

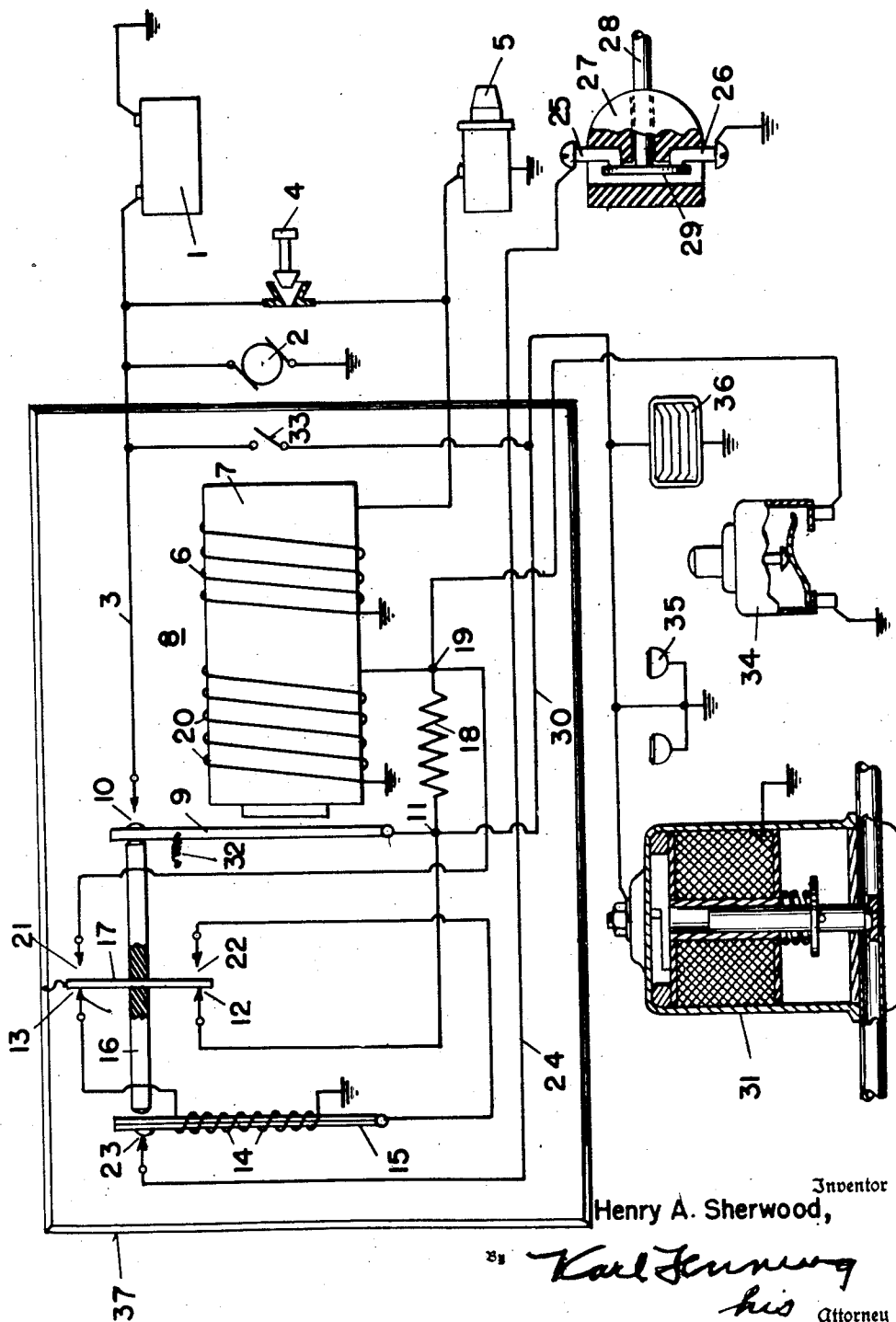
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CIRCUIT CONTROL

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CIRCUIT CONTROL

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This invention relates to time limit relay electrical controlling devices by means of which a sequence of operations may be accomplished for controlling power-consuming circuits in various ways.

The invention has other uses, but is especially adapted for use in connection with petroleum engines such as may be used on automobiles, trucks and the like whether the engines are of the usual ignition type or Diesel engines. It contemplates a circuit for starting the operation of the engine which initiates a second circuit for maintaining the operation of the engine in which second circuit may be a switch which causes it to be deenergized after a time interval, unless the operation of the engine produces sufficient pressure in the oil lubricating system.

In the enclosed drawing is shown a circuit diagram of one means for carrying out the invention.

The usual storage battery 1 may be used as a source of electrical energy or, when the engine is running, energy may be taken from the automobile generator indicated at 2. Both are grounded on one side and both are connected at their other sides to the wire 3. A starting switch 4 may be employed to initiate action of the system. A short closure of switch 4 energizes the starter 5 to start the motor turning in the usual way. Current also flows through the switch 4 from the wire 3 through a coil 6 about a core 7 of a relay 8. This causes the armature 9 to be attracted, closing the switch 10 so that current may flow from the wire 3 through the switch 10 and the armature 9 to the point 11, whence one branch goes through the switches 12 and 13, through a heating coil 14, about a bimetallic thermal device 15, so arranged that when it becomes heated it bends to the right and pushes to the right the switch operating element 16 (which latter is biased to the left by spring 32), on which is mounted the connecting bar 17 for the switches 12 and 13, thus opening the circuit at 12, 13. Another path of current from the point 11 goes through the limiting resistor 18 to the point 19 from which one branch goes to ground through the holding coil 20 of the relay 8. From 19 another branch goes through the contacts 21 and 22. These are closed by the connecting bar 17 when the switch operating element 16 has been moved to the right as the thermal element 15 is heated. The contact 22 is connected through the bimetallic element 15 and the switch 23 which is normally closed but opened by movement of the element 15 when it becomes heated. From 23 current may flow to ground

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through the wire 24 and the contacts 25 and 26 of a pressure switch 27 attached to the lubricating oil system 28, so that when the oil pressure rises as the motor operates, it forces the connecting member 29 to the left to break contact between 25 and 26. From the point 11 another wire 30 may run to the ignition device of an explosion engine, not shown, or to an oil control valve 31 to open and let through a flow of fuel oil to a Diesel engine. The circuit of wire 30 may be referred to as the working circuit or the supervised circuit. Also connected to the wire 30 may be the various service devices of an automobile such as the lights 35, or heater 36, and also windshield wiper, defroster, radio and the like, which are not shown.

When at rest, the apparatus will be in the position shown. On closing the starter switch 4 for a short time, the engine will turn over and the coil 6 will be energized, attracting the armature 9, closing the contact 10 to open the valve 31 or to feed current to the ignition system, and thus start the motor operating. At the same time, the closure of switch 10 will energize the coil 20 and the switch 10 will be held closed as long as the coil 20 is sufficiently energized so the starter switch 4 may be released or opened. On the closure of 10, the coil 14 will be energized through 12 and 13. As the coil 14 heats up it bends the bimetallic element 15 to the right, pushing switch operating element 16 to the right. This movement causes the bridging or connecting bar 17 to open the contacts 12 and 13 and close the contacts 21 and 22. This opens the circuit through coil 14 and the member 15 on cooling returns to its original position to close switch 23. There is thus closed a circuit from point 19 through 21, 22 and 23 through pressure switch 27. If oil pressure has been built up the circuit is open at 25 and 26, but if pressure has not been built up this circuit remains closed, and there is thus formed a short circuit around the coil 20 which thus receives insufficient current to keep the armature 9 attracted and allows the spring 32 to pull the armature 9 to open the switch 10 and return the apparatus to open or deenergized position.

When the ignition switch of an explosion engine is turned off, the oil pressure goes down at once, closing the switch 27 to return the apparatus to original position. A Diesel engine, however, dies more slowly and the oil pressure may remain high enough to delay the closure of the switch 27 and it may be desirable to provide an additional switch such as 34 connected to the point 19. This switch 34 is normally open but

may be closed for a short period to provide a short circuit to deenergize the coil 20 and so return the apparatus to original inoperative position, although there may be sufficient residual oil pressure to hold the switch 27 open for a short time.

While the relay coil 20 is energized, the operating circuit through 31, or the ignition circuit, is closed and the coil will remain energized, while the thermal coil 14 heats up and moves the connecting bar 17 to the right to open the circuit of said coil 14, whereupon the coil cools. When the coil 14 cools, it will deenergize 20 by short-circuiting it through the pressure switch 27. If, however, during this interval the pressure has built up so as to open the switch at 29, the short circuit will be opened and the coil 20 will remain energized and current will continue to flow to the operating circuit through 31 or the ignition circuit. The time interval of this delayed action may depend upon the construction, arrangement or adjustment of the thermally operating device.

For emergency or other use, there may be provided a manual switch 33 short-circuiting the switch 10 and feeding current directly to the controlled devices such as 31 or the ignition, etc., not shown.

Since the controlled circuits for fan, lights, etc. are indicated as connected through 10, the arrangement may prevent the drain of the battery current when the motor is not operating, if by inadvertence the individual control switches have not been turned off.

The oil pressure system need not be physically combined in the same housing as the rest of the apparatus. It may be sufficient to assemble that part of the apparatus enclosed by the frame 37 in any suitable place to be connected by wire or cable with the remaining devices, wherever they may be placed conveniently.

I claim as my invention:

1. Time-delay electrical controlling means, comprising a first circuit, a relay energized upon closing of said circuit, a second circuit energized responsively to energization of the relay, a third circuit including normally open first and normally closed pressure responsive switch means, a thermal delay-action device operative upon energization of said second circuit to open said second circuit a predetermined time interval after its energization and thereupon to close said first switch means of said third circuit, said pressure responsive switch means opening in response to a predetermined pressure condition but remaining closed in the absence of such condition to provide for closing of said third circuit upon closing of said first switch means, said third circuit when closed being operative to effect deenergization of the relay.

2. Time-delay electrical controlling means as set forth in claim 1, wherein said second and third circuits are branch circuits connected in parallel with the first circuit.

3. Time-delay electrical controlling means as set forth in claim 1, wherein a relay holding circuit energized responsively to energization of the second circuit is connected in parallel therewith, and wherein said third circuit is connected in shunt relationship to the relay holding circuit and is operative when closed to effect short-circuiting of said relay holding circuit.

4. Time-delay electrical controlling means, comprising a first circuit connected to a source of electrical energy, means for momentarily closing said first circuit, a relay adapted to be energized

upon closing of said first circuit, a holding circuit for the relay, a second circuit connected in parallel to said first circuit, said holding circuit being operative to maintain the relay energized and thereby the second circuit closed following opening of the first circuit, a third circuit including a normally open first and a normally closed pressure responsive switch means, said third circuit being connected in parallel to the second and relay holding circuits, a thermal delay-action device operative upon energization of the second circuit to open said second circuit a predetermined time interval after its energization and thereupon to close said first switch means of said third circuit, said pressure responsive switch means opening in response to a predetermined pressure condition but remaining closed in the absence of such condition to provide for closing of said third circuit upon closing of said first switch means, said third circuit when closed being operative to short-circuit the relay holding circuit.

5. Time-delay electrical controlling means as set forth in claim 1, wherein said thermal delay-action device includes a thermally responsive member, a heating coil in said second circuit for heating said member, and a switch operating element movable in one direction only by said member upon heating thereof and in the opposite only upon deenergization of said relay.

6. Time-delay electrical controlling means as set forth in claim 1, wherein normally closed switch means are provided in said second circuit, and wherein said thermal delay-action device includes a thermally responsive member, a heating coil in said second circuit, and a switch-operating element movable by said member upon heating thereof in one direction to open said normally closed switch means and in the opposite direction upon deenergization of the relay.

7. Time-delay electrical controlling means as set forth in claim 1, wherein said thermal delay-action device includes a thermally responsive element connected in said third circuit and adapted to complete said circuit when cool, and a heating coil connected in said second circuit for heating said thermally responsive element.

8. In a switching device, a first circuit, a relay energized upon closing of said circuit, a supervised circuit energized upon energization of the relay, thermal delayed-action means operative upon energization of the relay to maintain said supervised circuit closed throughout a cycle of heating and cooling, and a supervisory circuit connected in parallel to said supervised circuit and including a normally closed pressure-responsive switch means opening only in response to a predetermined pressure condition, said supervisory circuit being conditioned for closing upon the completion of said cycle and being closed upon the pressure responsive switch means remaining closed, thereby to effect deenergization of the relay and consequent opening of the supervised circuit.

9. In a switching device, a source of electrical energy, a first circuit, means for momentarily energizing said first circuit from said source, a relay initially energized upon energization of the first circuit, a supervised circuit connected to said source through said relay and in parallel to said first circuit, a relay holding circuit connected in parallel to said supervised circuit and operative to maintain the relay energized following opening of the first circuit, thermal delay-action means operative upon energization of the relay

to maintain the supervised circuit closed throughout a cycle of heating and cooling, and a supervisory circuit connected in parallel to said supervised and relay holding circuits and adapted when closed to short-circuit the relay holding circuit and thereby effect deenergization of the relay, said supervisory circuit including normally closed pressure-responsive switch means opening only in response to a predetermined pressure condition, said supervisory circuit being conditioned for closing upon completion of said cycle and being closed through the pressure-responsive switch means upon the latter remaining closed.

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