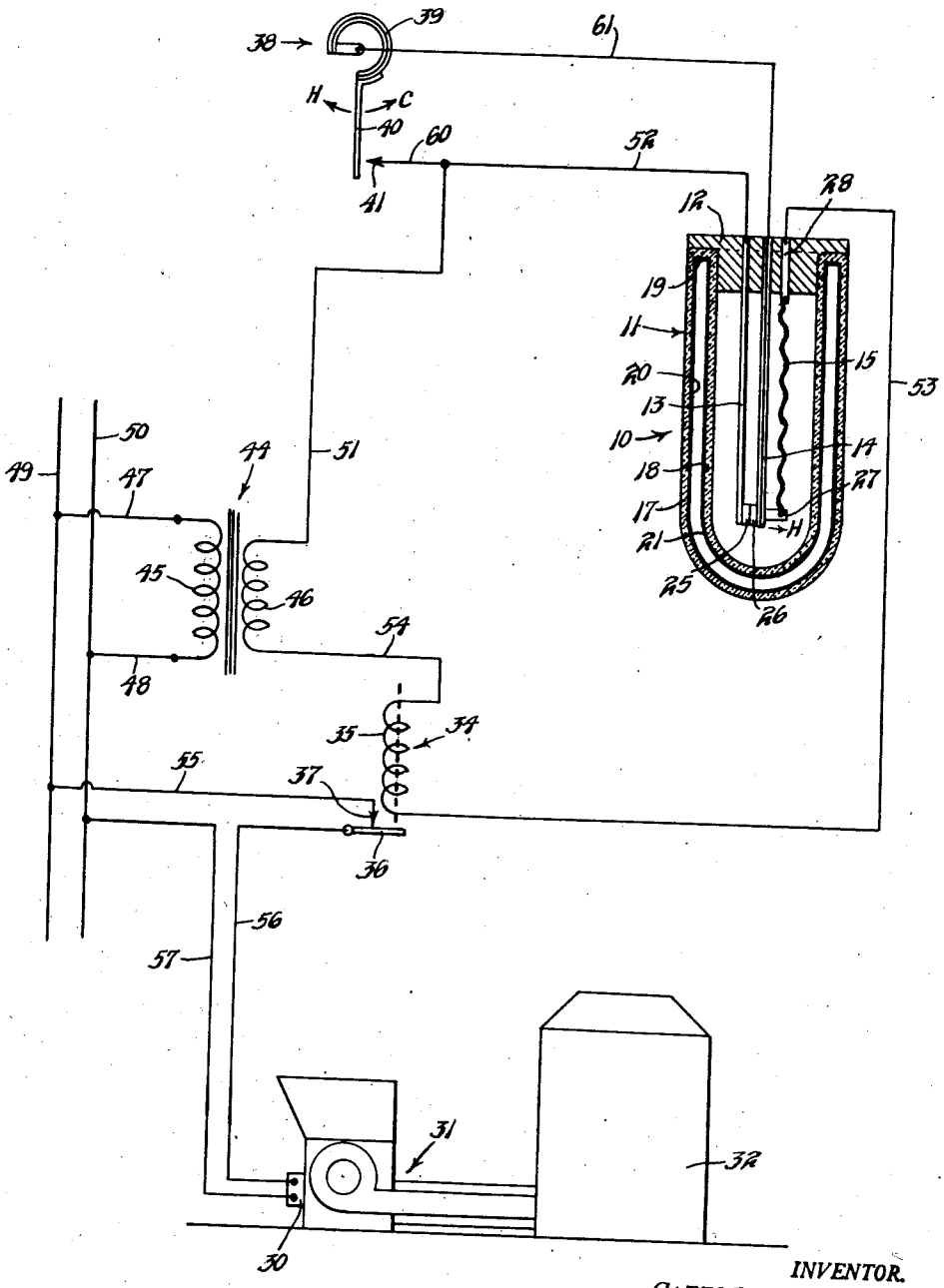
Sept. 14, 1943. G. I. HOLMES 2,329,614

TIMING DEVICE

Filed July 8, 1942



INVENTOR.
GIFFORD I. HOLMES
BY
George H. Fisher
ATTORNEY

Patented Sept. 14, 1943 2,329,614

UNITED STATES PATENT OFFICE

2,329,614

TIMING DEVICE

Gifford I. Holmes, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

Application July 8, 1942, Serial No. 450,159

6 Claims. (Cl. 200—122)

The present invention is concerned with a timing device and more particularly with one employing a thermally operated timing element.

A broad object of the invention is to provide a thermal timing device in which a high degree of heat insulation is obtained so as to provide relatively long cooling periods as compared with the heating periods.

A still further object of the invention is to provide such a timing device in which means is provided for predetermining the rate of cooling.

A still further object of the invention is to provide such a timing device in which the timed device is a switch.

These and other objects which will be apparent from the accompanying specification, claims, and drawing, are accomplished broadly by providing a double walled receptacle in which the walls are provided with a reflecting coating and in which the space between the walls is evacuated so as to decrease the heat conductivity therebetween. The various timing elements including a thermosensitive element and a heater are mounted through an opening in said receptacle which is sealed by a plug of predetermined heat conductivity. This plug serves to support the timing element and provide means for connecting them with external conductors.

The drawing shows a sectional view of my new timing device in the form of a time switch. In the drawing, the time switch acts as a controlling element in a stoker control system which is shown schematically for convenience of illustration.

Referring to the drawing for a more detailed understanding of the invention, my improved timing device is generally indicated by the reference numeral 10. This timing device comprises generally a double walled receptacle 11 and a closure plug 12 supporting a contact carrying strip 13, a bimetallic strip 14 and a heater 15. These various elements will now be described in more detail.

The double walled receptacle 11 comprises two spaced walls 17 and 18. The walls 17 and 18 are uniformly spaced throughout, being connected together at their ends by an annular portion 19 so as to form a sealed chamber. The innermost surface of outer wall 17 is provided with a silver coating 20. A similar silver coating 21 is provided on the outer surface of the inner wall 18. These silver coatings 20 and 21 act as reflecting coatings to reflect back heat either entering or leaving the receptacle. The space between the walls 17 and 18 is evacuated so as to decrease the heat conductivity through this space. The evacuation of this space, together with the fact that the space is sealed, prevents the silver coatings 20 and 21 from becoming tarnished.

It will be noted that the receptacle 11 is in the form of an elongated open ended chamber. The plug 12 is sealed in the open end of this chamber and acts as a closure. The plug 12 is preferably of material of predetermined heat conductivity so that by selecting a plug of the proper material, any desired rate of cooling of the timer may be obtained.

The contact carrying strip, the bimetallic element 14 and the heater 15 are supported by the plug 12 longitudinally of the receptacle. Associated with the contact carrying strip 13 and the bimetallic element 14 are contacts 25 and 26. As indicated by the legend adjacent the lower end of the bimetallic element 14 the bimetallic element 14 is adapted to warp to the right upon being heated. Such warping movement will cause separation of contacts 25 and 26.

The heater element 15 extends longitudinally of the bimetallic element for substantially the full length thereof. At its lower end it is electrically connected by a conductive member 27 to contact 26 through bimetallic element 14. At its upper end it is secured to a terminal strip 28 extending through the plug 12.

When the heater 15 is energized, the bimetallic element 14 is heated so that it warps to the right causing separation of contacts 25 and 26. This not only breaks a controlled circuit in a manner to be described later, but it also interrupts the circuit to heater 15. The contacts 25 and 26 are not reengaged until the bimetallic element 14 has cooled to the point where such reengagement is possible. Because of the extremely small heat conductivity through the evacuated space between the two walls and due to the tendency of the silvered surfaces 20 and 21 to reflect back any heat tending to leave, the majority of the heat leaving the receptacle is that conducted by plug 12. Obviously, by forming the plug of material having a desired rate of heat conductivity, a cooling period of any desired length can be obtained.

The timing switch is shown in the drawing as an element of a stoker control system in order to better illustrate the operation of the switch. In a conventional type of stoker control system, it is desirable to provide some means for periodically causing operation of the stoker when the

thermostat is not calling for heat. Unless the stoker is periodically operated in this manner, there is danger, particularly in mild weather, of the fire being extinguished.

Referring specifically to the stoker control system shown in the drawing, this stoker control system is employed to control the motor 30 of a stoker generally indicated by the reference numeral 31. This stoker serves to feed coal to a furnace 32 and comprises means for supplying the proper draft to the fuel bed of the furnace. A relay 34 directly controls the operation of the stoker motor 30. This relay comprises a relay coil 35, a relay switch blade 36, and a switch contact 37. The relay switch blade 36 is normally biased out of engagement with contact 37 by gravity or any other suitable biasing means. Upon the relay coil 35 being energized, the switch blade 36 is moved into engagement with contact 37.

A room thermostat 38 is employed to control the operation of the stoker in conjunction with the time switch 10. This thermostat comprises a bimetallic element 39 to which is secured a contact arm 40. The contact arm 40 is movable into and out of engagement with a fixed contact 41. The bimetallic element is so arranged that upon a drop in the temperature affecting the bimetallic element, it moves the contact arm 40 to the right towards contact 41. On the other hand, when the temperature rises the contact arm 40 is moved to the left away from contact 41. This is indicated in the drawing by the legends "C" and "H."

Power for operation of the relay 34 is supplied by a step-down transformer 44. This transformer comprises a line voltage primary winding 45 and a low voltage secondary winding 46. The line voltage primary winding 45 is connected by conductors 47 and 48 to line wires 49 and 50 leading to any suitable source of power (not shown).

Operation

The various elements are shown in the position they occupy when the room thermostat 38 is satisfied. Under these conditions, the stoker is being operated under the control of the time switch 10. It is to be noted that with the elements in the position shown, an energizing circuit is established to relay winding 35 of relay 34 as follows: from the upper terminal of secondary winding 46 through conductors 51 and 52, contact strip 13, contacts 25 and 26, conductive element 27, heater 15, terminal strip 28, conductor 53, relay winding 35, and conductor 54 to the lower terminal of secondary winding 46. Because of this circuit, the relay is in its energized position in which switch blade 36 is in engagement with contact 37. This in turn results in the following circuit to stoker motor 30 being closed: from line wire 49 through conductor 55, contact 37, switch blade 36, conductor 56, stoker motor 30, and conductor 57 to the other line wire 50. Because of the closure of the circuit, the stoker motor 30 is opened so as to cause fuel and air to be supplied to the furnace 32.

It will be noted that the circuit traced to relay winding 35 included the electric heater 15. Because of this, the electric heater 15 will operate to heat the bimetallic element 14 so that this bimetallic element will tend to warp to the right. After a predetermined heating period has elapsed, contacts 25 and 26 will be separated. When they do separate, the circuit traced to the relay coil 35 is interrupted so as to cause deenergization of relay 34. Such deenergization results in interruption of the circuit traced to stoker motor 30 so that the stoker is placed out of operation. Separation of contacts 25 and 26 also causes the circuit through heating element 15 to be interrupted so that bimetallic element 14 is no longer being heated by this heater and hence begins to cool. This cooling is relatively slow, however, due to the fact that the space within the receptacle has also been heated to a certain degree by the heater 15 and the heat passes out of the receptacle at an extremely slow rate, largely determined by the heat conductivity of the plug 12. As a result, a considerable cooling time elapses before contacts 25 and 26 reengage. In one typical case, the timing device is so constructed as to provide a two minute period during which the contacts 25 and 26 are closed and a thirty minute cooling period during which contacts 25 and 26 are opened.

If during this cooling period the thermostat 38 does not call for heat, contacts 25 and 26 will reclose so as to reestablish the energizing circuit to relay coil 35 previously traced. This in turn will cause operation of the stoker for another "heating" period. It will be seen that, disregarding the action of thermostat 38, the time switch 11 serves to periodically operate the stoker 30 for brief periods of time.

When the thermostat 38 calls for heat, that is, when the temperature adjacent bimetallic element 39 drops sufficiently to cause engagement of contact arm 40 with contact 41, the following circuit is established to relay coil 35: from the upper terminal of secondary winding 46, through conductors 51 and 60, contact 41, contact arm 40, bimetallic element 39, conductor 61, bimetallic element 14, conductive element 27, heater 15, terminal strip 28, conductor 53, relay coil 35, and conductor 54 to the lower terminal of secondary winding 46. This, in turn, causes relay 34 to move to its energized position so as to cause closure of the energizing circuit to the stoker motor 30, previously traced. It will be noted that the circuit just traced is independent of contacts 25 and 26 so that the stoker will continue to operate so long as thermostat contact blade 40 is in engagement with contact 41. When the temperature in the space due to operation of the stoker 31 has risen sufficiently to cause operation of contacts 40 and 41, the circuit just traced will be interrupted so as to cause termination of the operation of the stoker.

It would be undesirable for the timer 10 to cause operation of the stoker immediately after a prolonged operation of the stoker under the control of the thermostat 38. With the system shown in the drawing, this is avoided. It is to be noted that the thermostat circuit to relay coil 35 extends through the heating element 15. Thus, so long as the thermostat 38 is calling for heat the heater 15 is being energized. The heater 15 is thus effective normally to cause separation of contacts 25 and 26. These contacts cannot reclose, moreover, until the heat produced by the energization of heater 15 has been dissipated. Obviously, when the thermostat has been calling for heat for a substantial period of time, the cooling period will necessarily be somewhat greater than with a normal operation of the timer 10. This insures that the timer 10 will not cause the stoker motor 30 to be placed into operation as quickly as it would if it had been previously operated for merely a short period under the con-

trol of the timer 10. Where, however, the thermostat has called for stoker operation for only a very short period, the cooling period of timer 10 may be relatively short. Thus, the operation of timer 10 is adjusted so that it properly cooperates in the control of the stoker motor 30 without thermostat 38.

As previously noted, any desired rate of cooling can be obtained by properly selecting the material of which plug 12 is made. Plug 12 hence not only acts as a support for the timing elements but also as a means of determining the timing of the timing device. A further function of the plug 12 is that of providing means for connecting the timing elements to external conductors. It will be noted from the preceding description that contact carrying blade 13 is connected to conductor 52, bimetallic element 14 to conductor 61, and heater 15 to conductor 53 by means of terminal strip 28. Thus, the plug 12 provides means by which the elements 13, 14 and 15 located entirely within the receptacle 11 are connected to other circuit elements.

The silver reflecting coatings 20 and 21, as previously noted, not only serve to prevent the heat from leaving the receptacle but also serve to retard the entrance of heat into the receptacle. Because of this, the timing period is relatively unaffected by changes in ambient temperature. This freedom from the effects of changes in the ambient temperature can be further increased by adjusting the timer so that the switch contacts 25 and 26 are closed at a temperature considerably above ambient temperature. If this is done, the temperature within the receptacle will always be substantially above the ambient temperature so as to be relatively unaffected by ambient temperature.

It will be seen that I have provided an extremely simple thermal timing device particularly adaptable for use as a timing switch in a stoker control system. While it is particularly suitable for this application, it obviously can be employed in many other applications where it is desirable to have relatively short heating periods as compared with the cooling periods. In general, while I have shown a specific embodiment of the invention, it is to be understood that this is for purposes of illustration and that the invention is to be limited only by the scope of the appended claims.

I claim as my invention:

1. A thermal time switch comprising a thermally operated switch, a heater therefor, a double walled receptacle completely enclosing said switch and heater except for an opening in said receptacle, and a separate plug of material of predetermined heat conductivity closing the opening in said receptacle.

2. A thermal time switch comprising a thermally operated switch, a heater therefor, a double walled receptacle completely enclosing said switch and heater except for an opening in said receptacle, and a separate plug of material of predetermined heat conductivity closing the opening in said receptacle, said switch and heater being secured to said plug and supported thereby.

3. A thermal timing device comprising a double wall receptacle having an opening through the two walls thereof, the space between the walls of said receptacle being evacuated to decrease the heat conductivity thereof, a thermosensitive element, an element actuated thereby, a heater for heating said thermosensitive element, and a separate plug closing said opening and supporting said thermosensitive element, said actuated element, and said heater within said receptacle.

4. A thermal timing device comprising a double wall receptacle having an opening through two walls thereof, the outer surface of the inner wall and in the inner surface of the outer wall of said receptacle being provided with a reflecting coating and the space between said walls being evacuated to decrease the heat conductivity thereof, a thermosensitive element, an element actuated thereby, a heater for heating said thermosensitive element, and a separate plug of material of predetermined heat conductivity closing said opening and supporting said thermosensitive element, said actuated element, and said heater within said receptacle.

5. A thermal timing device comprising a double wall receptacle having inner and outer spaced cylindrical walls both closed at one end and integrally joined together at their opposite open ends so as to provide a sealed chamber between said walls, said chamber being evacuated to decrease the heat conductivity thereof, a thermosensitive element, an element actuated thereby, a heater for heating said thermosensitive element, and a separate flanged plug of material of predetermined heat conductivity projecting into and closing the open end of said inner wall with the flange thereof overlying the joint between said inner and outer walls, said plug closing said opening and supporting said thermosensitive elements, said actuated element, and said heater within said receptacle.

6. A thermal time switch comprising a double wall receptacle having inner and outer spaced cylindrical walls both closed at one end and integrally joined together at their opposite ends so as to provide a sealed chamber between said walls, said chamber being evacuated to decrease the heat conductivity thereof, a thermosensitive element, a first contact position thereby, a second contact, a contact carrying strip therefor, a heater for heating said thermosensitive element to cause separation of said contacts, said thermosensitive element being so disposed with respect to said contacts carrying strip that said contacts are re-engaged when the temperature of said thermosensitive element is still substantially above ambient temperature, and a separate flanged plug of material of predetermined heat conductivity projecting into and closing the open end of said inner wall with the flange thereof overlying the joint between said inner and outer walls, said plug closing said opening and supporting said thermosensitive element, said contact carrying strip, and said heater with said receptable.

GIFFORD I. HOLMES.