 79. A new sequence of operation may then be initiated.

However, if the operator removes one or both of his hands from the microswitches 4 and 8 before the predetermined monitoring time, relay 41 will be energized and will break the short circuit across terminals 16 and 18. Assuming that switch 4 has been moved to unactuated position by the operator, blade 5 will have come back into contact with contactor 6. This will break the short circuit across timer 15 as follows: Current flows from ground 88 through armature 83, contactor 85, conductor 89, coil 45, conductors 93 and 94, switch blade 5, conductor 33, contactor 25, conductor 23 to terminal 2. Since coil 45 will then be energized, armature blade 39 will be pulled away from contactor 40. It is seen that this will result in a break of the short circuit across terminals 16 and 18 since armature blade 39 and contactor 40 were included in the shorting circuit. Armature blade 39 will be latched in the open position by means of latch 46.

If the operator would then reactuate microswitch 4 with his hand, the timer would not be energized since there would be a break in the short circuit. This is due to the fact that armature blade 39 would be latched in the open position. It is apparent that once the sequence has been interrupted by withdrawal of the operator's hand it cannot be reinstituted until reset mechanism 101 is actuated.

It will be noted that if the operator were to have opened the other microswitch 8, as by releasing switch blade 9 so that it would come into contact with contactor 10 the short circuit across timer 15 would be broken in the same manner. To be specific, the current flow path would include ground 88, armature 83, contactor 85, wire 89, coil 45, conductor 95, contactor 10, switch

blade 9, conductor 34, contactor 7, switch blade 5, conductor 33, contactor 25, armature blade 24, conductor 23, and input terminal 2. Thus current would flow through coil 45 and break the contact between armature blade 39 and contactor 40, resulting in opening of the short circuit across terminals 16 and 18 of the timer.

It is apparent that the invention provides a novel tamper-proof time-dependent control circuit for use with a monitoring operation to be controlled. If the monitoring sequence is undisturbed, the timer will run for a predetermined time so that the sequence will be completed. If, however, there is interruption, as by a break in the circuit due to opening of one or both of the control switches, the timer will immediately cease to operate. The sequence cannot be resumed until after a reset operation has been initiated.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention, as set forth in the appended claim.

What is claimed is:

In a radiation control system manually controllable by an operator, a timer controllable by completion of an external current path to provide a potential at a first terminal after a predetermined interval of time, a pair of serially-connected double throw single pole switches each having a normal and an actuated position to selectively establish a first or a second path therethrough, said switches being mechanically connectable to the hands of the operator whereby insertion of the respective hands of the operator into a radiation area actuates the corresponding switches to their actuated position, a first relay having a first actuating coil, a first pair of normally open contacts and latch means for maintaining said first pair of normally opened contacts in a closed position following actuation thereof, a second relay having a second actuating coil, a second pair of normally closed contacts

and latch means for maintaining said second pair of normally closed contacts in an open position following actuation thereof by said second actuating coil, a third relay having a third actuating coil, a third pair of normally open contacts and latch means for maintaining said third pair of normally open contacts in a closed position following actuation thereof by said third actuation coil, first circuit means for establishing the external current path for controlling said timer including said second pair of normally closed contacts, said first path through said first and second double-throw single-pole switches and said first pair of normally closed contacts connected in series with each other, whereby actuation of both said first and second double-throw single-pole switches actuates said timer and said manually controllable operation, said first circuit also including circuit means including a second current path through said first and second double-throw single-pole switches, said first actuating coil and said third pair of normally open contacts, whereby release of one of said double-throw single-pole switches opens the external current path of said timer, second circuit means connecting said second actuating coil to said first terminal of said timer to actuate said second pair of normally closed contacts after said predetermined interval of time and thereby terminate operation of the manually controllable operation, third circuit means connecting said third actuating coil in parallel with the manually controllable load to actuate said third pair of contacts to a closed position during operation thereof, and means to release said latch means on said relays to reset the control system after each operating cycle.

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