

May 13, 1952

R. SHELLENBERGER ET AL

2,596,944

FURNACE LIGHTER WITH MECHANICALLY INTERLOCKED CONTROLS

Filed March 17, 1948

4 Sheets-Sheet 1

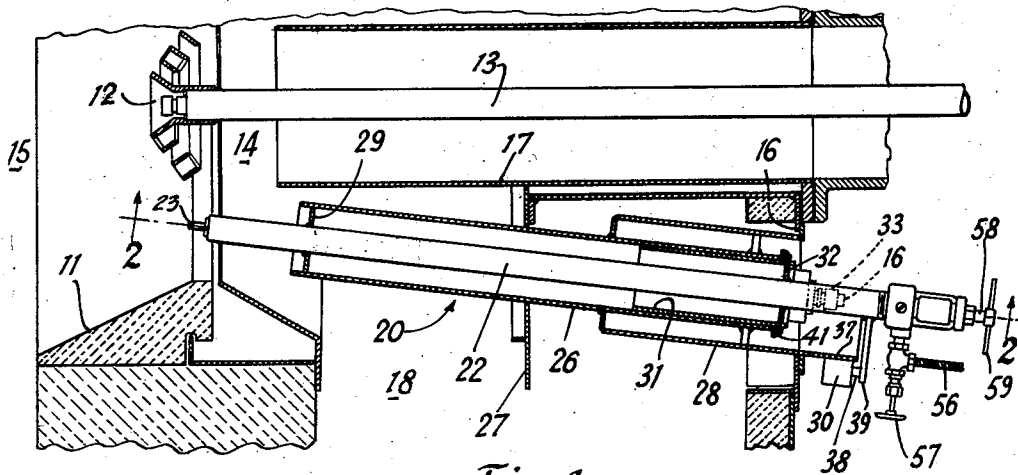


Fig. 1

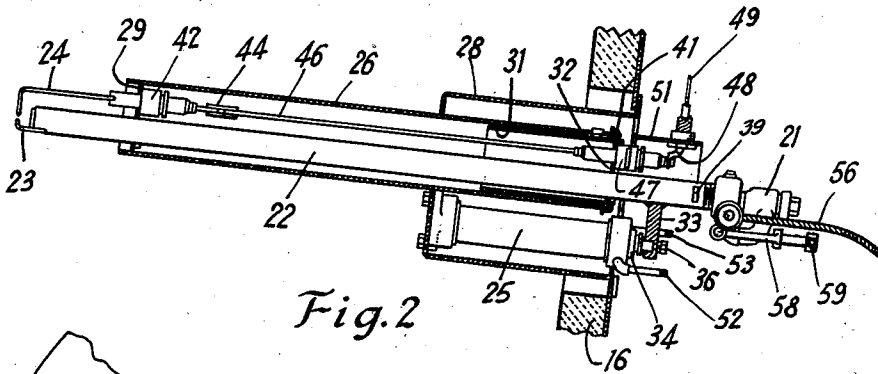


Fig. 2

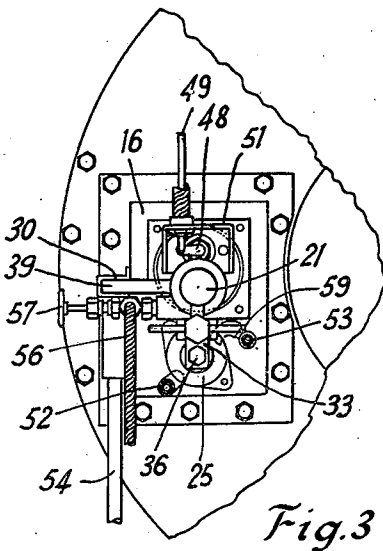


Fig. 3

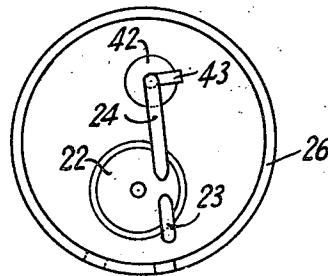


Fig. 4

Inventors

Rolfe Shellenberger
& Arthur J. Poole

J. Moran
Attorney

May 13, 1952

R. SHELLENBERGER ET AL

2,596,944

FURNACE LIGHTER WITH MECHANICALLY INTERLOCKED CONTROLS

Filed March 17, 1948

4 Sheets-Sheet 2

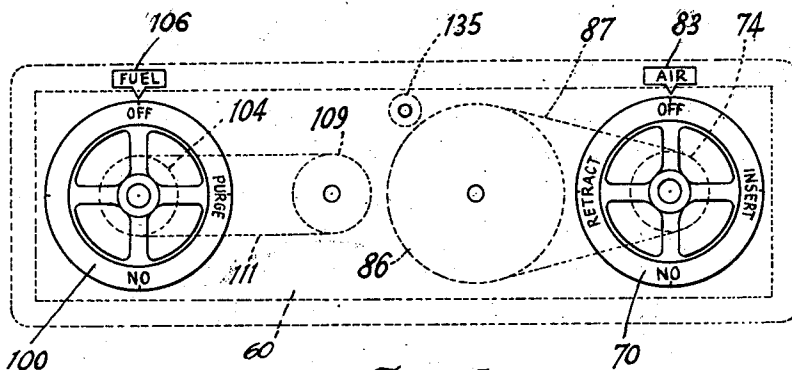


Fig. 5

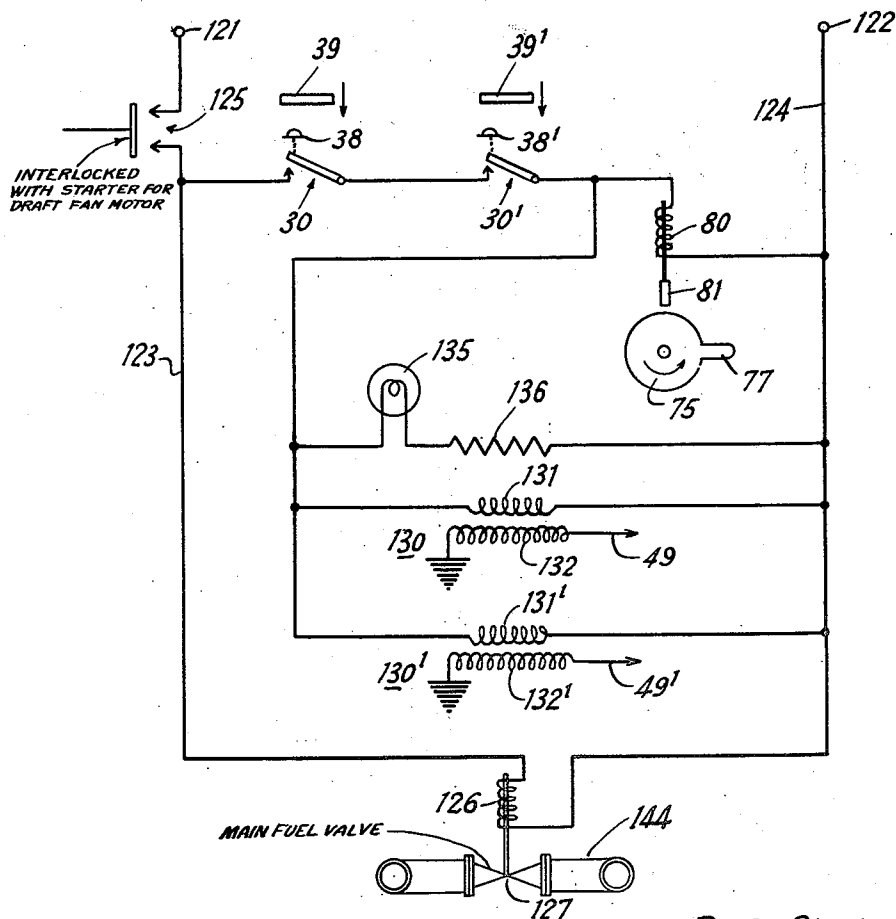


Fig. 14

Inventors
 Rolfe Shellenberger
 & Arthur J. Poole
J. Moran
 Attorney

May 13, 1952

R. SHELLENBERGER ET AL

2,596,944

FURNACE LIGHTER WITH MECHANICALLY INTERLOCKED CONTROLS

Filed March 17, 1948

4 Sheets-Sheet 3

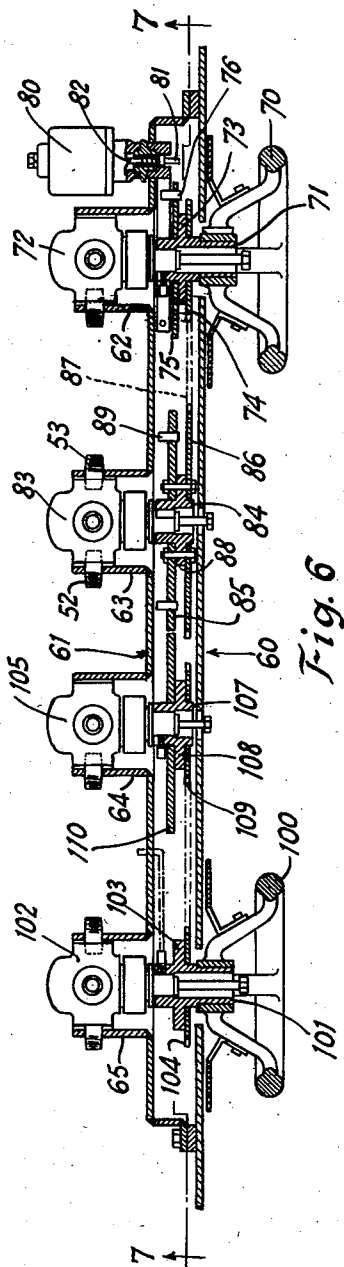


Fig. 6

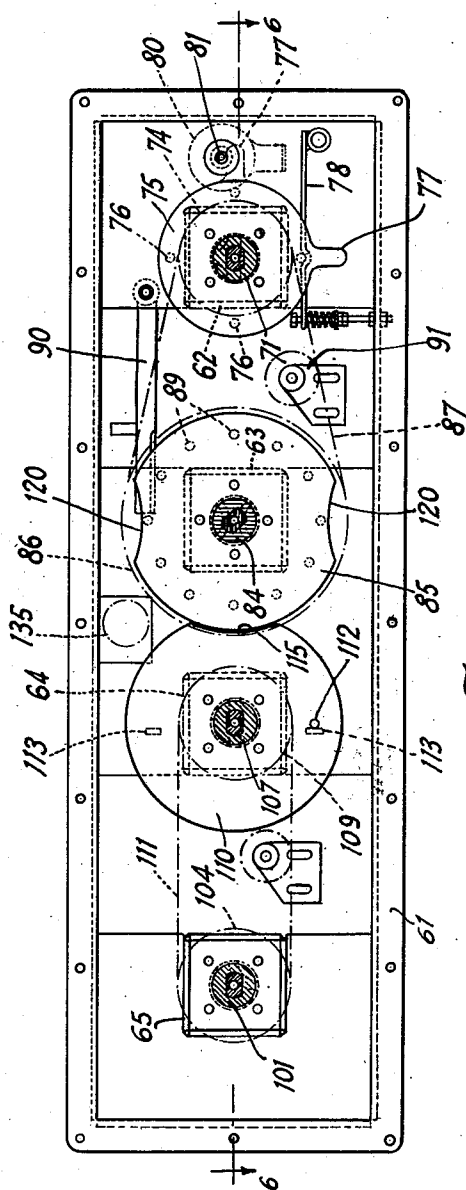


Fig. 7

Inventors

Rolfe Shellenberger
& Arthur J. Poole

J. P. Moran
Attorney

May 13, 1952

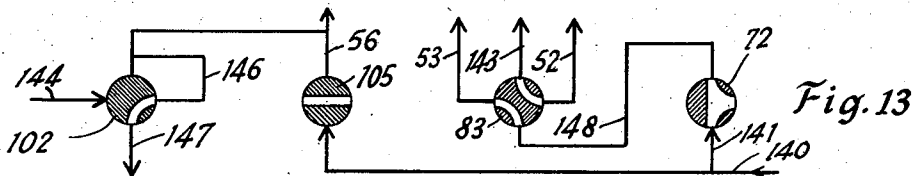
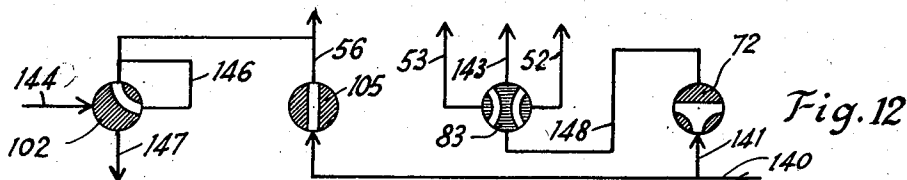
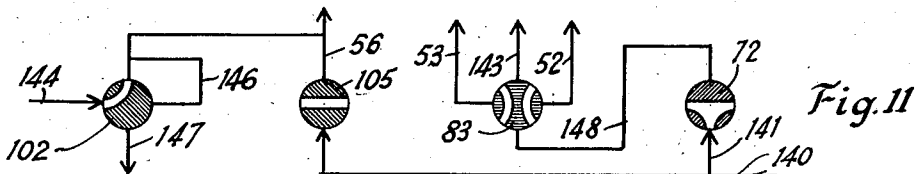
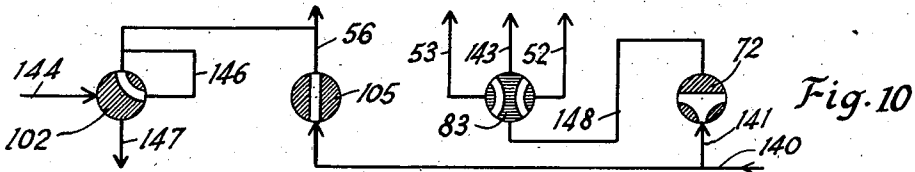
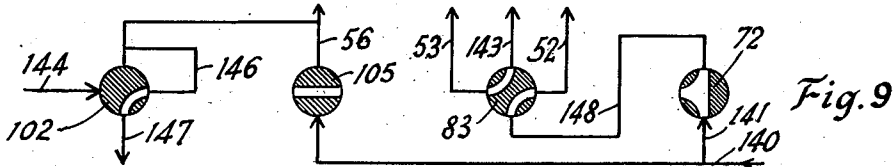
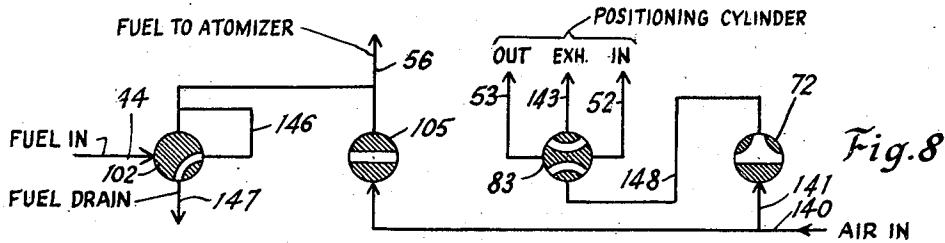
R. SHELLENBERGER ET AL

2,596,944

FURNACE LIGHTER WITH MECHANICALLY INTERLOCKED CONTROLS

Filed March 17, 1948

4 Sheets-Sheet 4



Inventors

Rolfe Shellenberger
& Arthur J. Poole

[Signature]
Attorney

UNITED STATES PATENT OFFICE

2,596,944

FURNACE LIGHTER WITH MECHANICALLY INTERLOCKED CONTROLS

Rolfe Shellenberger, Belvidere, and Arthur J. Poole, Belleville, N. J., assignors to The Babcock & Wilcox Company, New York, N. Y., a corporation of New Jersey

Application March 17, 1948, Serial No. 15,434

13 Claims. (Cl. 158—28)

1

This invention relates to ignition apparatus and, more particularly, to a retractable furnace lighter embodying novel, mechanically interlocking controls to insure a predetermined sequence of the lighting procedure.

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 until its fuel line has been purged by air or steam to assure a flow free line. The lighter fuel supply should be turned off and the lighter fuel line again purged before the lighter is retracted following ignition of the main burner.

The mechanical lighter arrangements proposed hitherto have not proven entirely satisfactory as concerns the means provided for insuring the required lighting procedure. Accordingly, the present invention provides a novel, direct-acting mechanical interlock arrangement between the lighter positioning control and the lighter fuel control, so that the lighter cannot be operated until it is positioned properly relative to the main fuel burner or burners. Means are provided for automatically purging the lighter fuel line with air or steam both before turning on the fuel and after lighting of the furnace. A novel electrical circuit arrangement is further provided to insure the furnace draft means being energized before the lighter is energized.

It is therefore among the objects of the invention to provide an automatic, retractable furnace lighter arrangement including novel, di-

2

rect-acting mechanical interlocking means to insure a predetermined lighting procedure.

Another object is to provide such a lighter arrangement including interlocking means insuring purging of the lighter fuel line both before and after use of the lighter.

A further object is to provide such a lighter arrangement including means preventing operation of the lighter or admission of fuel thereto until the lighter is in its projected, operative position.

A still further object is to provide an interlocking arrangement insuring operation of the furnace draft devices before ignition of the furnace.

These and other objects, advantages and novel features of the invention will be apparent from the following description and 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 front elevation view of an interlocking control panel for the lighter;

Fig. 6 is a horizontal sectional view on the line 6—6 of Fig. 7;

Fig. 7 is a longitudinal vertical sectional view of the panel on the line 7—7 of Fig. 6;

Figs. 8 through 13 are schematic views illustrating the sequential procedure of igniting the furnace, as insured by the interlocking controls of Figs. 4 and 5;

Fig. 14 is a schematic wiring diagram illustrating electrical interlocking means incorporated in the invention.

General description of invention

According to the present invention, a lighter unit, including a fuel atomizer and ignition means, is arranged to be projected into a furnace and retracted therefrom by suitable means such as a double-acting air cylinder. When the lighter has been so projected, a spark between a pair of electrodes, a hot wire, or other means 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

3

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

A remotely located control panel, having mechanically interlocked controls, is provided for inserting and retracting the lighter unit and igniting fuel delivered therefrom. A pair of control wheels, levers or knobs mounted on the panel respectively control first the lighter unit position, and second the lighter fuel supply and purging of the lighter fuel line.

The first or "air" control is movable between "off," "insert," "on" and "retract" positions. In the "off" position, the lighter unit is withdrawn or retracted and air control valves for the lighter unit positioning cylinder are closed. When the control is moved to the "insert" position, air is admitted to the cylinder to project or insert the lighter unit into the furnace.

In the "off" and "insert" positions, mechanical interlocking means associated with the "air" control prevent any movement of the second, or "fuel" control. Additionally, a latch obstructs continued movement of the "air" control beyond the "insert" position until the lighter unit has reached its fully projected, operative position. When the unit reaches such position, it operates means to effect release of the latch to permit continued movement of the "air" control to the "on" position.

In the "on" position of the "air" control, the air supply to the positioning cylinder is interrupted. At the same time, the interlocking means releases the "fuel" control so that the latter may be turned from the "off" position to the "purge" position. When the "fuel" control is in any position but its "off" position, mechanical interlock means associated therewith prevent any movement of the "air" control until the "fuel" control is returned to its "off" position.

In the "off" position of the "fuel" control, the lighter fuel line is connected to an oil drain or return line. In the "purge" position, an air valve connected to the "fuel" control admits purging air to the fuel line to blow out any foreign matter. After purging of the lighter fuel line, the "fuel" control is moved to the "on" position, connecting the lighter fuel line to the fuel supply and closing the purging valve. During all this time, the "air" control is locked in position by means of the mechanical interlock means associated with the "fuel" control.

When the main fuel burner of the furnace has been ignited, the "fuel" control is returned to its "off" position, and in its return movement passes through the "purge" position. The lighter fuel line is thus purged of fuel and foreign particles after the ignition operation. When the "fuel" control is again in the "off" position, the "air" control is unlocked for movement to its "retract" position. When the "air" control is moved from its "on" position to its "retract" position, the "fuel" control is locked against any movement. In this position of the "air" control, air is admitted to the positioning cylinder to withdraw the lighter unit to prevent damage thereto by the furnace heat. After such withdrawal, the "air" control is moved to the "off" position, closing its associated air valves. A feature of the invention is the unidirectional movement of the "air" control, with a ratchet being provided to prevent retrogressive movement. This further secures the proper sequence of operation.

A normally open switch is provided in the

4

lighter ignition circuit, and is closed only when the lighter unit is in the projected or inserted position. Should two or more lighter units be used in the same furnace, the normally open switches for all the lighter units are connected in series circuit relation so that no lighter circuit can be ignited until all the lighter units are in operative position. Additionally, another normally open switch prevents energization of the ignition circuit until the furnace has predetermined draft conditions, and this switch effects opening of a normally closed valve in the fuel line.

The lighter unit

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 16.

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. Casing 28 has a portion 37 extending from wall 16 to support a normally open switch 30 having a plunger 38 engageable by an arm 39 on barrel 22, when the lighter 20 is in its fully inserted or operative position, to close switch 30. 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 wire conductor 49, the terminal being mounted on an insulator shield 51 secured to casing 16. 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. A conduit 54 connected to switch 30 carries control wires back to the control panel. 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.

The mechanically interlocked control

Operation of lighter unit 20 and its positioning are controlled by an operator at a control panel 60 shown more particularly in Figs. 5, 6 and 7. The mechanical sequence of operation is schematically shown in Figs. 8 through 13 and electrical sequence in Fig. 14.

Referring to Figs. 5, 6, and 7, panel 60 has a bracket 61 secured to its rear face. Bracket 61 may be an integral structure or may comprise weld united sections, and is formed with four rearwardly extending rectangular enclosures 62, 63, 64 and 65, each supporting a two-port, three-port, or four-port valve.

The "air" control for positioning reciprocable barrel 22 is a wheel 70 secured to a bushing 71 on the spindle of a three-port valve 72. Bushing 71 has a radial flange 73 to the forward face of which is secured a chain sprocket 74. Secured to the rear face of flange 73 is a latch plate 75 having four, equally spaced, rearwardly projecting pins 76 and a radial finger 77. Pins 76 cooperate with a spring biased detent arm 78, and serve to releasably latch wheel 70 in any of its four operative positions. A spring biased latch 81 is positioned in the path of finger 77 and is secured to the armature 82 of a solenoid 80 on bracket 61. When solenoid 80 is energized, latch 81 is drawn out of the path of finger 77.

It will be noted that "air" control wheel 70 has four positions, each aligned with a pin 76. These positions are the "off," "insert," "on" and "retract," and are alignable with an indicator 83 on the face of panel 60, wheel 70 being releasably latchable in each position by engagement of a pin 76 with detent 78. Furthermore, solenoid 80 must be energized to withdraw latch 81 from the path of finger 77 before rotation of wheel 70 counterclockwise beyond the "insert" position can be continued. The importance of this will be apparent as the description proceeds.

Control wheel 70 also controls a second air valve 83 mounted in enclosure 63. Valve 83 is a four-port valve having a bushing 84 secured to its spindle. Bushing 84 has a radial flange 88 having an interlocking cam 85 secured to its rear face and a chain sprocket 86 secured to its front face. Sprocket 86 is twice the diameter of sprocket 74 of valve 72 and is connected therewith by a roller chain 87, so that valve 83 is rotated only one-half as fast as valve 72. Rearwardly projecting pins 89 arranged circumferentially around cam 85 cooperate with a pivoted bar 90 on bracket 61 to form a ratchet to prevent clockwise movement of valve 83 and interconnected valve 72. An idler pulley 91 keeps chain 87 taut.

The "fuel" control comprises a hand wheel 100 fixed on a bushing 101 secured to the spindle of a four-port fuel valve 102 mounted in enclosure 65. Bushing 101 has a radial flange 103 carrying a

chain sprocket 104. Wheel 100 is movable between three positions, "off," "purge" and "on," as indicated by a pointer 106.

Wheel 100 also controls a four-port "purge" valve 105 mounted in enclosure 64 and having a bushing 107 secured to its spindle. Bushing 107 has a radial flange 108 carrying, on its forward face, a sprocket 109 equal in diameter to sprocket 104 and interconnected therewith by a roller chain 111. An interlocking cam 110 is secured to the rear face of flange 108, and carries a pin 112 cooperable with stops 113 on bracket 61 to limit angular movement of interconnected "fuel" control wheel 100 to 180°.

The mechanical interlock between the "air" and "fuel" controls is provided by the cams 85 and 110. In Figs. 5 and 6, the controls are both in the "off" position, and it will be noted that "fuel" control 100 cannot be operated. The lock, in this instance, comprises an arcuate recess or notch 115 in the periphery of cam 110, having a radius substantially equal to that of cam 85 and, when diametrical of cam 85, concentric with the latter. As long as cam 110 is in the position shown, control 70 can be operated at will.

Means are provided, however, for locking control 70 when control 100 is in any but the "off" position. This means comprises a pair of arcuate notches or recesses 120 in the periphery of cam 85, which are substantially equal in radius with cam 110. When recesses 120 are rotated to a position diametrical of cam 120, they each conform substantially to the outer diameter and circumference of cam 110. It will be apparent that, when cam 85 is in a position 90° from that shown, cam 110 and connected control 100 may be freely turned at will. Likewise, in any but the "off" position of control 100, the unbroken portion of the periphery of cam 110, riding in a recess 120, will lock cam 85 and interconnected control 70 against movement.

The electrical interlock

The electrical interlocking arrangement is shown in Fig. 14. Referring to this figure, a suitable control potential is applied to terminals 121, 122 connected to conductors 123, 124, respectively. Energizing circuit 123, 124 is controlled by a normally open switch 125 closed only when the furnace draft devices are activated. For example, switch 125 may be interlocked with the starter for the draft fan motor. Closure of switch 125 energizes a solenoid 126 to open a normally closed valve 127 in the fuel line.

The other control elements are connected directly to conductor 124, and to conductor 122 through one or more normally open switches 30, 30' each associated with one lighter unit. These switches are in series relation, so that all must be closed before the primary windings 131, 131' of ignition transformers 130, 130' are connected across the line and solenoid latch 80 is energized to withdraw latch 81 from the path of finger 77 on latch plate 75. Switches 30, 30' are closed when their respective lighter units are fully inserted so that arms 39, 39' on the fuel barrels strike the operating buttons 38, 38' to close the switches.

When all the switches 30, 30' are closed, solenoid 80 is energized to withdraw latch 81 and pilot light 135 on panel 60, having a resistance 136 in series therewith, is lit. Ignition transformers 130, 130' are energized so that a high secondary voltage is applied from secondary

7

windings 132, 132' to conductors 49, 49' to produce a spark across the lighter electrodes.

Operational sequence

The operational sequence will be best understood by reference to Figs. 5 through 14, with more particular attention to Figs. 8 through 14. In Figs. 8 through 14, a source of air under pressure is indicated schematically as applied through a conduit 140 and a branch 141 to valves 72 and 105. Valve 83 has connected thereto conduits 52 and 53 for air cylinder 25 and an air exhaust conduit 143. Fuel under pressure is supplied to valve 102 through a conduit 144, and conduit 56 conducts the fuel to atomizer barrel 22. A branch 146 is connected between two adjacent ports of valve 102 and the fourth port is connected to a fuel drain conduit 147.

In starting up the furnace, the draft devices are first activated. These may comprise an induced draft fan which is turned on first and a forced draft fan which is turned on second. The motor starter of the induced draft fan has an interlock with switch 125, so that this normally open switch is closed when the draft fan is energized. As explained, this energizes solenoid 126 to open the valve 127 in the main fuel line 144.

In Fig. 8, the valves operated by controls 70 and 100 are shown in "off" position. It will be noted that fuel line 56 is connected to the fuel drain line 147, and valves 72, 83 and 105 are closed. The operator first turns "air" control wheel 70 counterclockwise to the "insert" position which moves valves 72 and 83 to the positions shown in Fig. 9. Air is now supplied through conduits 140 and 141, valve 72 and conduit 148 to valve 83. Valve 83 is now turned so that air under pressure passes through the valve and conduit 52 to operate the piston of cylinder 25 to advance the lighter atomizer barrel 22 into operative relation with the main fuel burner 14 of the furnace. Conduit 53, connected to the opposite end of cylinder 25, is in communication through valve 83 with exhaust conduit 143. Valves 102 and 105 are still in the "off" position.

When all of the lighter units have reached their fully inserted position, arms 39 and 39' on fuel barrels 22 and 22' strike buttons 38 and 38' of switches 30 and 30' to close these switches. This closure connects solenoid 80 across conductors 123 and 124 so that the solenoid is energized to withdraw latch 81 from the path of finger 77. Control wheel 70 may now be turned to the "on" position in which the formerly uppermost recess 120 of cam 85 is moved to a position diametrically adjacent cam 110. Valves 72 and 83 now occupy the closed position shown in Fig. 10. Control wheel 100 may now be turned 90° to the intermediate "purge" position, which moves valves 102 and 105 to the position shown in Fig. 10. In this position, fuel inlet line 144 is still blocked from communication with lighter unit fuel line 56. However, air line 140 is now connected to fuel line 56 through open valve 105 so that a blast of air is blown through the lighter unit 20 to purge the same. It should be noted that in the position of Fig. 10, control wheel 70 is locked against movement through the interaction of cams 85 and 110.

The "fuel" control 100 is now moved to the "on" position, with the valves 102, 105 occupying the position shown in Fig. 11 and valves 72 and 83 remaining in the same position as in Fig. 10. This connects fuel inlet line 144 to lighter unit fuel line 56 through valve 102, with the air sup-

8

ply to the lighter unit being interrupted through closing valve 105. The fuel mixture discharged from atomizer fuel barrel 22 is ignited by the spark produced between electrodes 23 and 24. It will be noted that the electrode 24 through the conductor 49, was previously energized from the secondary winding 122 of transformer 130 due to the energization of primary winding 131 by closure of switches 130 and 130'. The lighter unit, being lit, ignites the fuel emitted from burner 14.

When the operator observes that fuel from main burner 14 has been ignited, he turns "fuel" control 100 backward to the "purge" position which closes valve 102 and opens 105 to apply a blast of air through the lighter unit to purge the same of residual fuel. This is shown schematically in Fig. 12. The "fuel" control 100 is then turned further to the "off" position, closing valve 105 and connecting fuel line 56 to drain line 147 through conduit 146 and valve 102. Likewise, the interlocking cam 85 is now again in the position of Fig. 7 so that air control 100 may again be moved. The operator moves control 100 in the counterclockwise direction to the "retract" position, schematically shown in Fig. 13. Valve 72 is now opened so that air is supplied through valve 83 and conduit 53 to the forward end of cylinder 25 to move the piston of the latter to withdraw or retract atomizer barrel 22 rearward from the furnace opening. The other end of cylinder 25 is connected through conduit 52 and valve 83 to exhaust conduit 143. When the lighter units have been fully retracted, control 70 is again returned to the "off" position schematically shown in Fig. 7.

The described arrangement thus provides a novel mechanically controlled furnace burner lighter in which the controls are mechanically interlocked so that a predetermined sequence of operation must take place. For example, the "air" control cannot be moved to the "on" position until all lighter units are fully inserted, energizing solenoid 80 to withdraw latch 81. This latch, in the extended position, prevents movement of control 70 beyond the "insert" position. Also, the ignition current cannot be turned on until such time as all the lighter units are all fully inserted. The "fuel" control 100 cannot be operated until "air" control 70 is in the "on" position, after which the "fuel" controls lock the "air" control in the "on" position until such time as the "fuel" control has been returned to the "off" position.

In passing in either direction between the "off" and "on" positions, the control 100 operates its connected valve 105 to apply a purging air blast to the lighter unit 20. The pin 112 on cam 110, cooperating with stops 113, permits movement of control 110 only through 180° and return. The detent 78, cooperating with pins 76 on latch plate 75, releasably holds control 70 in any one of its four positions and assures proper positioning of cam 85 to release cam 110 when control 70 is in the "on" position. Due to the direct interengagement of the interlocking cams 85 and 110 there is no possibility of failure of the interlocking, as may occur when solenoid controls are used, for example. The interlocking control action is by direct mechanical engagement of cooperating elements. For example, switch 30 is open until arm 39 depresses its operating button 38 when lighter unit 20 is 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 thereof, it should be understood that the invention may be embodied otherwise without departing from such principles.

We claim:

1. In 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 said unit into operative relation with a main fuel burner in the furnace and to retract the same therefrom; means for applying an electric potential to said electrodes to produce an ignition spark; first manually operable control means selectively operable to condition said mechanism to insert said unit and to retract said unit; second manually operable control means controlling the supply of fuel to said supply conduit; mechanical interlocking means operable by said first and second control means, said interlocking means including latch means locking said second control means against operation; and release means operable, responsive to full insertion of said unit into operative relation with the furnace main fuel burner by said mechanism under control of said first control means, to release said latch means.

2. In 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 said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; means for applying an electric potential to said electrodes to produce an ignition spark; first control means operable to condition said mechanism to insert said unit and to retract said unit, and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; second control means controlling the supply of fuel to said supply conduit and movable between a "fuel off" and a "fuel on" position; mechanical interlocking means operatively associated with said first and second control means; said interlocking means locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means; and means operable, responsive to full insertion of the unit into such operative relation, to release said latch means to unlock said first control means for continued movement to the "on" position.

3. In a furnace lighter unit including a fuel atomizer having a nozzle, and having a fuel supply conduit connected to said nozzle and a pair of ignition electrodes adjacent said nozzle, mechanism operable to insert said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; a source of non-combustible fluid under pressure; means for applying an electric potential to said electrodes to produce an ignition spark; first control means operable to condition said mechanism to insert said unit and to retract said unit, and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; a first valve controlling the supply of fuel to said nozzle through

said supply conduit; second control means movable between "off" and "on" positions to open and shut said first valve; a second valve interposed between said source and said supply conduit and mechanically connected to said second control means, said second control means, in operating said first valve between its open and closed positions, first opening and then closing said second valve to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto, interlocking means operatively associated with said first and second control means and locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means.

4. In a furnace lighter unit including a fuel atomizer, having a nozzle, and having a fuel supply conduit connected to said nozzle, and a pair of ignition electrodes adjacent said nozzle, mechanism operable to insert said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; a source of non-combustible fluid under pressure; means for applying an electric potential to said electrodes to produce an ignition spark; first control means operable to condition said mechanism to insert said unit and to retract said unit and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; a first valve controlling the supply of fuel to said nozzle through said supply circuit; second control means movable between "off" and "on" positions to open and shut said first valve; a second valve interposed between said source and said supply conduit and mechanically connected to said second control means; said second control means, in operating said first valve between its open and closed positions, first opening and then closing said second valve to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto; mechanical interlocking means operatively associated with said first and second control means; said interlocking means locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means; and means operable, responsive to full insertion of the unit into such operative relation, to release said latch means to unlock said first control means for continued movement to the "on" position.

5. In 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 said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; means for applying an electric potential to said electrodes to produce an ignition spark; first control means operable to condition said mechanism to insert said unit and to retract said unit and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; second control means controlling the supply of fuel to said sup-

ply conduit and movable between a "fuel off" and a "fuel on" position; mechanical interlocking means operatively associated with said first and second control means; said interlocking means locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means; a solenoid operable to withdraw said latch means; normally open switch means controlling the energization of said solenoid; and means on said unit operable, when the unit is fully inserted into such operative relation, to close said switch means to unlock said first control means for continued movement to the "on" position.

6. In a furnace lighter unit including a fuel atomizer having a nozzle, and having a fuel supply conduit connected thereto, and a pair of ignition electrodes adjacent said nozzle, mechanism operable to insert said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; means for applying an electric potential to said electrodes to produce an ignition spark; a source of non-combustible fluid under pressure; first control means operable to condition said mechanism to insert said unit and to retract said unit and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; a first valve controlling the supply of fuel to said nozzle through said supply conduit; second control means movable between "off" and "on" positions to open and shut said first valve; a second valve interposed between said source and said supply conduit and mechanically connected to said second control means; said second control means, in operating said first valve between its open and closed positions, first opening and then closing said second valve to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto; mechanical interlocking means operatively associated with said first and second control means; said interlocking means locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means; a solenoid operable to withdraw said latch means; normally open switch means controlling the energization of said solenoid; and means on said unit operable, when the unit is fully inserted into such operative relation, to close said switch means to unlock said first control means for continued movement to the "on" position.

7. In 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 said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; means for applying an electric potential to said electrodes to produce an ignition spark; first control means operable to condition said mechanism to insert said unit and to retract said unit and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; second con-

trol means controlling the supply of fuel to said supply conduit and movable between a "fuel off" and a "fuel on" position; mechanical interlocking means operatively associated with said first and second control means; said interlocking means locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means; a solenoid operable to withdraw said latch means; normally open switch means controlling the energization of said solenoid; means on said unit operable, when the unit is fully inserted into such operative relation, to close said switch means to unlock said first control means for movement to the "on" position; an electric circuit including said ignition means, said switch means and said solenoid; a normally open switch interposed between said circuit and a source of electric energy; and means for closing said switch only in response to operation of the energizing control means of the furnace draft creating devices.

8. In a furnace lighter unit including a fuel atomizer having a nozzle, and having a fuel supply conduit connected thereto, and a pair of ignition electrodes adjacent said nozzle, mechanism operable to insert said unit into operative relation with the main fuel burner of the furnace and to retract the same therefrom; means for applying an electric potential to said electrodes to produce an ignition spark; a source of non-combustible fluid under pressure; first control means operable to condition said mechanism to insert said unit and to retract said unit and movable between "off," "insert," "on" and "retract" positions; latch means normally effective to prevent continued movement of said first control means beyond the "insert" position when moving toward the "on" position; a first valve controlling the supply of fuel to said nozzle through said supply conduit; second control means movable between "off" and "on" positions to open and shut said first valve; a second valve interposed between said source and said supply conduit and mechanically connected to said second control means; said second control means, in operating said first valve between its open and closed positions, first opening and then closing said second valve to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto; mechanical interlocking means operatively associated with said first and second control means; said interlocking means locking said second control means against movement except when said first control means is in the "on" position and locking said first control means against movement in any but the "off" position of said second control means; a solenoid operable to withdraw said latch means; normally open switch means controlling the energization of said solenoid; means on said unit operable, when the unit is fully inserted into such operative relation, to close said switch means to unlock said first control means for movement to the "on" position; an electric circuit including said ignition means, said switch means and said solenoid; a normally open switch interposed between said circuit and a source of electric energy; and means for closing said switch only in response to operation of the energizing control means of the furnace draft creating devices.

9. In a furnace lighter unit, including a fuel atomizer having a nozzle, and having a fuel sup-

ply conduit connected thereto, and a pair of ignition electrodes adjacent said nozzle, a double acting air cylinder operable to insert and retract said unit relative to the main fuel burner of the furnace; means for applying a relatively high electric potential to said electrodes to produce an ignition spark; a control panel having first, second, third and fourth valves mounted thereon; a source of non-combustible fluid under pressure connected to said first valve; conduit means interconnecting said first and second valves; a positioning control mechanically connected to said first and second valves and movable between "off," "insert," "on" and "retract" positions; a fuel control mechanically connected to said third and fourth valves and movable between a "fuel off" and a "fuel on" position; said first valve being open in the "insert" and "retract" positions of said positioning control and closed in the other two positions thereof; said second valve being operable, in the "insert" and "retract" positions of said positioning control, to connect one end of said cylinder to said conduit means and the other end to exhaust, and vice versa, respectively; said third valve connecting said supply conduit to a source of fuel and to a fuel drain in the "on" and "off" positions, respectively, of said fuel control, and being closed in intermediate positions thereof; said fourth valve connecting said source to said supply conduit in an intermediate position of said fuel control to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto; and being closed in the "off" and "on" positions thereof; mechanical interlock means in direct mechanical connection with said controls; said interlocking means locking said fuel control against movement except when said positioning control is in the "on" position and locking said positioning control against movement in any but the "off" position of said fuel control; latch means normally effective to prevent continued movement of said positioning control beyond the "insert" position when moving toward the "on" position; a solenoid operable to withdraw said latch means; normally open switch means controlling the energization of said solenoid; and means on said unit operable, when the unit is fully inserted into such relation with the main burner, to close said switch means to unlock said positioning control means for continued movement to the "on" position.

10. In a furnace lighter unit including a fuel atomizer having a nozzle, and having a fuel supply conduit connected thereto, and a pair of ignition electrodes adjacent said nozzle, means for applying an electric potential to said electrodes to produce an ignition spark; a source of non-combustible fluid under pressure; a first valve controlling the supply of fuel to said supply conduit; control means operable to open and close said first valve; and a second valve interposed between said source and said supply conduit and mechanically connected to said control means; said control means, in operating said

first valve between its open and closed positions, first opening and then closing said second valve to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto.

11. In a furnace lighter unit including a fuel atomizer having a nozzle, and having a fuel supply conduit connected thereto, and a pair of ignition electrodes adjacent said nozzle, means for applying an electric potential to said electrodes to produce an ignition spark; a source of non-combustible fluid under pressure; a first valve controlling the supply of fuel to said supply conduit; control means movable between off, intermediate and on positions to open and close said first valve; and a second valve interposed between said source and said supply conduit and mechanically connected to said control means; said control means, in the off and on positions, closing said second valve and, in the intermediate position, opening the same to purge said supply conduit and nozzle with the non-combustible pressure fluid both before and after fuel is supplied thereto.

12. In combination with a furnace and its main fuel burner, forced draft means for the furnace, a fluid fuel burning ignition unit for the furnace burner, means for projecting said unit into the furnace and retracting it therefrom, fuel supply means for the unit, means for purging the unit, means for igniting the fuel upon its introduction to the unit, mechanical interlock means preventing the introduction of fuel to said unit before purging, a control for the forced draft means, and additional interlock means associated with said control and the igniting means and acting to prevent operation of igniting means unless the forced draft control has been operated to activate the forced draft means.

13. In combination with a furnace and its fuel burner, a fluid fuel burning ignition unit for the furnace burner, said unit having a nozzle arranged to deliver fuel therefrom; fluid fuel supply means for said unit; a source of non-combustible fluid under pressure; means for directing the non-combustible fluid through said nozzle to purge the latter of residual fuel and foreign matter; means for igniting the fluid fuel upon its delivery from the nozzle; and mechanical interlock means preventing the introduction of fluid fuel to said unit before purging.

ROLFE SHELLENBERGER.

ARTHUR J. POOLE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
508,739	McNaughton	Nov. 14, 1893
1,333,785	Sweeney	Mar. 16, 1920
1,941,411	Mulholland	Dec. 26, 1933
2,354,999	Ladd	Aug. 1, 1944
2,382,483	Holden	Aug. 14, 1945