

Sept. 14, 1954

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2,689,000

FURNACE LIGHTER WITH CAM INTERLOCKED AIR OPERATED CONTROLS

Filed June 6, 1951

3 Sheets-Sheet 1

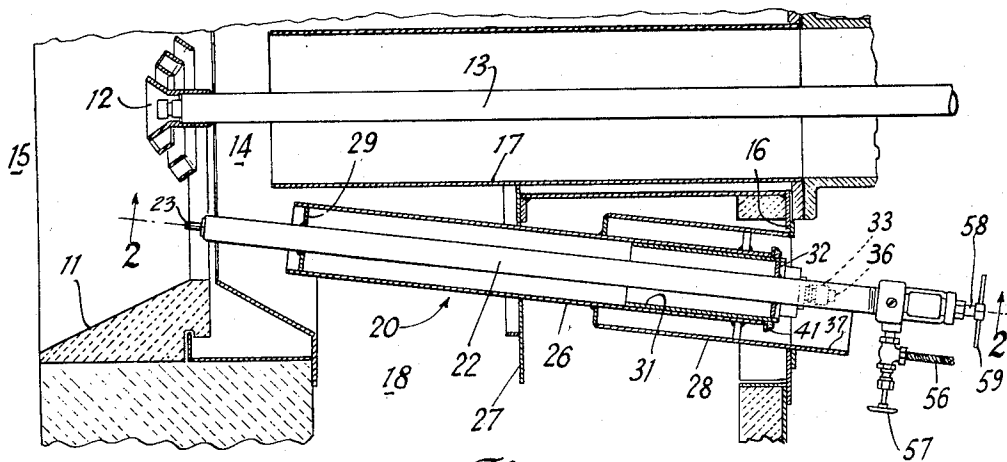


Fig. 1

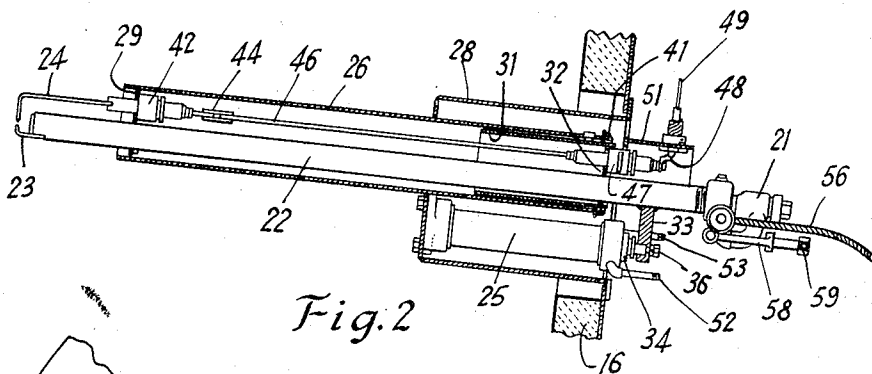


Fig. 2

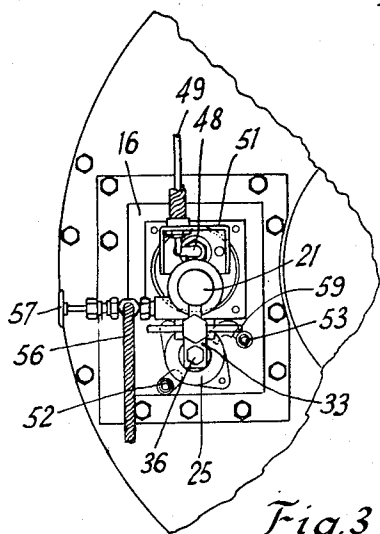


Fig. 3

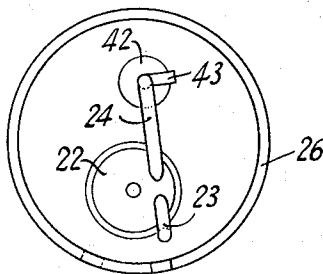


Fig. 4

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3 Sheets-Sheet 2

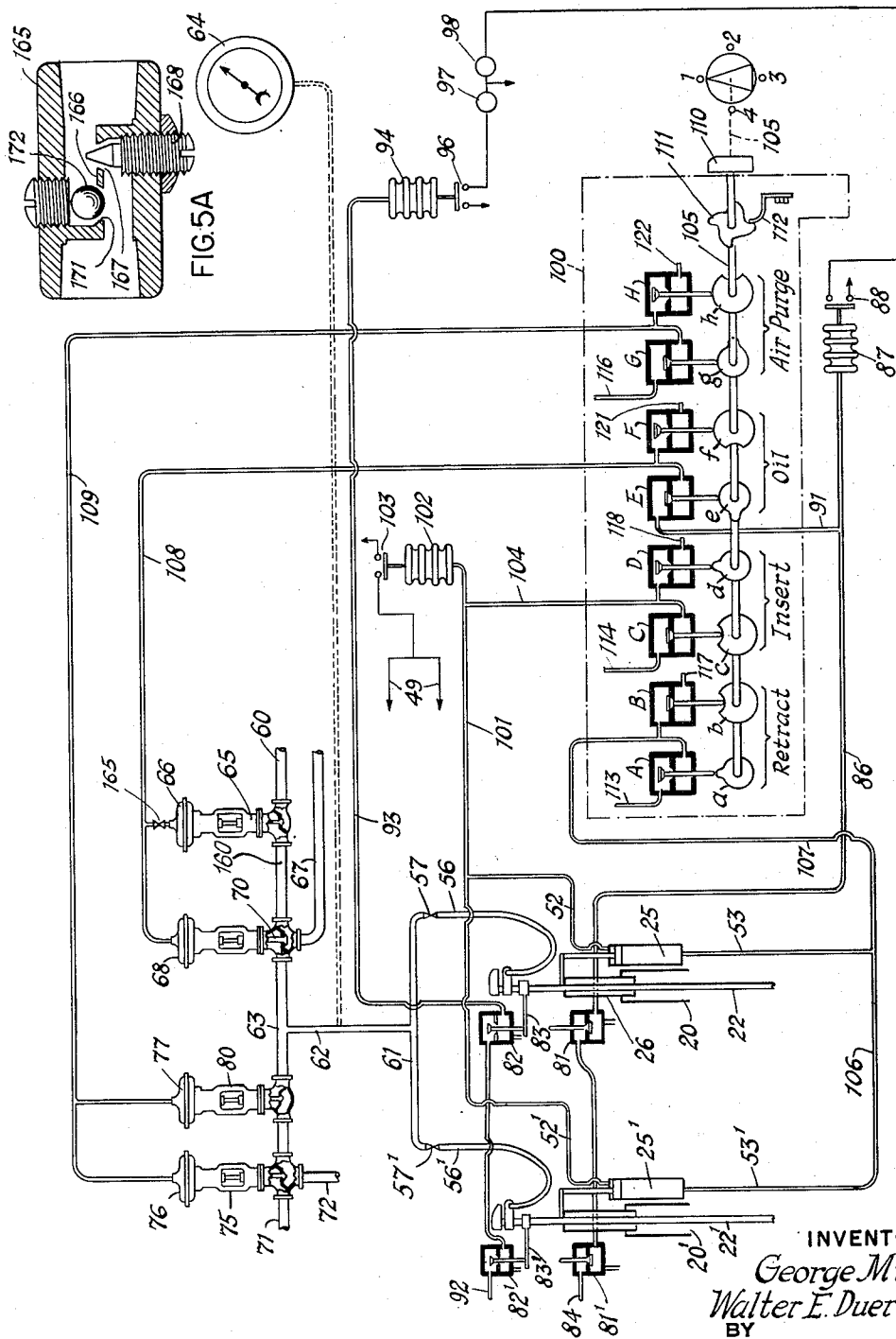


FIG. 5

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FIG. 6

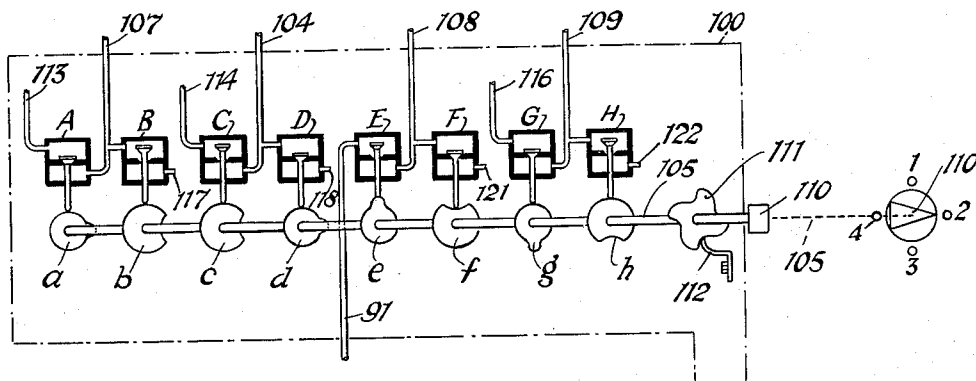


FIG. 7

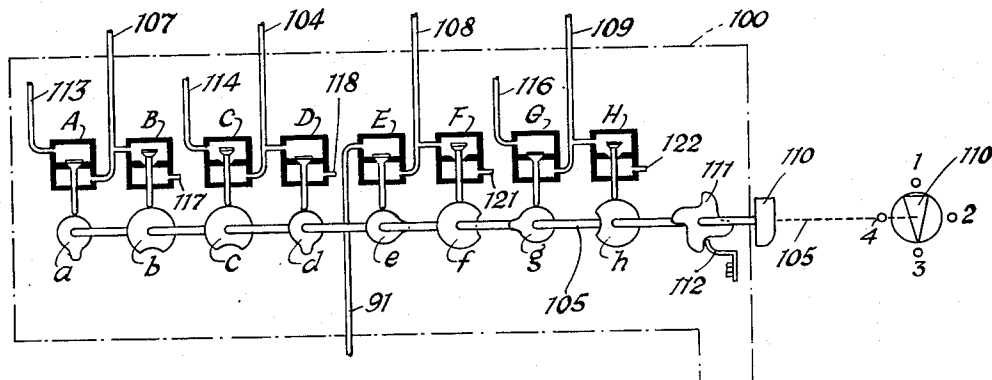
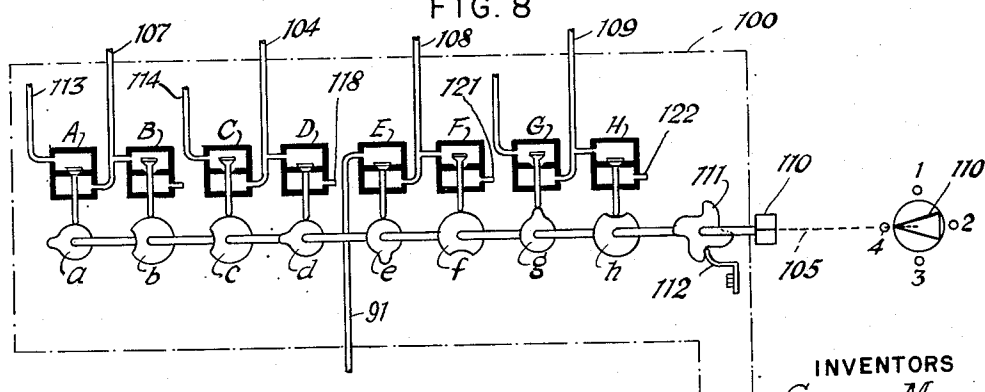


FIG. 8



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FURNACE LIGHTER WITH CAM INTER-
LOCKED AIR OPERATED CONTROLS

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Application June 6, 1951, Serial No. 230,096

15 Claims. (Cl. 158—28)

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This invention relates to ignition apparatus and, more particularly, to a retractable furnace lighter having air operated means controlling the position thereof, the flow of fuel thereto, and the flow of purging fluid therethrough, the air operated means being interlocked for a predetermined sequence of the lighting procedure by a plurality of control valves operated by a single cam shaft.

With the increase in the size of furnaces, particularly for steam power plants, manual lighting of the furnaces has become hazardous and impractical. This is particularly so in the case of furnaces burning liquid, gaseous or pulverized fuel, and it has been proposed to light or "touch off" these furnaces by means of remotely controlled mechanical lighters.

However, the use in practice of such mechanical devices has presented difficulties due to the necessity of following a predetermined procedural sequence in lighting the furnaces. For example, it is necessary to arrange such mechanical lighters so that they are normally withdrawn from the vicinity of the fuel burner to prevent damage to the lighters by the heat of the furnace. Consequently, the lighter must be projected or inserted into the furnace adjacent the main fuel burner when fuel from the latter is to be ignited, or else there is danger of non-functioning of the lighter arrangement due to its not being in close enough relation to the burner. The fuel supply to the lighter should not be initiated until the lighter is in proper position and the lighter fuel supply should be interrupted and the fuel line purged before the lighter is retracted to the "off" position following ignition of the main burner.

The control arrangement for effecting such predetermined sequence of operation should desirably meet several criteria. The means for inserting and retracting the lighter should be positive in operation and normally not subject to derangement by high temperature conditions prevailing adjacent the main burner. Control valves, and other operating media, should be preferably located remote from the zone of high temperature to assure that their functioning will not be impaired by conditions resulting from exposure to such high temperatures. Preferably, the master control arrangement should be so located as to be readily accessible by the furnace operator, while still assuring that the connections to the lighters are maintained at the minimum possible length.

The lighter arrangement of the present inven-

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tion effectively fulfills the foregoing requirements in addition to including a master control positively assuring a predetermined sequence of operation. An air operated cylinder or piston is provided for inserting and retracting each lighter. Air operated valve means are provided controlling the flow of fuel to the lighter fuel supply conduit, and other air operated valve means are interposed between such conduit and a source of purging fluid, such as air or steam under a relatively high pressure. Preferably, each one of the fuel control and purging fluid control valve means includes a pair of valves. The pair of valves for the fuel control includes a shut-off valve and a three-way valve interposed between the latter and the lighter fuel supply conduit, this three-way valve connecting the supply conduit either to the shut-off valve or to a fuel return conduit. The purging fluid control valves include a three-way valve connected to the purging fluid source and to a vent, and a shut-off valve connected between the three-way valve and the lighter fuel supply conduit.

A source of control pressure fluid, such as air, is connectable, through cam operated valve means, to the lighter positioning mechanism, the fuel control means, and the purging fluid control means. The cam operated control valves for the positioning mechanism include two pairs of valves operable selectively to admit air to one end of the cylinder and exhaust air from the other end thereof. Another pair of cam operated control valves control the operation of the fuel control means, and this other pair of valves has interposed between itself and the control fluid supply one or more series connected normally closed valves each associated with a different lighter unit and opened thereby only when the respective lighter unit is fully inserted. Thereby, the fuel source can not be connected to the lighter supply conduit until all the lighters have been fully inserted in an operative position. A fourth pair of cam operated valves controls the supply of air to the purging fluid control means. A single cam shaft is provided for all of the cam operated valves, and has a plurality of individual cams each affixed thereto and each associated with a different cam control valve. A ratchet and pawl type of interlock is provided on the shaft so that the same may be turned in only one direction and reverse movement of the shaft is prevented. The pair of cam operated valves controlling insertion of the lighter also controls air to a pressure operated switch for connecting the ignition electrodes to a source

of electric potential, so that the ignition electrodes are energized when the cam control is moved to a "lighter on" position. The normally closed valves associated with each of the lighters, and opened thereby only in the fully inserted position, also control a pressure operated switch for an indicator or pilot light denoting when the lighters have all been inserted. A similar set of normally closed valves, connected in series and individually operated by the lighters only in the fully retracted position, control a pressure operated switch for a second indicator light denoting when the lighters have all been fully retracted.

When the operator moves the cam shaft control of the "lighter on" position, air is admitted to the several positioning cylinders to insert the lighters, and the cam operated valve controlling operation of the fuel supply valve means is moved to the open position. However, the fuel supply control means are not opened until such time as each lighter has opened its normally closed valve when the lighter is fully inserted. The second position of the control is the "fuel off" position in which the cam operated valves cause the fuel supply valve (two-way valve) to close, shutting off the oil, and also cause the three-way valve to move to exhaust position, so that if the two-way valve should leak for any reason, this leakage will drain back through the return conduit to storage rather than into the lighters which would cause a hazardous condition. In the third position of the cam control, the cam operated valves admit control fluid under pressure to the purging fluid control means so that purging fluid flows, under pressure, through the lighter fuel supply conduits and clears out any fuel remaining between the three-way fuel valve and the fuel supply conduits. In the fourth, or "lighter off" position of the cam operator, pressure air is admitted to the opposite end of the positioning cylinder to move the lighters to the retracted position, where they remain until the control is again operated.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a plan view of a lighter embodying the invention as mounted in a furnace and in the extended or operative position;

Fig. 2 is a longitudinal sectional view on the line 2—2 of Fig. 1;

Fig. 3 is an outer end elevation view of the lighter;

Fig. 4 is an inner end elevation view of the lighter;

Fig. 5 is a schematic elevation view of the cam control and fluid connections for the lighter illustrated in Figs. 1-4, showing the cam control in the "lighter off" position;

Fig. 5A is an axial sectional view of a throttling valve forming part of the control system; and

Figs. 6, 7 and 8 are schematic views of the cam control in each of its other three positions.

According to the present invention, a lighter unit, including a fuel atomizer and ignition electrodes, is arranged to be projected into a furnace and retracted therefrom by suitable means such as a double-acting air cylinder. When energized, the spark between the electrodes ignites a combustible mixture discharged from the atomizer, and the resultant flame ignites a combustible mixture discharged from the main burner, which is located adjacent the operative end of the lighter

unit when the latter has been projected into the furnace. After ignition of the main fuel supply, the lighter unit is withdrawn to prevent damage thereto by the furnace heat.

Referring more particularly to Figs. 1 through 4 of the drawings, a lighter assembly generally indicated at 20 is shown in operative relation to a main fuel burner 14 mounted in an aperture 11 in a wall of a furnace 15. Lighter assembly 20 includes a mechanical fuel atomizer unit 21, of a well known construction, having a fuel barrel 22 extending forwardly, and a pair of ignition electrodes 23, 24 at the fuel atomization tip. Barrel 22 is retracted and projected within an inwardly extending housing 26 secured to front wall 16 of the burner housing, and a double-acting air cylinder 25 is provided for effecting such movement.

Main burner 14 is illustrated as a well-known pulverized coal burning type including a primary air and coal nozzle 17, an impeller 12 and an impeller support member 13, which may also be an oil tube having an atomizer therein, whereby burner 14 is adapted to burn oil, if desired. Secondary air for burner 14 is supplied through secondary air chamber 18 having an outer wall 19.

Housing 26 is mounted, intermediate its ends, in a bracket 27 welded or otherwise secured to primary air and coal nozzle 17. At its outer end, housing 26 is supported in a casing 28 secured to the front wall 16 of secondary air chamber 18. A tubular sleeve 31 slidable in housing 26 and having a transverse end wall 32 supports the fuel barrel 22 and electrode 23. The forward end of the barrel 22 has a plate 29 welded thereto and slidable in housing 26. An arm 33 welded or otherwise secured to barrel 22 is detachably connected to the piston 34 of cylinder 25 by means of a nut 36. Suitable sealing means 41 on casing 26 engage sleeve 31 to provide a tight joint between these relatively movable elements.

Electrodes 23 and 24 are of suitable heat resistant metal such as "Nichrome," for example. Electrode 23 is grounded by direct securement to barrel 22. Electrode 24 is mounted through an insulating bushing 42 on plate 29, and has a radial pin 43 welded thereto and lying in a radial recess in the forward face of bushing 42. Pin 43 maintains the radial end of electrode 24 properly aligned with the radial end of electrode 23, as may be seen in Fig. 4. The rear end of electrode 24 is electrically connected, by a connector 44, to a steel electrode 46 which extends outwardly through an insulating bushing 47 mounted on plate 32. At its outer end, electrode 46 is connected to the terminal 48 of a flexible wire conductor 49, the terminal being mounted on an insulator shield 51 secured to end wall 32. Conductor 49 is connected to the high voltage secondary winding of the ignition transformer.

Air for powering cylinder 25 to insert lighter unit 20 is supplied through a pipe 52, and unit retracting air is supplied through a pipe 53 to the opposite end of the cylinder. The fuel supply conduit for atomizer assembly 21 is indicated at 56 and is provided with a shut-off valve 57. A quick-acting clamp 58 having a T-operating handle 59 is provided for quickly interchanging atomizer units for element 21.

Referring to Fig. 5, two lighter units 20 and 20' are schematically illustrated, the previously described elements of lighter 20 being given the same reference numerals primed in lighter assembly 20'. While two lighter assemblies are indicated, more or less than this number may be

used with a single control in any given installation. The fuel supply lines 56 and 56' are connected through valves 57 and 57' to a fuel supply manifold 61 which has connected thereto, preferably at a point intermediate the valves 57, 57', a cross connection 62 leading to a main 63. A pressure gauge 64 may be connected to connection 62.

Fuel under pressure, such as oil at 150-250 p. s. i., is supplied through supply conduit 60 to an air opened, spring closed shut-off valve 65 having an operating diaphragm arrangement 66. The other side of valve 65 is connected by a pipe 160 to an air opened, spring closed three-way valve 70 which is also connected to main 63 and to a fuel return conduit 67. Valve 70 has an operating diaphragm arrangement 68, and is operable to connect valve 65 either to main 63 or to return flow conduit 67.

One problem encountered with remote or automatic control of furnace lighters has been that of maintaining the fuel system pressure when a group of lighters is placed in service. A drop in the fuel pressure occurs due to the high rate of fuel flow during the interval when the fuel lines are being filled. Once the lines are full, the flow is reduced to the rate at which it will pass through the orifices in the atomizers.

In the arrangement of the present invention, this surge in pressure is prevented by controlling or throttling the fuel flow. For this purpose, a throttling valve 165 is provided between operating or control air supply line 108 and the diaphragm operating arrangement 66 of valve 65. Valve 165 is shown in Fig. 5A as having a diaphragm 166 with a first valve seat 167 controlled by an adjustable needle valve 168 and a second valve seat 171 for a ball check valve 172. With the arrangement shown, flow of air to open valve 65 is adjustably throttled by needle valve 168, ball check valve 172 being seated during such flow. This controls the rate of opening valve 65 and prevents the pressure surge in the fuel supply line. When valve 65 closes, exhaust of control air from diaphragm arrangement 66 is unimpeded as ball check 172 lifts off seat 171.

During operation of valves 65 and 70, the three-way valve 70 may be in an intermediate position allowing fuel to flow from pipe 160 into both main 63 and return conduit 67 when valve 65 is open or opening. This, likewise, would cause an increase in the fuel flow with a consequent pressure drop in the fuel supply line. This is prevented by effecting operation of the valves in sequence, with valve 70 completing its opening before valve 65 opens, and valve 65 completely closing before valve 70 closes. Such sequential operation is effected by providing a much stronger closing spring for valve 65 than the closing spring for valve 70. Thereby, valve 65 opens last and closes first. In a typical example, a 5-15 pound closing spring may be used in valve 70 and a 16-25 pound closing spring in valve 65.

A purging fluid under pressure, such as air or steam, is connected to a supply line 71 in turn connected to a three-way air opened and spring closed valve 75 having an operating diaphragm arrangement 76. Valve 75 is connected to main 63 through an air opened, spring closed shut-off valve 80 having an operating diaphragm arrangement 77. Three-way valve 75 connects valve 80 either to purging fluid supply conduit 71 or to an exhaust connection 72.

Each lighter assembly 20 or 20' has associated

therewith a pair of valves 81, 82 or 81', 82', these valves being normally biased to the closed position. An operating arm 83 or 83' opens valves 82, 82' in the fully retracted positions of the lighters, and opens valves 81, 81' in the fully inserted positions of the lighters. The valves 81, 81' are connected in series between a source of control air supplied to a conduit 84 and a conduit 86 leading to a bellows 87 operating a switch 88. The latter controls energization of an indicating lamp 98 which is thus lighted only when all of the lighters have been fully inserted. Conduit 86 has a branch 91 leading therefrom for a purpose to be described.

The valves 82, 82' are connected in series between a conduit 92 leading to a source of fluid under pressure and a conduit 93 connected to a bellows 94 controlling switch 96 which in turn controls the energization of an indicating lamp 97. Lamp 97 is thus lighted only when all of the lighters have been fully retracted. The conduits 52, 52' for supplying unit inserting pressure fluid to the lighter assemblies are connected to a main 101 leading to a bellows 102 controlling a switch 103. Switch 103 controls the supply of electric potential to the conductors 49 leading to the ignition electrodes 23. Conduit 101 is supplied with operating fluid through a branch conduit 104 in a manner described hereinafter. With the arrangement shown, switch 103 is closed to energize the ignition electrodes whenever operating fluid is supplied to main 101. The conduits 53, 53' are connected to a main 106 which receives pressure operating fluid from a conduit 107 in a manner to be described.

The operating diaphragm assemblies of valves 65 and 70 are supplied with pressure operating fluid or connected to exhaust through a conduit 108. Similarly, the operating diaphragm assemblies of valves 75 and 80 are connected to a source of pressure fluid or exhaust through a conduit 109.

Insertion and retraction of the lighter units, control of the fuel supply thereto, and the purging of the fuel supply conduits is effected by a control unit generally indicated at 100. Control 100 includes a cam shaft 105 having thereon eight cams respectively labeled from *a* through *h*. Each of these cams controls the operation of a valve indicated by a corresponding upper case letter such as A to H. It will be noted that, starting from the left end of cam shaft 105, the valves are arranged in four pairs, and the cams of each pair are so interrelated that one valve of the pair is open when the other is closed, and vice-versa. For example, in position 1 of shaft 105, which is the "lighter off" position, cam *a* opens valve A and cam *b* closes valve B.

The left hand valve of each pair is connected to a source of pressure fluid such as 113, 114, 91 and 116, and the right hand valve of each pair is connected to exhaust as at 117, 118, 121 and 122. Valves A and B are connected to conduit 107, valves C and D are connected to conduit 104, valves E and F are connected to conduit 108, and valves G and H are connected to conduit 109.

The cam shaft 105 is operable by a control element or operator 110 which may be moved to any one of four positions designated 1, 2, 3 and 4. A four-armed ratchet 111 is secured to cam shaft 105 and has cooperable therewith a spring 112 which effectively prevents movement of shaft 105 in the counter-clockwise direction. Therefore, the shaft can only be moved in the clock-

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wise direction from position 1 through each of the other positions in sequence and back to position 1. Position 1 is the "lighter off" position, with the positions of the cam operated valves in position 1 being as shown in Fig. 5. Fig. 6 illustrates the second or "lighter on" position, Fig. 7 illustrates the "fuel off" position, and Fig. 8 illustrates the fourth or "purge" position of the control unit.

In the position shown in Fig. 5, cam *a* has opened valve A and cam *b* has closed valve B. This admits pressure air from conduit 113 to conduit 107 and, through main 106 and conduits 53, 53', to the inner ends of cylinders 25, 25' to move the lighter assemblies to the retracted positions. As the lighter assemblies move to the retracted positions, arms 83, 83' release valves 81, 81' to close, so that switch 98 opens to extinguish lamp 96. As the lighter units reach the fully retracted positions, arms 83, 83' open valves 82, 82' so that bellows 94 is expanded to close switch 96 and light lamp 97. In the position of Fig. 5, cam *c* has closed valve C and cam *d* has opened valve D so that conduit 104 is connected to exhaust. This connects conduits 52, 52' and main 101 to exhaust, and collapses bellows 102 which opens switch 103 to de-energize the electrodes. Similarly, valve E is closed and valve F is opened so that conduit 108 is connected to exhaust which closes fuel shut-off valve 65 and operates valve 70 to close main 63 and connect valve 65 to return conduit 67. Valve G is closed and valve H is opened, exhausting conduit 109 to close valve 80 and operate valve 75 to connect valve 80 to exhaust at 72.

When operator 110 is moved to the second, or "lighter on" position, the cams and valves assume the position shown in Fig. 6. Valve A is closed by cam *a* and valve B is opened by cam *b*. This connects conduit 107 to exhaust, and thus connects the conduits 53 and 53' to exhaust. Cam *c* opens valve C and cam *d* closes valve D, supplying pressure fluid to conduit 104. Thus, fluid is applied through conduits 52, 52' to the outer ends of the operating cylinders and the lighters begin to move toward the inserted position. Finally, bellows 102 is expanded to close switch 103 to energize the ignition electrodes.

Cam *e* opens valve E and cam *f* closes valve F, but no pressure fluid is supplied to conduit 108 as valves 81, 81' remain closed until the lighters are fully inserted. Valves G and H remain respectively closed and open. As the lighters begin to move toward the inserted position, valves 82, 82' are closed so that bellows 94 contracts, opening switch 96 and extinguishing lamp 97. As each lighter unit reaches the fully inserted position, it opens its associated valve 81 or 81', and when all of the units are fully inserted, pressure fluid is supplied to conduit 86. This expands bellows 87 to close switch 88 and light lamp 98. Also, pressure fluid now flows through valve E to conduit 108 to open valve 65 and operate valve 70 to connect pipe 160 to main 63 and close return line 67. Fuel under pressure is thus supplied to manifold 61 and to conduits 56 and 56' and to the fuel supply conduits 22, 22' for ignition and burning to ignite the fuel stream supply from the main burner.

When the main burners have been lighted, knob 110 is moved to position 3, shown in Fig. 7. In this position, valves A, D and G remain closed, valves B, C and H remain open, valve E is closed by cam *e* and valve F is opened by cam *f*. Valve F connects conduit 108 to exhaust, which closes

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fuel shut-off valve 65 and operates fuel valve 70 to shut-off main 63 and connect valve 65 to return conduit 67. The fuel supply to the lighter units is now interrupted, and the lighters may be retracted.

However, in moving control 110 to the retracted position 1, the control must pass through the "purge" position No. 4 shown in Fig. 8. In this "purge" position, valves A, D, and E remain closed, valves B, C, and F remain open, valve G is opened by cam *g* and valve H is closed by cam *h*. The lighter units remain in the fully inserted position, and the fuel supply remains interrupted. Valve G supplies pressure fluid from conduit 116 to conduit 109 which results in opening of shut-off valve 80 and operation of valve 75 to close exhaust or vent 72 and connect valve 80 to the purging fluid supply conduit 71. The purging fluid thus flows through conduit 63, blowing any residual fuel through the lighters. The purging fluid flows through connection 62, main 61, conduits 56 and 56', and fuel supply conduits 22, 22', blowing all residual fuel from these lines. Control 110 is maintained in the "purge" position for a sufficient time to assure complete purging of the fuel lines connected to the lighters. The control knob 110 is then moved to the "lighter off" position, which is shown in Fig. 5 and has been previously described.

When the lighters start to retract, valves 81, 81' are closed to extinguish lamp 98 and, when all of the units have been fully retracted, pressure fluid is supplied through valves 82, 82' to expand bellows 94 and illuminate lamp 97.

The described arrangement thus provides a positive operating control for assuring a predetermined sequence of operation of the lighter units, including purging of the units before they are moved to the retracted position. Furthermore, the fuel cannot be supplied to the lighters until all of the lighters are in the fully inserted position.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be otherwise embodied without departing from such principles.

We claim:

1. In combination, a furnace lighter unit including a fuel atomizer having a fuel supply conduit connected thereto and a pair of ignition electrodes; mechanism operable to insert the unit into operative relation with the main fuel burner of the furnace and to retract the unit therefrom; a source of fuel; a source of purging fluid under pressure; a source of control fluid under pressure; first fluid operated valve means controlling the flow of fuel to said supply conduit; second fluid operated valve means controlling the flow of purging fluid to said supply conduit; a first device controlling operation of said mechanism to insert said unit; a second device controlling operation of said mechanism to retract said unit; a third device controlling flow of control fluid to said first valve means; a fourth device controlling flow of control fluid to said second valve means; an operator interlocking all of said devices for a predetermined sequence of operation of the latter, said operator having an operating cycle including first, second, third, and fourth positions; said operator, in its first position, operating said first device to an inoperative position and said second device to condition said mechanism to retract said unit, maintaining said

third device in the inoperative position, and operating said fourth device to the inoperative position, to retract said unit and interrupt the flow of purging fluid thereto; said operator in its second position operating said first device to condition said mechanism to insert said unit and said third device to provide for flow of control fluid to open said first valve means, operating said second device to an inoperative position, and maintaining said fourth device in an inoperative position, to insert said unit and establish a flow of fuel thereto; said operator in its third position maintaining said first device in its operated position, and said second and fourth devices in the inoperative position, and operating said third device to an inoperative position interrupting the flow of control fluid to said first valve means and establishing a fluid bleeding connection thereto to interrupt the flow of fuel to said unit; said operator, in its fourth position maintaining said first device in its operated position and said second and third devices in the inoperative position, and operating said fourth device to open said second valve means to establish a flow of purging fluid through said unit; and means operable by said first device, when the latter is operated, to connect said ignition electrodes to a source of electric potential.

2. The combination claimed in claim 1 including means constraining said operator to move in one direction only.

3. In combination, a furnace lighter unit including a fuel atomizer having a fuel supply conduit connected thereto and a pair of ignition electrodes; mechanism operable to insert the unit into operative relation with the main fuel burner of the furnace and to retract the unit therefrom; a source of fuel; a source of purging fluid under pressure; a source of control fluid under pressure; first fluid operated valve means controlling the flow of fuel to said supply conduit; second fluid operated valve means controlling the flow of purging fluid to said supply conduit; a first device controlling operation of said mechanism to insert said unit; a second device controlling operation of said mechanism to retract said unit; a third device controlling flow of control fluid to said first valve means; a fourth device controlling flow of control fluid to said second valve means; an operator interlocking all of said devices for a predetermined sequence of operation of the latter, said operator having an operating cycle including first, second, third and fourth positions; normally closed valve means interposed between said source of control fluid and said third device, and operable to an open position by said unit when the latter reaches the fully inserted position; said operator, in its first position, operating said first device to an inoperative position and said second device to condition said mechanism to retract said unit, maintaining said third device in the inoperative position, and operating said fourth device to the inoperative position, to retract said unit and interrupt the flow of purging fluid thereto; said operator in its second position operating said first device to condition said mechanism to insert said unit and said third device to connect said first valve means to said normally closed valve means, operating said second device to an inoperative position, and maintaining said fourth device in an inoperative position to insert said unit and establish a flow of fuel thereto; said operator in its third position maintaining said first device in its operated position, and said second and fourth de-

vices in the inoperative position, and operating said third device to an inoperative position interrupting the flow of control fluid to said first valve means and establishing a fluid bleeding connection thereto to interrupt the flow of fuel to said unit; said operator, in its fourth position maintaining said first device in its operated position and said second and third devices in the inoperative position, and operating said fourth device to open said second valve means to establish a flow of purging fluid through said unit; and means operable by said first device, when the latter is operated, to connect said ignition electrodes to a source of electric potential.

4. In combination, a furnace lighter unit including a fuel atomizer having a fuel supply conduit connected thereto and a pair of ignition electrodes; pressure fluid operated mechanism operable to insert said unit into operative relation with the main fuel burner of the furnace and to retract the unit therefrom; a source of pressure operating fluid for said mechanism; a source of fuel; a source of purging fluid under pressure; a source of control fluid under pressure; first fluid operated valve means controlling the flow of fuel to said supply conduit; second fluid operated valve means controlling the flow of purging fluid to said supply conduit; an operator including cam operated valves and a cam shaft interlocking said valves for a predetermined sequence of operation of said valves, said operator having an operating cycle including "insert," "fuel off," "purge," and "retract" positions and its valves being connected to said source of control fluid and to the source of pressure operating fluid for said mechanism; normally closed valve means interposed between said source of control fluid and said operator, and operable to an open position by said unit when the latter reaches the fully inserted position; said operator, in its "insert" position, operating said mechanism to insert said unit, and connecting said first valve means to said normally closed valve means to establish a flow of fuel to said unit when the latter reaches the fully inserted position, in the "fuel off" position, maintaining said mechanism operated to hold said unit in the fully operated position and disconnecting said first valve means from said normally closed valve means to interrupt the flow of fuel to said unit, in the "purge" position, maintaining said mechanism operated to hold said unit in the fully inserted position and connecting said second valve means to said source of control fluid to establish a flow of purging fluid through said unit and, in the "retract" position, operating said mechanism to retract said unit and disconnecting said second valve means from said source of control fluid to interrupt the flow of purging fluid through said unit; and means operable by said operator, in its "insert" position, to connect said ignition electrodes to a source of electric potential.

5. The combination claimed in claim 4 including means constraining said operator to move in one direction only.

6. In combination, a furnace lighter unit including a fuel atomizer having a fuel supply conduit connected thereto and a pair of ignition electrodes; pressure fluid operated mechanism operable to insert said unit into operative relation with the main fuel burner of the furnace and to retract the unit therefrom; a source of pressure operating fluid for said mechanism; a source of fuel; a source of purging fluid under pressure; a source of control fluid under pressure; first fluid

operated valve means controlling the flow of fuel to said supply conduit; second fluid operated valve means controlling the flow of purging fluid to said supply conduit; an operator including cam operated valves and a cam shaft interlocking said valves for a predetermined sequence of operation of said valves, said operator having an operating cycle including "insert," "fuel off," "purge," and "retract" positions and its valves being connected to said source of control fluid and to the source of pressure operating fluid for said mechanism; normally closed valve means interposed between said source of control fluid and said operator, and operable to an open position by said unit when the latter reaches the fully inserted position; a normally open pressure operating switch effective, when operated, to connect said ignition electrodes to a source of electric potential; said operator, in its "insert" position, operating said mechanism to insert said unit and connecting said first valve means to said normally closed valve means and said switch to said source of control fluid to establish a flow of fuel to said unit when the latter reaches the fully inserted position and to energize said electrodes, in the "fuel off" position, maintaining said mechanism operated to hold said unit in the fully inserted position and disconnecting said first valve means from said normally closed valve means to interrupt the flow of fuel to said unit, in the "purge" position, maintaining said mechanism operated to hold said unit in the fully inserted position and connecting said second valve means to said source of control fluid to establish a flow of purging fluid through said conduit and, in the "retract" position, operating said mechanism to retract said unit and disconnecting said second valve means from said source of control fluid to interrupt the flow of purging fluid through said unit.

7. The combination claimed in claim 6 in which said first valve means includes a shut-off valve connected to said source of fuel and a three-way valve connected to said supply conduit, to said shut-off valve, and to a fuel return conduit leading to said source of fuel.

8. The combination claimed in claim 6 in which said second valve means includes a shut-off valve connected to said supply conduit and a three-way valve connected to said source of purging air, to said shut-off valve, and to exhaust.

9. The combination claimed in claim 6 in which said first valve means includes a shut-off valve connected to said source of fuel and a three-way valve connected to said supply conduit, to said shut-off valve, and to a fuel return conduit leading to said source of fuel, and said second valve means includes a shut-off valve connected to said supply conduit and a three-way valve connected to said source of purging air, to said last-named shut-off valve, and to exhaust.

10. In combination, a furnace lighting arrangement comprising a plurality of lighter units each including a fuel atomizer having a fuel supply conduit connected thereto and a pair of ignition electrodes; a supply main connected to said supply conduits; a plurality of pressure fluid operated mechanisms each operable to insert a different one of said units into operative relation with the main fuel burner of the furnace and to retract the unit therefrom; a source of pressure operating fluid for said mechanisms; a source of fuel; a source of purging fluid under pressure; a source of control fluid under pressure; first fluid operated valve means controlling the flow of fuel to said supply main; second fluid operated valve

means controlling the flow of purging fluid to said supply main; an operator including cam operated valves and a cam shaft interlocking said valves for a predetermined sequence of operation of said valves, said operator having an operating cycle including "insert," "fuel off," "purge," and "retract" positions and its valves being connected to said source of control fluid and to the source of pressure operating fluid for said mechanisms; a plurality of normally closed valve means connected in series between said source of control fluid and said operator, and each operable to an open position by a different one of said units when the latter reaches the fully inserted position; a normally open pressure operated switch effective, when operated, to connect said ignition electrodes to a source of electric potential; said operator, in its "insert" position, operating said mechanisms to insert said units and connecting said first valve means to said normally closed valve means and said switch to said source of control fluid to establish a flow of fuel to said units when all of the latter reach the fully inserted position and to energize said electrodes, in the "fuel off" position, maintaining said mechanisms operated to hold said units in the fully inserted position and disconnecting said first valve means from said normally closed valve means to interrupt the flow of fuel to said unit, in the "purge" position, maintaining said mechanisms operated to hold said units in the fully inserted position and connecting said second valve means to said source of control fluid to establish a flow of purging fluid through said units and, in the "retract" position, operating said mechanisms to retract said units and disconnecting said second valve means from said source of control fluid to interrupt the flow of purging fluid through said units.

11. The combination claimed in claim 10 including means constraining said operator to move in one direction only.

12. The combination claimed in claim 10 in which said first valve means includes a shut-off valve connected to said source of fuel and a three-way valve connected to said supply main, to said shut-off valve, and to a fuel return conduit leading to said source of fuel.

13. The combination claimed in claim 10 in which said second valve means includes a shut-off valve connected to said supply main and a three-way valve connected to said source of purging air, to said shut-off valve, and to exhaust.

14. The combination claimed in claim 10 in which said first valve means includes a shut-off valve connected to said source of fuel and a three-way valve connected to said supply main, to said shut-off valve, and to a fuel return conduit leading to said source of fuel and said second valve means includes a shut-off valve connected to said supply main and a three-way valve connected to said source of purging air, to said last-named shut-off valve, and to exhaust.

15. In combination, a furnace lighting arrangement comprising a plurality of lighter units each including a fuel atomizer having a fuel supply conduit connected thereto and a pair of ignition electrodes; a supply main connected to said supply conduits; a plurality of mechanisms each operable to insert a different one of said units into operative relation with the main fuel burner of the furnace and to retract the unit therefrom; control means for activating all of said mechanisms for operation to insert the units or to retract the units; a source of fuel; fluid operated valve means controlling the flow of fuel to said supply

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main; a source of control fluid under pressure; valve means controlling the flow of control fluid to said fluid operated means to connect said fuel source to said supply main; and a plurality of normally closed valves connected in series between said source of control fluid and said valve means, and each operable to an open position by a different one of said units when the latter reaches the fully inserted position; whereby, flow of control fluid to said fluid operated means can be effected by said valve means only when all of said units have been fully inserted.

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