April 18, 1950 G. D. BOWER 2,504,174

HIGH-LOW CONTROL FOR POT-TYPE BURNERS

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Fig. 1.

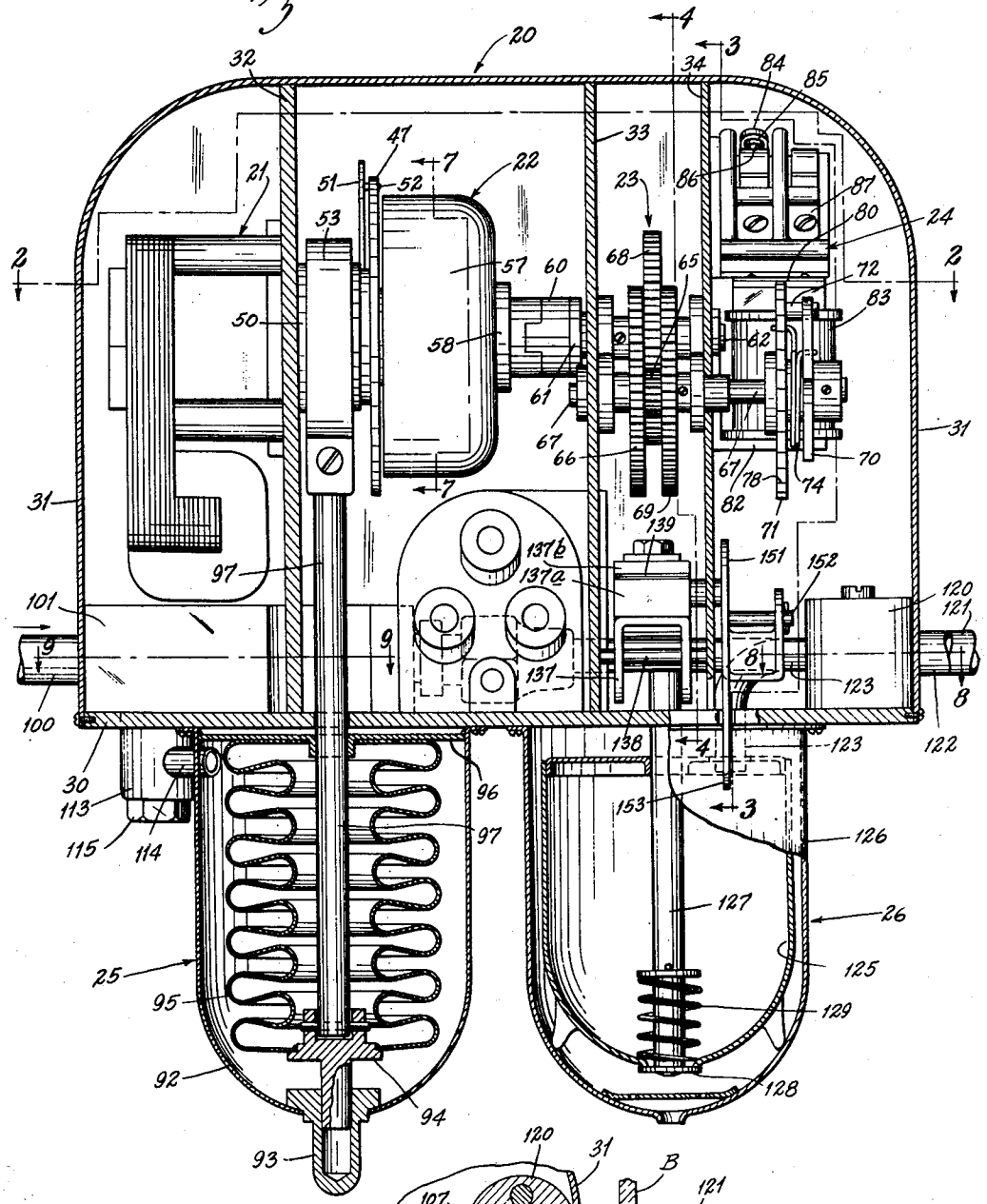


Fig. 8.

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HIGH-LOW CONTROL FOR POT-TYPE BURNERS

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Fig. 2

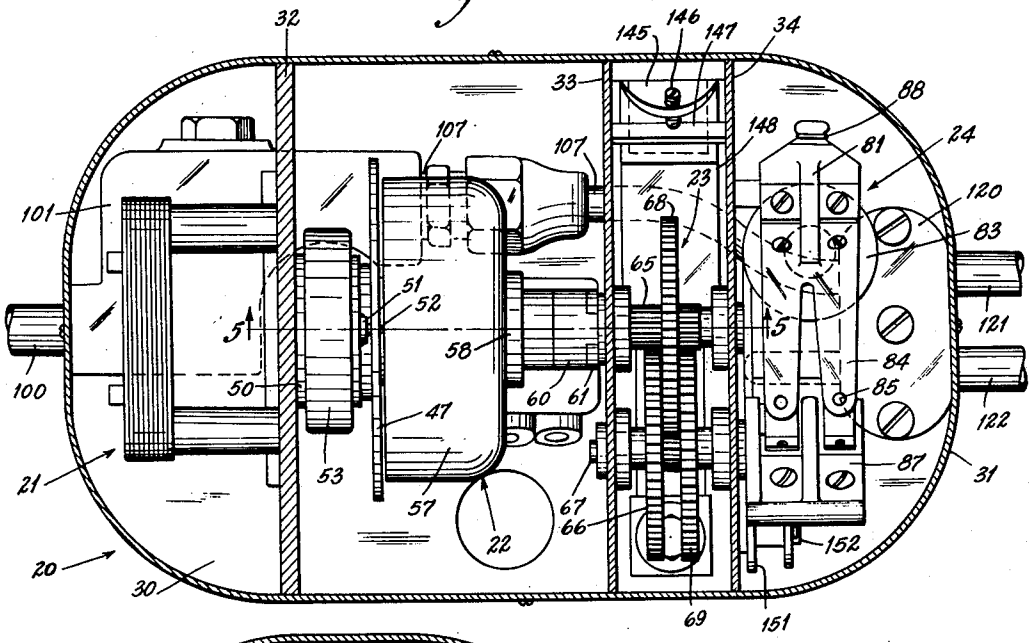


Fig. 3.

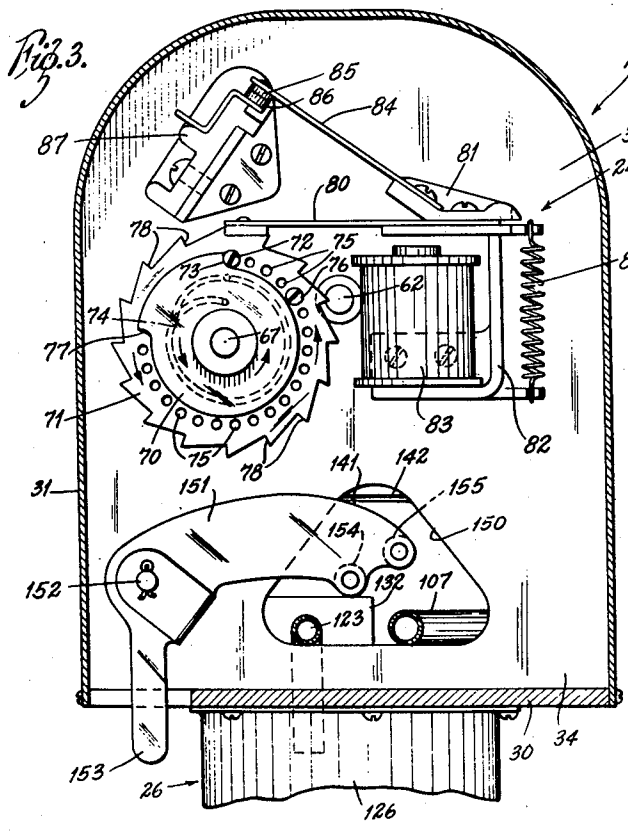
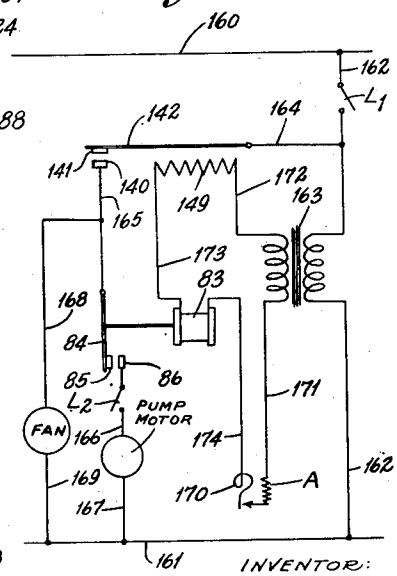


Fig. 11.



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HIGH-LOW CONTROL FOR POT-TYPE BURNERS

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Fig. 9.

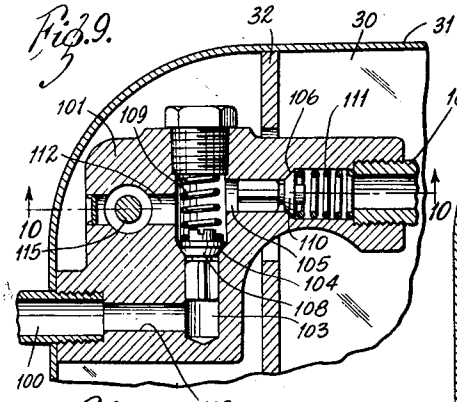


Fig. 10.

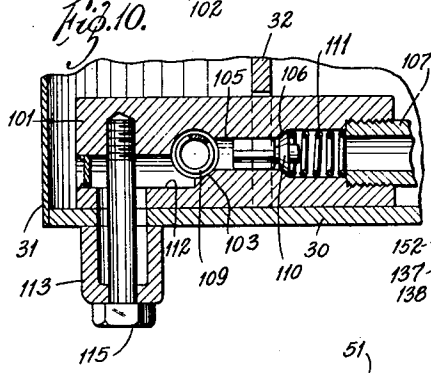


Fig. 4.

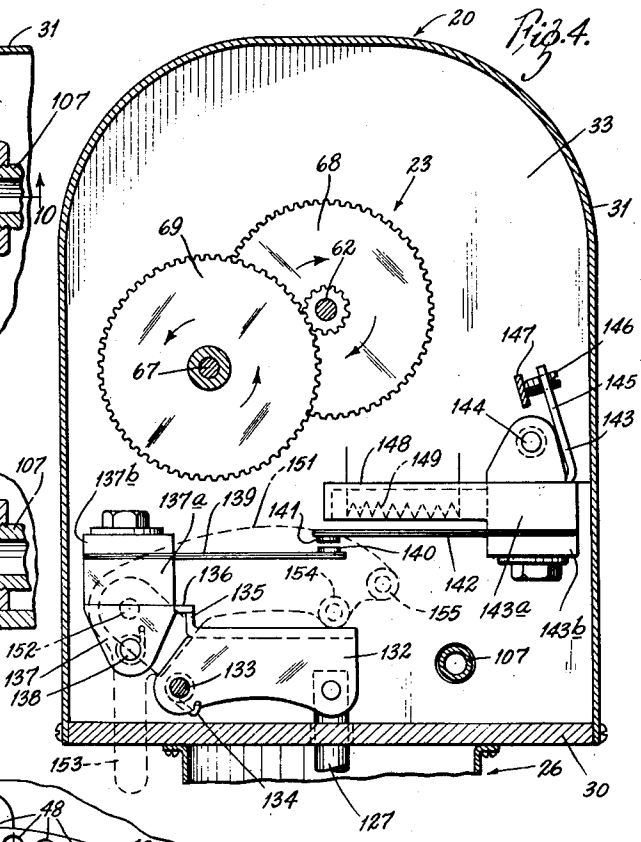
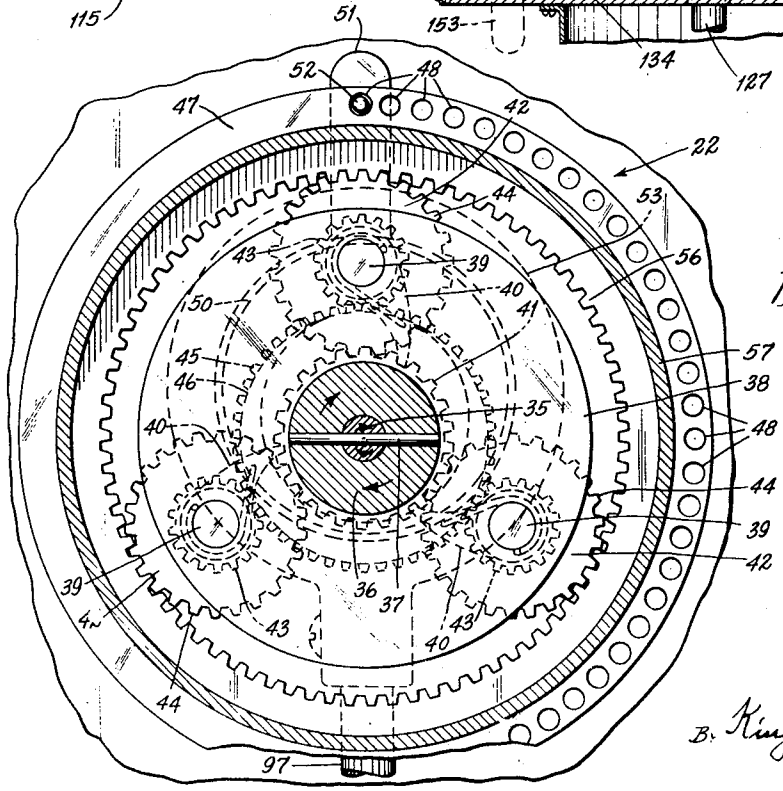


Fig. 7.



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HIGH-LOW CONTROL FOR POT-TYPE BURNERS

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Fig. 5.

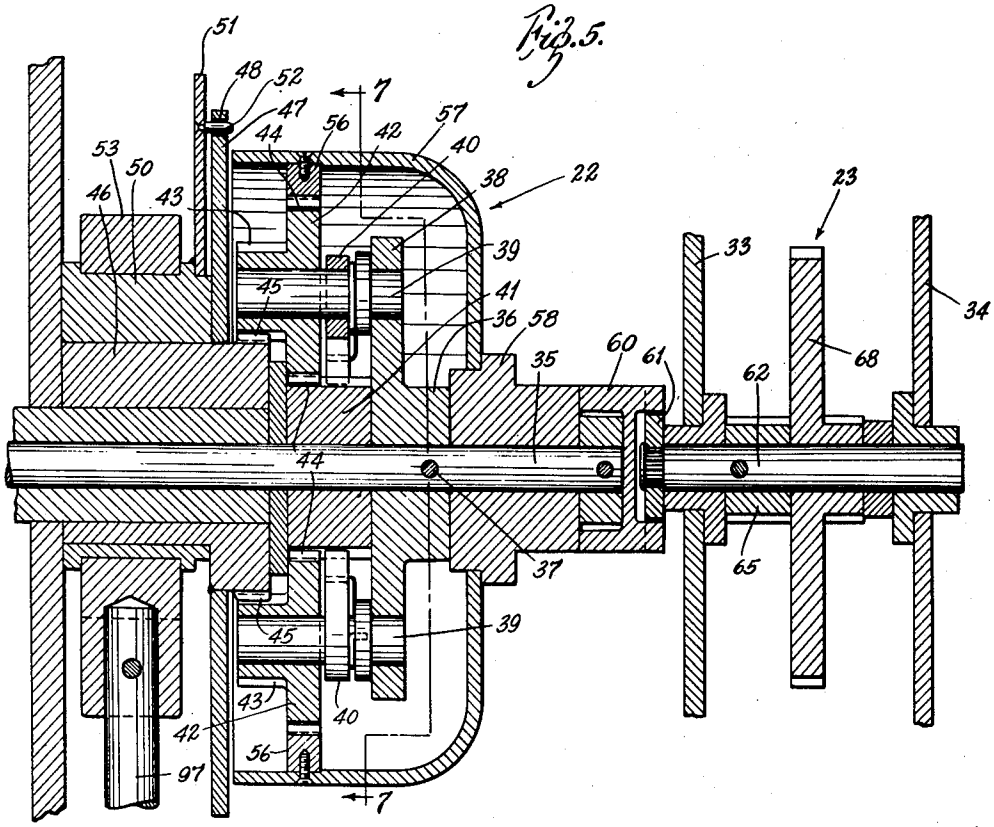
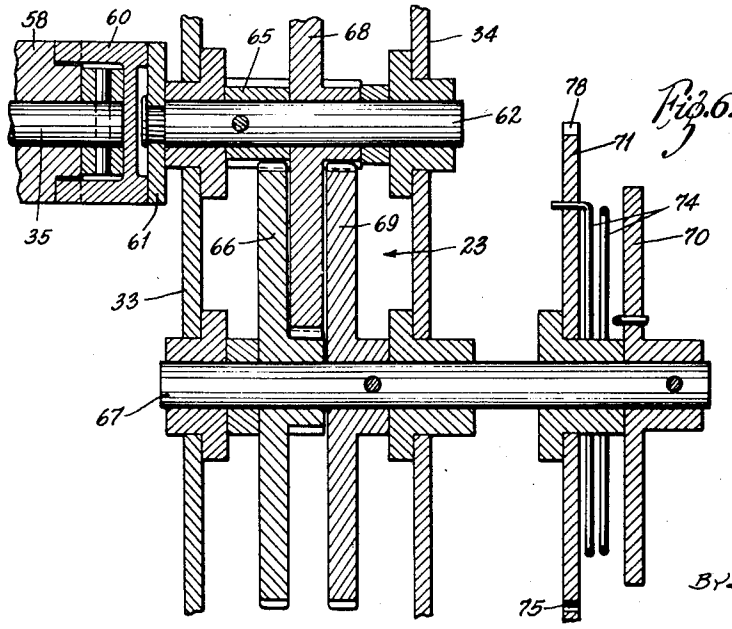


Fig. 6.



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Patented Apr. 18, 1950

2,504,174

UNITED STATES PATENT OFFICE

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HIGH-LOW CONTROL FOR POT-TYPE BURNERS

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Application December 17, 1943, Serial No. 514,587

13 Claims. (Cl. 158—28)

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The present invention relates to a liquid fuel burner, and a control therefor.

An object of the invention is to provide a fuel feeding means which will feed fuel to a burner at a definite rate regardless of the consistency of the fuel. More particularly, this object is to provide a fuel feeding means which feeds fuel as a function of a pumping mechanism, rather than as a function of the force of gravity.

Another object is to provide a means for adjustment of the rate of fuel feed which is easily and quickly changed and which may be changed without the use of tools.

A further object is to provide a two stage or high-low control which may be controlled by any two wire thermostat.

A further object is to provide a control that will shift from low rate to high rate as a function of time and trend.

A further object is to provide a control applicable to pot type burners which maintains a circulating fan for the combustion air in operation for a period after the fuel feed has stopped, so as to burn out or scavenge any fuel left in the burner.

A further object is to provide a readily operable adjustment for the high-low mechanism.

A further object is to provide a pot type burner control without floats or needle valves.

A further object is to provide a drip bucket safety mechanism wherein the drip bucket is permanently enclosed and protected against obstructions to its operation and against mishandling.

A further object is to provide a mechanism for emptying the drip bucket after a safety shut down, which is automatic, avoiding handling and which prevents accidental resetting of the control into a position to permit operation of the burner unless the drip bucket mechanism is in condition to provide subsequent safety shut down when necessary. This safety shut down mechanism includes a "trip-free" reset device.

A further object is to provide a control embodying a timing mechanism, a pump and a drip bucket mechanism interrelated but contained in a single unit, the interrelation of which permits separation of the individual elements thereof.

In the drawings:

Fig. 1 (Sheet 1) is a side elevation of the mechanism partly in section;

Fig. 2 (Sheet 2) is a view taken on the line 2—2 of Fig. 1, and is a plan view of a mechanism with the cover shown in section;

Fig. 3 is an elevation view from the right end

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of Fig. 1, partly in section, taken on the line 3—3 of Fig. 1, and showing the relay, and the reset mechanism for the drip bucket;

Fig. 4 (Sheet 3) is a vertical section on the line 4—4 showing the gear mechanism and showing an additional part of the drip bucket control;

Fig. 5 (Sheet 4) is a mid section on the line 5—5 of Fig. 2 showing the pump drive, the epicyclic gearing, and part of the second gear train but with the spacing of the gears spread for clarity;

Fig. 6 is a horizontal section through the second gear train;

Fig. 7 (Sheet 3) is a further view of the epicyclic train taken on the line 7—7 of Fig. 1;

Fig. 8 (Sheet 1) is a view of the drip bucket connections taken on the line 8—8 at the right side of Fig. 1 just below the middle thereof;

Fig. 9 (Sheet 3) is a view of the oil line connections taken on the line 9—9 at the left side of Fig. 1 just below the middle;

Fig. 10 is a section on line 10—10 of Fig. 9; and

Fig. 11 (Sheet 2) is a wiring diagram of the mechanism.

In general, the mechanism comprises a control unit 20 including a timing motor 21, an epicyclic 22, a second gear train 23, a relay switch mechanism 24, a pump 25, and a drip bucket mechanism 26.

The mechanism includes a base plate 30 and a cover 31 extending upwardly from the base plate with three partitions 32, 33, and 34 secured to the base and adapted to support some of the component elements of this mechanism.

The timer 21 comprises an electric motor of conventional type that drives a shaft 35 (Figs. 5–7). The timer 21 is mounted at one side of the partition 32, and the shaft 35 passes through this partition to the other side thereof.

A hub 36 is secured to the shaft 35 by a pin 37. The hub 36 has a disc or wheel 38 extending therefrom. This disc 38 supports a plurality of pins 39. Each of the pins 39 supports a pawl 40, which pawls engage a pinion 41 floating on the shaft 35. The pins 39 also support planetary gears 42, having a first set of teeth 43 and a second set of teeth 44.

The teeth 43 mesh with teeth 45 on an eccentric 46 rotatable on a bushing that supports the shaft 35. The eccentric 46 carries a dial 47 having holes 48 around one half of its periphery. These holes comprise graduations for a purpose to be described.

A second eccentric 50 is rotatable on the eccen-

tric 46. It carries a spring finger 51 that has a pin 52 engageable in any of the holes 48. The outer eccentric 50 carries a strap 53 for operating the pump mechanism as will appear.

Returning to the second set of teeth 44 on the planetaries 42, these teeth mesh with those on an internal ring gear 56, secured to a case 57 attached to a hub 58, rotatably mounted on the shaft 35. The hub 58 receives a coupler 60 by which it may be coupled with, or decoupled from, a complementary coupling element 61 on a second shaft 62 that projects through the partition 33 and is journaled therein. The other end of this shaft 62 is journaled in the partition 34.

The shaft 62 operates part of the second gear train 23. A pinion 65 is secured to the shaft 62 and engages the larger teeth of a double gear 66. The gear 66 is mounted on a shaft 67 supported in the partition 33 and supported in and extending through the partition 34. The smaller teeth of the gear 66 mesh with the larger teeth on a gear 68 rotatably mounted on the shaft 62. The smaller teeth on this gear 68 mesh with a gear 69 secured to the shaft 67. From the foregoing, it will be seen that the shaft 67 rotates at a much lower speed than does the shaft 62. The size of the several gears of this second gear train 23 may be selected to give the desired speed reduction.

Rigidly mounted on the end of the shaft 67 is a stop plate 70. This plate (Figs. 1, 3, and 6) cooperates with a timing disc 71, rotatably mounted on the shaft 67, and from which a pin 72 extends. The pin 72 is normally maintained in engagement with an edge 73 on the stop plate 70 by a coil spring 74. The timing disc 71 also has a series of screw receiving holes 75 around it, to receive a screw 76 which is disposed in any one of them for proper adjustment as will appear. The disc 71 may be rotated until it brings the pin or screw 76 against another edge 77 of the stop plate 70.

The timing disc 71 has notches 78 for engagement by a blade 80 of the relay mechanism 24. This blade is secured to a bracket 81 pivotally mounted on another bracket 82 that supports a relay coil 83 on the partition 34. The bracket 81 carries also a switch blade 84, having a contact 85 that may close with a contact 86 on a bracket 87 secured to the partition 34. A coil spring 88 acts between a projection on the bracket 81 and a projection on the bracket 82, to urge the arm 80 away from the timing disc 71 and the switch arm 84 to break the contacts 85 and 86. When the coil 83 is energized it operates the bracket 81 in the opposite direction, to bring the arm 80 into the upper one of the notches of the contact disc 71, and to close the contacts 85 and 86.

The pump 25 comprises an outer shell 92 secured to the bottom of the plate 30 (Fig. 1). A guide pin 93 in the bottom of the shell 92 supports a projection on a bellows end 94. This portion 94 is sealed to one end of a pump bellows 95, the other end of which is sealed to a plate 96. The fitting 94 also receives one end of the pump connecting rod 97, the other end of which is secured to the strap 53 surrounding the eccentric 50.

A pump inlet 100 enters from the left of Fig. 1 and, as shown in Fig. 9, is secured to a fitting 101 disposed on the base 30. This fitting has a port 102 registering with a cross port 103 provided with a valve seat 104. The cross port 103 above the valve seat communicates with a

cross port 105 having a valve seat 106 therein, and beyond this latter valve seat connects with a pipe 107.

The valve seat 104 receives a check valve 108 urged into the closed position by a spring 109. This check valve 108 prevents back flow of oil into the inlet 100.

A second check valve 110 cooperates with the valve seat 106 against which it is normally urged by a spring 111. This check valve 110 prevents back flow of oil from the line 107.

Within the fitting 101 and also communicating with the port 103 above the valve 108 is another port 112. This port 112 is in communication with the interior of a cup 113 from which a pipe 114 (Fig. 1) extends into the interior of the pump casing 92. The cup 113 is secured in position by a screw 115.

From the description thus far, it may be seen that alternate suction and pressure within the pump chamber 92, provided by contraction and expansion of the bellows 95, will draw oil on through the inlet 100 past the valve 108, and then expel that oil past the valve 110 into the line 107.

The line 107 is connected through a fitting 120 to join with a line 121 that leads to the pot B of the oil burner. Another pipe 122, comprising an over-flow pipe from the oil burner B, leads into the fitting 120 and connects with a pipe 123 leading into a drip bucket 125, within a casing 126. The casing 126 has drainage holes in the bottom.

The float or drip bucket 125 has within it and extending from it a rod 127. This rod extends through the bottom of the bucket 125 and has on its end a valve 128, urged by a spring 129 into closed position. The spring 129 urges the rod 127 upwardly but may be compressed to drain off any oil or the like that passes into the bucket.

The upper end of the rod 127 passes through the bottom plate 30 and is pivotally secured to a bracket 132 (Fig. 4) that, in turn, is pivoted at 133 between the partitions 33 and 34. A torsion spring 134 acts to hold the bracket 132 and the bucket 125 up, with a light force. The bracket 132 has a projecting dog 135. The dog 135 is adapted, when elevated by the spring 134, to rest under and support a ledge 136 projecting from a U-shaped bracket 137 pivoted at 138 between the partitions 33 and 34. A light torsion spring may be used to urge the bracket 137 clockwise about its pivot 138, as is shown in Fig. 4. It may be observed that upon lowering of the rod 127 the bracket 132 will pivot clockwise (Fig. 4) to withdraw the dog 135 from its support of the ledge 136, whereupon the bracket 137 will fall clockwise.

The bracket 137 carries a bi-metallic switch blade 139, having a contact 140 at the end thereof, and supported on the bracket between two insulating blocks 137a and 137b of porcelain or the like. This contact is adapted to be closed with the contact 141 on a second bi-metallic blade 142 that is secured to a bracket 143, between two insulating blocks 143a and 143b of porcelain or the like. The bracket 143 is pivoted at 144 to the partition 33, and urged in a counterclockwise direction about its pivot by a light torsion spring, as shown. An arm 145 on the bracket 143 carries an adjustable screw 146 engageable with a lug 147 supported between the partitions 33 and 34 adjustably to limit counterclockwise (Fig. 4) movement of the bracket 143.

This adjustment determines the initial relative positions of the contacts 140 and 141.

The bracket 143 likewise carries a heater shield 148 supporting an electrical heating coil 149 that is in a circuit to be described, and which is adapted to influence the bi-metallic blade 142. The blade 139 is subject to ambient temperature, and compensates for effects of changes in ambient temperature on the blade 142. It may be seen that the initial relative positions of the contacts 140 and 141 determine the length of time required for their closing and opening after energizing or deenergizing of the heater coil.

The partition 34 has an opening 150 therein (Fig. 3). On the right side of the partition 34 in Fig. 1, as appears also in Fig. 3, is a trip-free reset lever 151 pivoted at 152. It has a handle portion 153 projecting through a slot in the bottom plate 30.

The inner end of the lever 151 has on it two insulative members 154 and 155 that project back through the opening 150 to be disposed respectively for contact with the switch blades 139 and 142. The member 154 rests upon, and is adapted for depression of, the bracket 132. It will be seen that when the handle 153 is pressed back, it will lift the members 154 and 155. These latter are so spaced that the member 155 may engage the blade 142 and pivot it with its bracket 143, and the member 154 may engage the blade 139 and pivot it with its bracket 137, so that the bracket 137 can be displaced to enable the ledge 136 to pass over the dog 135. But when the two blades 139 and 142 are engaged by their respective members 154 and 155, the contacts 140 and 141 will be maintained out of engagement. When the handle 153 is drawn out, it will force the member 154 down against the bracket 132, causing depression of the rod 127, to open the valve 128 to drain any oil in the bucket 125.

The wiring diagram in Fig. 11 shows power lines at 160 and 161. A line 162 connects through a limit switch L_1 into the primary of a transformer 163 and leads therefrom to the other power line 161. A second line 164 connects into the line 162, inside the limit switch L_1, and leads to the blade 142 and the contact 141, which may close with the contact 140. That contact, in turn, is connected by a line 165 to the switch blade 84, which controls the contact 85. The contact 86 is connected by a line 166 through a limit switch L_2 to the pump motor which, in turn, is connected by a line 167 to the other power line 161. An additional line 168 is connected to the line 165 between the contact 140 and the switch blade 84 and leads to the fan motor which, in turn, is connected by a line 169 to the line 161.

The secondary circuit includes a room thermostat 170, one side of which is connected by a line 171 to the secondary. This thermostat may have an anticipating heater A. Thence, from the secondary, the line 172 leads into the heater 149. The other side of the heater 149 is connected by a line 173 into the coil 83 of the relay 24, the other side of which is connected by a line 174 back to the thermostat 170.

Operation

It will be seen that transformer 163 is always across the lines. When the room thermostat 170 closes, demanding heat, it energizes the coil 83 to draw the bracket 81 down, closing the contacts 85 and 86 and setting the arm 80 against the adjacent one of the teeth 78 of the timing disc 71.

The heater 149, being in circuit, heats up to close the contacts 141 and 140 by warping the blade 142. Thereupon, since the contacts 85 and 86 have been closed previously by the relay coil 83, the pump motor starts operating, and the fan motor is put in circuit to operate. Any excess warping of the blade 142, after closure of the contacts, merely pivots the bracket 143 clockwise about its pivot 144, without materially affecting the blade 139 and associated structure.

When the pump motor starts, the shaft 35 is rotated. This causes rotation of the wheel 38 carrying the pins 39. These pins carry the ratchet dogs 40 which engage with the teeth on the gear 41 and rotate that gear at the same speed as the rotation of the wheel 38. The gear 41 meshes with the planetary gears 42 and they, in turn, mesh with the internal ring gear 56. This latter gear is not held against rotation at the start so that it is rotated as a unit through the foregoing connections with the wheel 38. Since the planetary gears 42 are engaged with the teeth 45 of the eccentric 46, they will cause the eccentric 45 to rotate as a unit with the shaft 35. As the eccentric 45 rotates, it rotates the eccentric 50 with it, and this action lifts and depresses the pump rod 97. This pump rod then oscillates at the frequency of rotation of the shaft 35 and causes oil to be drawn into the inlet 100 and expelled through line 107 and the line 121 to the burner at a predetermined rate.

The rotation of the hub 58, attached to the casing 57, supporting the ring gear 56, causes rotation of the shaft 62 and, through the gear reduction 23, ultimately produces rotation at a slower speed of the shaft 67. The rotation of this shaft rotates the stop plate 70 to withdraw the shoulder 73 thereon from the pin 72 on the now held timing disc 71, which is restrained against rotation by the arm 80. Here, the restraining force applied need only be sufficient to operate the epicyclic 22. In so doing it tightens the spring 74 which applies a restoring force to return the members 70 and 71 to their original relative positions, wherein the pin 72 and the shoulder 73 are in contact.

After a predetermined time of rotation of the pump shaft 35 and the driving shaft 67, the shoulder 77 will engage the pin 76 on the timing disc 71 to stop rotation of the shaft 67. The interval of time is adjustable by changing the pin 76 to another hole 75, it being noted that the shaft 67 is rotated at a rate which will move the stop plate 70 a distance equal to one hole on the timing disc in a time interval approximating one minute. This stopping of the stop plate, in turn, stops rotation of the gear train 23 and ultimately of the ring gear 56. Thereupon, rotation of the wheel 38 causes the planetary gears 42 to rotate within the stationary ring gear 56 and to impart a rotation to the eccentric 45 at a higher rate than before when the casing 57 was free. As a result, the pump operates at a higher speed to deliver greater quantities of oil.

If the room thermostat becomes satisfied during the low feed rate of the pump, it will break the circuit of the coil 83 and of the heater 149. As soon as the coil 83 is deenergized, the spring 88 lifts its armature to break the contacts 85 and 86 and to lift the arm 80 from its notch in the timing disc 71.

The first of the foregoing, namely, the opening of the contacts 85 and 86, stops the pump motor. The second, namely, lifting of the arm 80, permits the timing disc to be rotated by the

spring 74 until it brings its pin 72 against the shoulder 73 on the stop plate at whatever point the pin 72 may have stopped when the motor stopped.

The heater 149 cools relatively slowly after its circuit is broken. Its time for cooling is arranged to keep the fan motor in operation long enough so that proper scavenging of the burner may occur. When it does cool, it permits the blade 142 to separate the contact 141 from the contact 140 and open the circuit to the fan and provide an additional break in the circuit to the pump motor. Its period of heating provides sufficient delay in opening and closing of the contacts 141 and 140 to prevent an immediate change in the position of the contact 141 and the circuits responsive to this contact, should the thermostat open and then reclose quickly.

If the heat delivered during the low stage of pump operation is insufficient to satisfy the room thermostat, then the high stage of operation will begin. Should the room thermostat open during the high stage, the relay coil 83 will be deenergized, the contacts 85 and 86 separated, to stop the motor, the arm 80 will be withdrawn to permit return of the timing disc to its starting position relative to the stop plate, and the heater 149 will slowly cool, holding the contacts 140 and 141 closed for a scavenging period of operation of the fan and finally permitting them to open.

If ignition or combustion fails at any time when the pump is running, oil will build up in the pot to the over-flow level, and will then flow back through the over-flow pipes 122 and 123 into the drip bucket 125. When it builds up to a certain level within the drip bucket 125, it will overcome the effect of the balancing spring 134 and cause the drip bucket to descend, removing the dog 135 from the ledge 136, whereupon the bracket 137 pivots clockwise (Fig. 4) to withdraw the contact 140 from the contact 141. This immediately breaks the circuits to the fan motor and to the pump motor, regardless of the condition of the room thermostat. The control will then return to its starting condition. As the flame is extinguished, no scavenging is required, although, generally speaking, an interval usually elapses before the manual reset is operated, and the heater 149 becomes cool.

When the foregoing drip bucket action occurs, manual reset is required to reestablish operation of the burner. This is accomplished by drawing the handle 153 forward to force the member 154 down against the top of the bracket 132, depressing the rod 127, and opening the valve 128. This position is held until oil stops draining from the bottom of the casing 126, indicating that the excess has drained from the bucket 125. Thereupon the handle 153 is pressed backwardly, to permit the spring 129 to reclose the valve 128 and to cause the member 154, engaging the blade 139, to lift it toward reset position. Prior to any engagement of the contacts 140 and 141, the member 155 will engage the blade 142 and lift it, to keep the contacts apart. The spring 134 lifts the bracket 132 to relocking position (if, and only if, the bucket 125 is empty). Thereupon, release of the handle 153 will permit the bracket 137 to fall, to place its ledge 136 against the dog 135, and to withdraw from both blades, leaving them in operating condition determined by the condition of the heater 149. If the bucket has not been emptied during this last operation, the latching elements 135 and 136 will not engage, and the contacts will never be disposed in position to close. It will be seen that even if the blade 142 is in warped position, closure of the contacts cannot occur unless the bucket is emptied.

It may be desirable to use an anticipating heater in connection with the room thermostat, although the low speed operation prior to the high speed operation tends to prevent, or at least diminish, the over-riding effect caused by the lag in delivery of heat from the burner to the room. When a thermostat is used which has a differential and an anticipating heater, the imperative opening interval of the anticipating heater, based upon constant room temperature, may be less than the length of the low speed operation. This imperative opening interval will be stretched when heat loss is increased, and will permit higher speed operation to overcome such loss.

Two limit switches L_1 and L_2 have been shown in Fig. 11. These switches may take the form of maximum temperature controls conveniently located in the furnace bonnet or stack to open when a maximum furnace temperature is reached. One may be an overall high temperature limit switch. In many cases, one or the other may be eliminated. In case the limit switch L_1 opens, the entire circuit is deenergized. When that limit switch recloses, if the thermostat 170 is closed, the mechanism will start over again on low speed operation, because release of the arm 80 upon deenergization of the coil 83 permits the timing disc and locking disc to assume their relative starting positions. This limit switch may be desirable under conditions where operation of the burner at such intense heats is accompanied by such a lag that usually the thermostat will be satisfied by delivery of such heat to the room during the interval the limit switch is open.

The limit switch L_2 is disposed in the pump motor circuit. When it opens, the pump motor stops. However, the rest of the circuit remains energized as long as the room thermostat remains unsatisfied. The fan will continue operating and the control will remain in whatever position it had attained. Usually, the slow speed operation will be insufficient to cause the limit switch to open. In any case, upon reclosure of the limit switch L_2, the pump motor will restart, and the cycle will proceed as if the hiatus had not occurred. Of course, if the room thermostat opens while the limit switch is open, the control will return to starting position, and, upon reclosure of the limit switch, may start a new cycle.

As previously noted, the second eccentric 50, bearing upon the first eccentric 45 (Fig. 5), is adjustable to have a particular position relative to the first eccentric. It will be seen that when the point of maximum thickness of the eccentric 50 is aligned with the point of maximum thickness of the eccentric 45, the pump rod 97 will be lifted the greatest distance above the center of the shaft 35 and will descend a maximum distance below that line. When the eccentric 50, however, is turned at 180° relative to the eccentric 45, it will present its widest point adjacent the narrowest point of the eccentric 45 and will reduce the lift and fall of the pump rod to a minimum.

To this end, the spring clip 51 may be drawn back to withdraw the pin 52 from the opening 48 in the disc 47, then rotated to shift the eccentric 50 relative to the eccentric 45, and released to reengage the pin 52 in another of the holes 48. Fig. 7 shows that the holes 48 extend over 180° of the disc 47. By this means, the holes 48 comprise graduations, as well as setting holes, and

the pump stroke may be adjusted between minimum and maximum positions.

The interval of the low feed period is determined by the speed of the motor, the reduction effected through the gearing 23 and the angular distance between the pin 76 and the shoulder 77 on the stop plate 70. To change the length of this interval, it is necessary only to change the position of the pin 76 to another hole 75.

It will be seen further that providing teeth around the entire periphery of the timing disc 71 enables that disc to be stopped by the arm 80 substantially immediately after rotation of the shaft begins. The stop plate 70 is fixed to the shaft and its angular position in space is fortuitous, but the only critical factor is the relative positions of the plates 70 and 71.

It will be seen from the foregoing that the invention provides a control that determines the quantitative operation of a burner in response to time and trend. The time factor enters through the fixed interval between the starting low speed operation, and the high speed operation; and the trend factor enters in through the element of how readily the room thermostat may be satisfied.

The control also embodies numerous safety features, such as those described in detail and those apparent from the disclosure.

It is fairly evident how the cycle could be applied to other than heat supply, and particularly its application to a refrigeration cycle. Thus the ultimate drive could be to a compressor pump, to produce a relatively slow operation for an initial predetermined period, and a consequent low refrigeration production for that period. If the refrigeration system involves circulation of a cooling medium, such as brine or air, the control would provide the two-speed operation of the brine pump or air circulator.

What is claimed is:

1. In a control for a liquid fuel burner, power means including a driving member, fuel delivery means operated by said driving member, the quantity rate of fuel delivery of said means being determined by the speed of the driving member, control means to determine the speed of operation of said driving member, said control means having timing mechanism operable to drive said driving member at a first speed for a predetermined time interval, and thereafter to drive the same at a second speed.

2. In a control for a heat-change producing device, power means, means for delivering a heat-change medium adapted to be operated by said power means, planetary gear means interposed between the power means and the delivery means, said planetary gear means including a member movable to produce one speed transmission rate from the power means to the delivery means and fixable to produce another such rate, automatic means operable to hold fixed said movable and fixable means to change the rate of transmission and thereby to change the rate of delivery of said heat-change medium, said last-named means comprising a stop mechanism to stop rotation of the movable and fixable means after a predetermined amount of rotation thereof.

3. In a control for a heat-change producing device, power means, means for delivering a heat-change medium adapted to be operated by said power means, planetary gear means interposed between the power means and the delivery means, said planetary gear means including a member movable to produce one speed transmission rate from the power means to the delivery means and fixable to produce another such rate, automatic means operable to hold fixed said movable and fixable means to change the rate of transmission and thereby to change the rate of delivery of said heat-change medium, said last-named means comprising a stop mechanism to stop rotation of the movable and fixable means after a predetermined amount of rotation thereof, said stop mechanism comprising two relatively movable members, means connecting one member with the movable and fixable member, interengaging means between the two stop mechanism members adapted to be engaged after relative movement of said members, and means to adjust the interengaging means to adjust the amount of relative movement before the members are stopped.

4. In a control for use with a heat-change producing device, power means, means for delivering a heat-change medium adapted to be operated by said power means, planetary gear means interposed between the power means and the delivery means, said planetary gear means including a member movable to produce one speed transmission rate from the power means to the delivery means and fixable to produce another such rate, automatic means operable to hold fixed said movable and fixable means to change the rate of transmission and thereby to change the rate of delivery of said heat-change medium, said last-named means comprising a stop mechanism to stop rotation of the movable and fixable means after a predetermined amount of rotation thereof, said stop mechanism comprising two relatively movable members, means connecting one member with the movable and fixable member, said other member being normally movable relative to the one member, means urging the two members toward a predetermined relative starting position, means to hold said other member, said last-named means being operated upon operation of the power means, interengaging means between the two stop mechanism members adapted to be engaged after relative movement of said members.

5. In a control for a heat-change producing device, power means, means for delivering a heat-change medium adapted to be operated by said power means, planetary gear means interposed between the power means and the delivery means, said planetary gear means including a member movable to produce one speed transmission rate from the power means to the delivery means and fixable to produce another such rate, automatic means operable to hold fixed said movable and fixable means to change the rate of transmission and thereby to change the rate of delivery of said heat-change medium, said last-named means comprising a stop mechanism to stop rotation of the movable and fixable means after a predetermined amount of rotation thereof, said stop means comprising two members relatively movable and movable together, means to limit the relative movement of the two members to a predetermined amount, means to cause one of the members to move with movement of the movable and fixable member, and means to stop movement of the other member, whereupon the first member may move only the distance provided by the relative movement between them and then stop to stop the movable and fixable member.

6. In a control for a heat-change producing device, a power means, a delivery means operable to deliver a heat-change medium at two different rates to the said device and transmission means

to produce the two different rates of medium deliveries, said transmission means including a member movable to provide a first rate of delivery during movement and a second rate of delivery when stopped, a stop means for said movable means, means to pre-set the movable means relative to the stop means to obtain a predetermined movement of the former before operation with the latter to effect stopping, and means to move the movable means by the power means until it is stopped and thereafter to change the rate of delivery of the medium delivery means.

7. In a fuel feeding mechanism capable of delivering different quantities of fuel, means to start said mechanism in operation to deliver fuel in a first quantity, timing means, means to start the timing means upon start of the fuel feeding mechanism, and means operated by the timing means to change the rate of operation of the fuel feeding mechanism at the end of a predetermined time interval after start of the timing means.

8. In a fuel feeding mechanism capable of delivering different quantities of fuel, means to start said mechanism in operation to deliver fuel in a first quantity, timing means, means to start the timing means upon start of the fuel feeding mechanism, means operated by the timing means to change the rate of operation of the fuel feeding mechanism at the end of a predetermined time interval after start of the timing means, and means to adjust the rate of delivery of the fuel feeding mechanism.

9. In a control for a fuel feeding device of the variable speed pump type, the combination of means energizable to cause the pump to operate at one speed, timing means, means to start operation of the timing means upon start of the first mentioned energizable means, and means operated by the timing means after a predetermined period of operation thereof, to cause the pump to operate at a different speed.

10. In a control for fuel burners, a fuel supply device, a motor, a circuit for the motor, a shaft driven by the motor and connectable to the fuel supply device for effecting delivery of fuel thereto, timing means operated by the motor and means interconnected with the timing means operable to increase the speed of the driven shaft after it has operated a predetermined time interval to increase the rate of fuel delivery.

11. In a burner control for use with a fuel delivery means operable to produce different rates of fuel delivery, timing means, said timing means being adapted to produce operation of the fuel delivery means at one rate for a predetermined

period and thereafter to produce operation at a different rate, an electrical control means energizable to cause said timing means to produce said period of operation, and means to cause the timing means to return to starting condition upon release of said control means.

12. In a control, a pump for a burner or the like, a driving shaft, gear mechanism for connecting the driving shaft with the pump, means in the gear mechanism to establish a first speed of the pump, means in the gear mechanism to establish a second speed of the pump, timing means actuated by the first means as a function of the duration of the operation thereof to actuate the second named means, to operate the pump at said second speed after a predetermined period of operation at the first speed.

13. In a control, a pump for a burner or the like, a driving shaft, planetary gear mechanism for connecting the driving shaft with the pump, means in the gear mechanism to establish a first speed of the pump, including a movable member, that acts, when obstructed, to establish a second speed of the pump, means in the path of the movable member to stop the same after predetermined movement thereof, to cause the pump to be changed from first speed to second speed.

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