April 1, 1952 S. A. SLOAN 2,591,626

AUTOMATIC GAS IGNITER TUBE FOR BURNERS

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Fig. 1

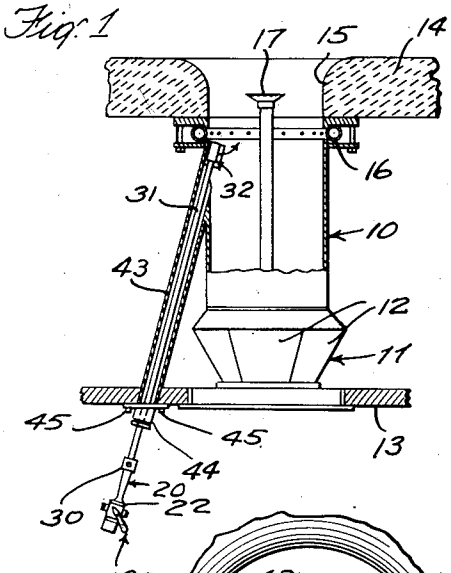


Fig. 1a

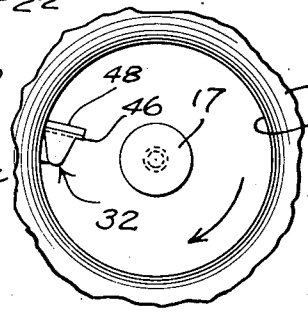
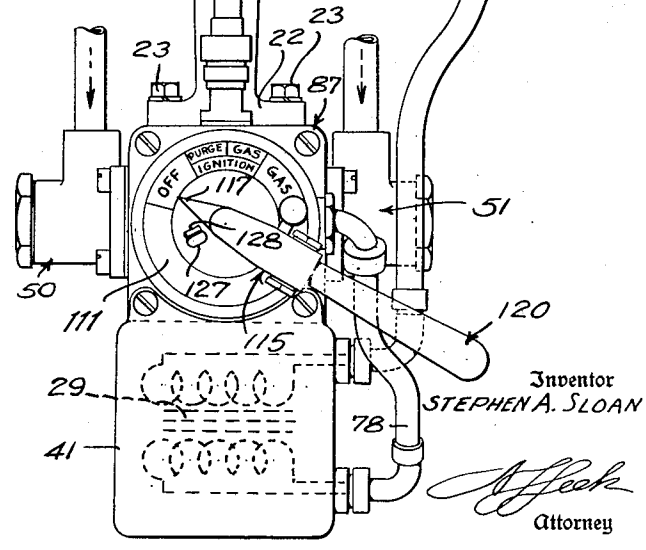


Fig. 2.



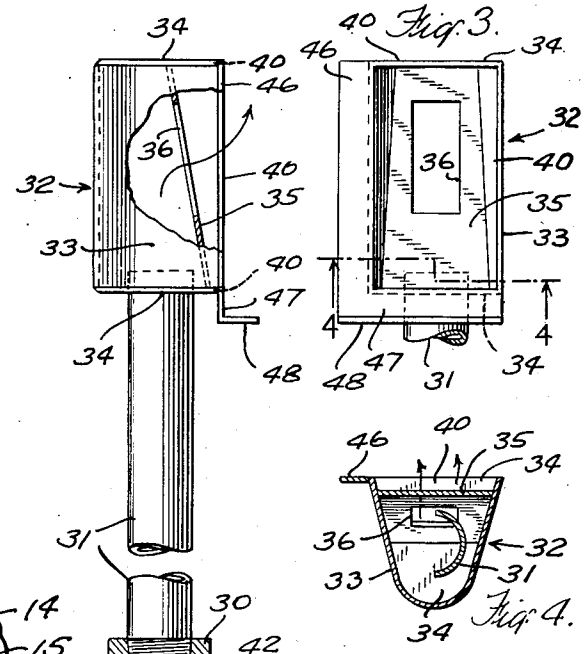


Fig. 3.

Fig. 4.

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Fig. 5.

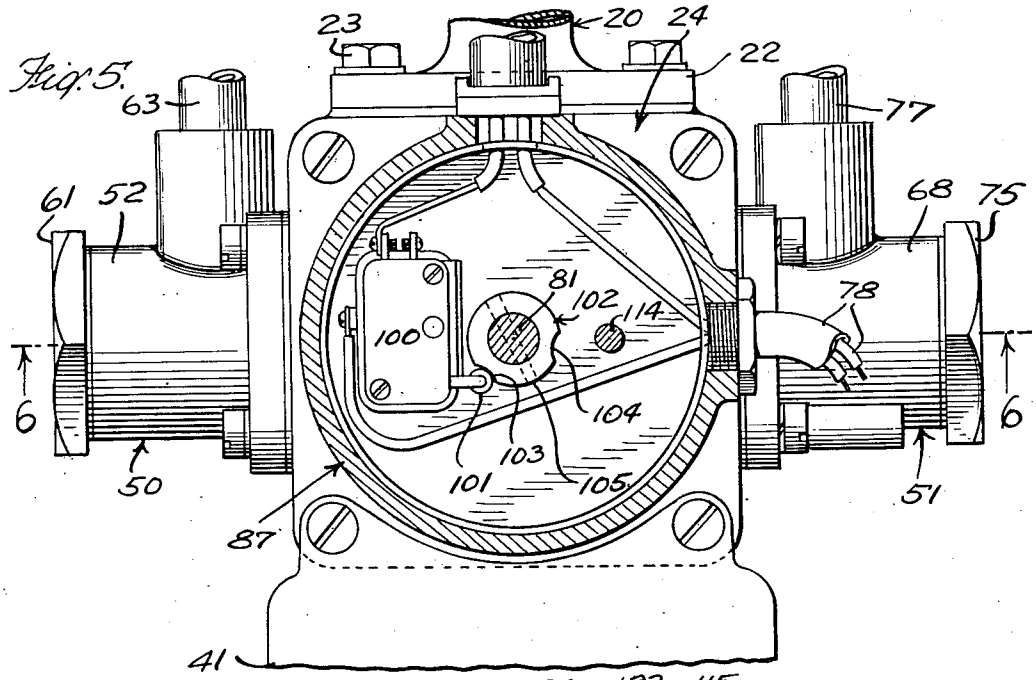
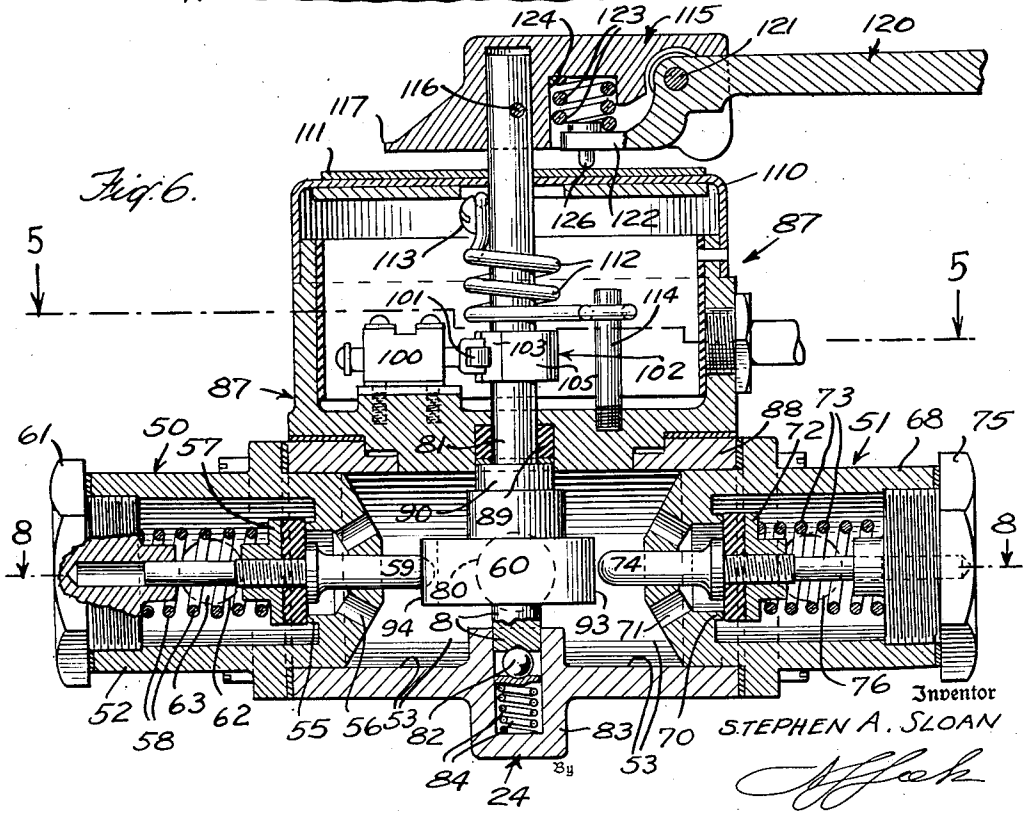


Fig. 6.



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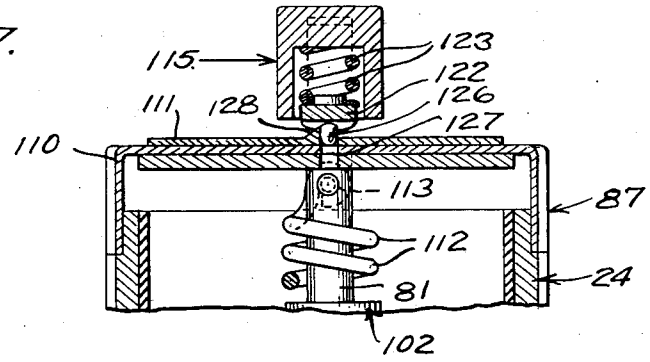
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Fig. 7.



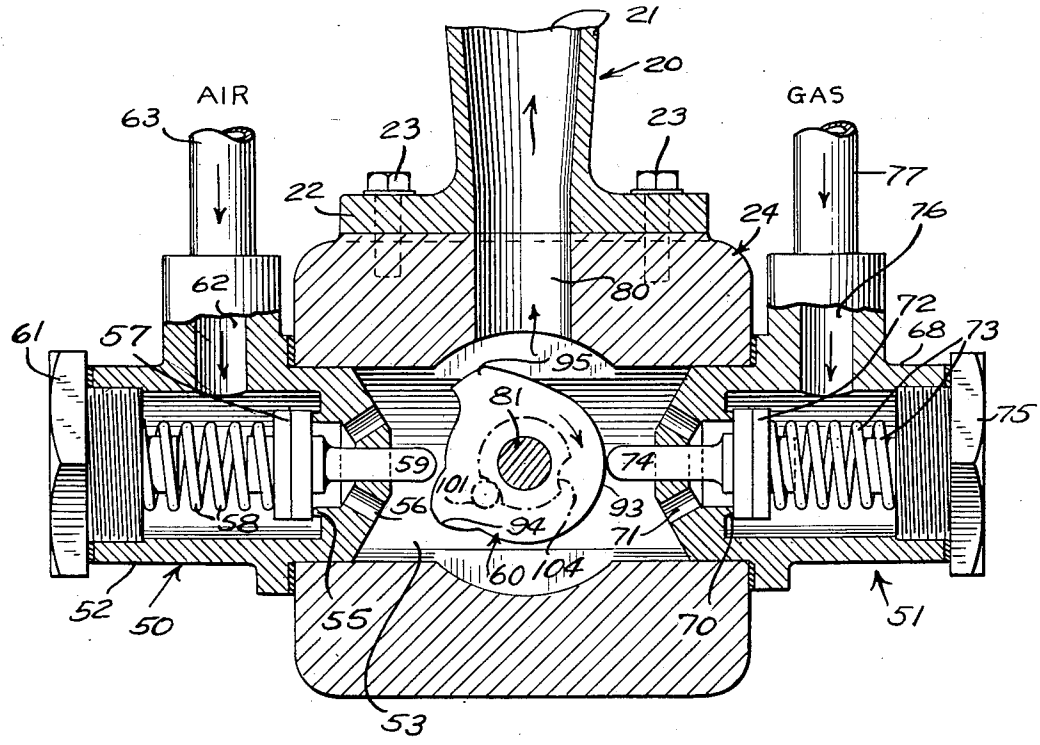


Fig. 8.

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AUTOMATIC GAS IGNITER TUBE FOR BURNERS

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This invention relates to gas igniters and more particularly to an ignition system having automatic control means to supply purge air and gas in correct sequence through the igniter tube and to energize an ignition spark in proper timed relationship to the passage of the gas.

The invention also provides a novel and improved tip for an igniter which will ignite and retain its flame even with the blast of air through a burner tube.

An object of the invention is to provide an ignition system of the above type which operates automatically in proper timed sequence.

Another object is to provide a gas igniter of the above type which is stable and dependable in operation.

Another object is to provide an igniter which is capable of operation with fuels of widely varying heat content without adjustment.

Another object is to provide an igniter of the above type having short ignition electrodes which are located at a point remote from the tip.

Another object is to provide an igniter having built in transformers and valves, which may be installed and removed as a unit, and which is connected to an external line by low tension leads.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Although the novel features which are characteristic of this invention are pointed out more particularly hereinafter, the nature of the invention will be better understood by referring to the following description, taken in connection with the accompanying drawings, in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a longitudinal section through a typical burner showing the igniter in one position for ignition;

Fig. 1*a* is a diagrammatic end elevation of the burner of Fig. 1 showing a representative orientation of the igniter tip in the burner air stream;

Fig. 2 is a side elevation of the igniter on a larger scale with parts broken away to show the construction thereof;

Fig. 3 is a fragmentary elevational view of the igniter tip shown in Fig. 2;

Fig. 4 is a transverse section of the igniter tip taken on the line 4—4 of Fig. 3;

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 6 showing the arrangement

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of the gas and air control valves and the igniter switch;

Fig. 6 is a longitudinal section taken on the line 6—6 of Fig. 5;

Fig. 7 is a detail view showing the position of the detent for locking the handle in gas supply position; and

Fig. 8 is a transverse section taken on the line 8—8 of Fig. 6.

Referring to the drawings more in detail, the invention is shown as applied to a conventional fuel burner including a burner tube 10 through which the combustion air passes in the form of a rotating mass, an air register 11 having air doors 12 through which this air is admitted to the burner tube, a front plate 13 at the front of the wind box, a furnace wall 14 having a throat 15 registering with the burner tube, a fuel admission ring 16 located around the burner tube 10 adjacent the throat 15 and a fuel atomizer 17 which supplies other fuel for combustion. The burner may also be adapted to burn powdered fuel suspended in carrier air as is well known in the art.

The igniter, according to the present invention, comprises a body 20 (Fig. 2) having an axial passage 21 and provided at one end with flanges 22 which are secured by bolts 23 to a casting 24 (Figs. 2 and 8) carrying the control elements to be described. At its other end the igniter body 20 carries a pair of ignition electrodes 25, one of which may be grounded to the body 20 by a cap 26, and the other of which may be insulated by and supported in a spark plug 27 which is connected by a cable 28 to the high tension side of a transformer 29 which is mounted in a housing 41 attached to the casting 24 or formed integral therewith. A sight glass 42 is shown as mounted in the body 20 over the electrodes 25. The electrodes, sight glass, cables, casting, transformer and associated parts are sealed against the pressure in the wind box.

The body 20 is also provided with a coupling flange 30 in which a tube 31 of any desired length is secured. The tube 31 is slidable in an outer tube 43 which extends through the front plate 13, as indicated in Fig. 1, and projects at its inner end through the burner tube 10. The tube 31 extends through a stuffing box 44 which is secured to the front plate 13 by bolts 45 and supports the outer tube 43. The tube 31 carries a tip 32 which is positioned within the burner tube 10 in the path of the air stream therein and adjacent the fuel streams to be ignited.

The tip 32 is shown in the form of a flared

U-shaped housing 33 (Fig. 4) which is coaxial with the tube 31 and is closed at the two ends by plates 34. The flared side of the U-shaped member 33 is closed by a front plate 35 which is inclined to the axis of the U-shaped member 33 and of the igniter tube 31 and is provided with a central opening 36 through which the gas for combustion passes. The plate 35 is recessed from the extremities of the U-shaped member 33 and of the end plates 34 to form upstanding peripheral flanges 40 which extend entirely around the periphery of the plate 35 to shield the same from the blast of secondary air in the burner tube and to form eddy currents which serve to hold the igniter flame against the plate 35. The plate 35 is inclined in the direction of air flow towards the burner throat 15 so that the flame passing from the aperture 36 therein is directed towards the ignition zone of the burner. A lateral flange 48 extends outwardly from the side of the member 33 exposed to the rotating air stream and an end flange 47 having an upstanding lip 46 is mounted on the end plate 34 towards the air register 11. The U-shaped member 33 is preferably placed at such an angle with respect to the direction of air flow through the burner tube 10 that the air passes over the curved surface of the U-shaped member 33 so as to flow in a general direction from its closed end toward the open end thereof whereby the member 33 serves to deflect the air blast away from the igniter flame projecting from the aperture 36 and the flanges 40, 46 and 47 producing eddy currents to hold the flame to the plate 35 and preventing its being blown out by the force of the air blast.

The casting 24 carries an air valve 50 and a gas valve 51. The air valve 50 is shown as comprising a housing 52 which is secured in a transverse bore 53 in the casting 24. The valve housing 52 has a valve seat 55 and ports 56 to communicate with the transverse bore 53 of the casting 24. A valve plunger 57 registers with the seat 55 and is held in pressure engagement therewith by means of a spring 58 seated in a valve cap 61. The valve plunger 57 carries a pin 59 which is actuated by a cam disc 60 mounted in the transverse bore 53. The valve housing 52 is also provided with a passage 62 which registers with an air pipe 63 leading to a suitable source of purge air.

The gas valve 51 comprises a housing 68 having a valve seat 70 and passages 71 communicating with the transverse bore 53 of the casting 24. A valve plunger 72 registers with the valve seat 70 and is held in pressure engagement therewith by a spring 73 seated in a cap 75 threaded into the housing 68. The valve plunger 72 also carries a pin 74 which is actuated by the cam disc 60. The valve housing 68 is also provided with a passage 76 communicating with a gas supply pipe 77 through which combustible gas is supplied. The casting 24 also contains a passage 80 communicating with the igniter body 20 for the passage of air or gas thereto from the respective pipes 63 and 77.

The cam disc 60 is mounted on a shaft 81 which, as shown in Fig. 6, bears against a thrust bearing in the form of a ball 82, the thrust of which is taken up by a spring 84 seated in a boss 83 and formed in the casting 24. The casting 24 is also provided with a top flange 88 on which is mounted a switch housing 87. The shaft 81 extends through a bore in the switch housing 87 and is sealed by means of packing 89. A flange 90 attached to the shaft 81 bears against the packing 89 and is held in sealing contact therewith by the spring 84.

The cam disc 60 is provided around a portion of its periphery with an arcuate surface 93 which, in the position shown in Fig. 8, has a running clearance with the pins 59 and 74 so that the valve plungers 57 and 72 remain seated. The disc 60 also carries a raised position 94 which is adapted to engage the pin 59 and raise the valve plunger 57 from the seat 55 at the beginning of the arc of movement of the disc 60 in a clockwise direction from the position shown in Fig. 8. It is to be noted that the raised portion 94 is of a shape to open and reclose the valve 50 during the first portion of the arc of movement of the disc 60.

The arcuate portion 93 of the disc merges into a raised portion 95 which is positioned to engage the pin 74 for opening the valve 51 shortly after the valve 50 has been closed. The arc of movement of the disc 60 starts at the position shown in Fig. 8 and extends to a position such that the raised portion 95 engages the pin 74 to hold the valve plunger 72 in full open position. Hence during the movement of the cam disc 60 from the position first shown, the valve 50 is first opened and then closed and the valve 51 is then opened and held in open position until the disc 60 is restored to its original position.

A microswitch 100 is mounted in the switch housing 87 and is provided with an actuating arm 101 which engages a cam 102 mounted on the shaft 81. The cam 102 is provided with recessed portions 103 and 104 which are adapted to release the switch arm 101 for allowing the switch 100 to remain in open position when the cam 102 is at both ends of its normal arc of travel. The cam 102 is provided with a raised arcuate portion 105 between the recesses 103 and 104 which is adapted to shift the arm 101 to a position to close the switch 100. The arrangement is such that the switch will be closed shortly after the shaft 81 begins to turn and remains closed until the shaft reaches practically the end of its arc of travel. Thereafter the switch 100 is opened.

The switch housing 87 carries a cover 110 on which an index plate 111 is mounted. A spring 112 is disposed in the switch housing 87 having one end secured by a screw 113 to the shaft 81 and the other end attached to a fixed pin 114. The spring 112 is designed to hold the shaft 81 in its initial position and to restore the shaft to that position after it has been actuated and released.

A lead 78 connects the primary of the transformer 29 to the switch 100 and a low tension lead 79 extends from the switch 100 to a suitable source of current such as the usual 110 volt supply.

A yoke 115 is attached to the projecting end of the shaft 81 by a pin 116. The yoke 115 carries a pointer 117 registering with an index carried by the index plate 111. The yoke also carries an operating handle 120 which is pivoted thereto by a pin 121 and is provided with an arm 122 which is held downwardly by a spring 123 seated in a recess 124 in the yoke 115. The arm 122 carries a pin 126 which is held against the index plate 111 by the spring 123 and when the handle 120 has been shifted to its extreme position enters a hole 127 in the index plate 111. The index plate is shown in Fig. 7 as provided with an upstanding flange 128 adjacent the hole 127 to prevent the pin 126 from overriding the hole and passing the same. The arrangement is such that when the handle is shifted to its extreme posi-

tion, the pin 126 enters the hole 127 and locks the handle in that position. The handle may be released, however, by pressing downwardly, thereby compressing the spring 123 and withdrawing the pin 126 from the hole 127 whereupon the spring 112 restores the handle and the shaft 81 to its initial position.

Operation

In order to start the ignition, the handle 120 is shifted gradually in a clockwise direction from the position shown in Fig. 2 to the extreme limit of its movement. As indicated by the index, the initial position of the handle 120 corresponds to the off position wherein both valves 50 and 51 are closed and the switch 100 is open. During the first part of the movement of the handle 120, the valve 50 is opened to supply purge air from the pipe 63 to the igniter tube. At about the same time the switch 100 is closed to start the ignition spark at the electrode 25. Upon further movement of the handle 120, the valve 50 is closed to cut off the supply of purge air and the valve 51 is opened to supply gas from the pipe 77, the ignition switch remaining closed. The ignition then takes place at the interface between the purge air and the gas where there is sufficient air to initiate combustion regardless of variations in the B. t. u. content of the gas. The flame passes downwardly through the tube 31 with the gas and thence through the opening 36 in the plate 35 to burn adjacent the face of the plate 35 which, as pointed out above, is located in the air stream of the burner tube 10 where there is sufficient air present to complete the combustion. As the handle 120 is further advanced to its extreme position, the ignition switch 100 is opened to cut off the ignition spark so as to prevent carbonization at the electrodes due to long continued sparking, and the gas valve 51 remains in open position. The flame then continues to burn at the tip. The handle 120 is latched in this position by the pin 126, as above described, and may remain in this position until the burner 10 has become ignited. The handle 120 may then be depressed to release the pin 126 and permit the spring 112 to restore the handle and the cams 60 and 102 to their initial positions thereby cutting off the ignition flame.

Since the flame is initiated at the electrodes and passes downwardly through the tube 31, the tube may be of any desired length to carry the flame to the zone of combustion. Hence the body 20 and electrodes may be located in front of the front plate 13 and the tip may be located at a remote point in the burner tube as shown. Long electrodes and high tension insulators are thus eliminated. The tube 31 and tip 32 may be retracted into the outer tube 43 for protection when the igniter is not in use by sliding the body 20 in the stuffing box 44. If the tube 31 is to be entirely withdrawn from the tube 43, a check valve should be provided to prevent escape of the air from the wind box. The entire assembly may be removed by loosening the bolts 45 and withdrawing the inner and outer tubes from the front plate 13.

It is to be understood that the tip may be located axially of the burner or may pass through the air register if desired. A specific location has been shown for purposes of illustration only.

In the construction above described, a stable flame is produced at the tip 32 which is not blown out by the blast of air through the burner tube 10. While the angular position of the tip in the burner tube 10 may be varied somewhat, the best results are obtained when the closed end of the member 33 is pointed in the direction of air flow so that the air passes around the outside of the member 33. The flanges 40, 46 and 47 provide turbulence which retains the flame on the surface of the plate 35. Due to the difference in depth of the flange 40 around the different portions of the periphery of the plate 35, a proper degree of turbulence is maintained over at least one portion of the plate 35 to support combustion under the different conditions of use. In certain instances it may be desirable to mount the plate 35 in a plane parallel to the axis of the tube 31 or to form the flanges 40 of the same depth around the entire plate. The construction shown, however, has been found to operate satisfactorily over a wide range of burner conditions and to maintain a stable ignition flame even when the combustion air within the burner tube 10 is turned on suddenly. Due to the automatic control of the sequence of operation of the air and gas valves and of the ignition switch, a proper timing is always maintained for securing the best results without the variations which would be inherent in separate manual controls for the different elements.

The invention is particularly adapted for use with large size industrial burners although its application is not to be restricted thereto. The shaft 81 may be power-operated by a remote control if desired. The igniter is not to be restricted to use with a burner, but may be used in various instances where the initial ignition at the electrodes takes place under conditions to cause incomplete combustion and the air to complete the combustion is present at the tip. Hence the device is not dependent upon the heat content of the fuel supplied as sufficient air for complete combustion is supplied at the remote tip.

Various changes and adaptations may be made in the various details of construction without departing from the scope of the invention.

What is claimed is:

1. A gas igniter comprising an igniter tube having a tip, a source of purge air and a source of combustible gas for ignition, ignition electrodes disposed in said igniter tube, a switch connected to control the supply of current to said electrodes, valves connected to control the passage of purge air and combustible gas from the respective sources to said igniter tube, and a timed control having means operable in timed sequence for actuating the purge air valve, the combustible gas valve, and the igniter switch so as to first purge the igniter tube with air, then supply combustible gas thereto and energize said ignition electrodes.

2. An igniter comprising a housing carrying an igniter tube having a tip, a chamber in said housing communicating with said igniter tube, an air supply duct and a gas supply duct, a pair of valves oppositely disposed in said chamber, and adapted to control the communication between said ducts and said chamber, valve actuating pins operatively associated with each valve and projecting into said chamber, a rotary cam positioned in said chamber and having a cam surface positioned to engage said pins for the actuation of the respective valves, a shaft carrying said cam, and means rotating said shaft to actuate said valves, said cam being shaped to first open and close the air control valve and then to open the gas control valve.

3. An igniter comprising a housing carrying an igniter tube having a tip, a chamber in said housing communicating with said igniter tube, an air

supply duct and a gas supply duct communicating with said chamber, a pair of valves oppositely disposed in said chamber and adapted to control the communication between said ducts and said chamber, valve actuating pins operatively associated with each valve and projecting into said chamber, a rotary cam positioned in said chamber and having a cam surface positioned to engage said pins for the actuation of the respective valves, a shaft carrying said cam, means rotating said shaft to actuate said valves, said cam being shaped to first open and close the air control valve and then to open the gas control valve, electrical ignition means operatively associated with said igniter tube, a switch to control said ignition means and a switch cam mounted on said shaft having means to actuate said switch, said switch cam being shaped to close said switch during a period which overlaps the open periods of said air valve and of said gas valve and to open said switch in the other positions of said cam.

4. An igniter comprising a housing carrying an igniter tube having a tip, a chamber in said housing communicating with said igniter tube, an air supply duct and a gas supply duct communicating with said chamber, a pair of valves oppositely disposed in said chamber and adapted to control the communication between said ducts and said chamber, valve actuating pins operatively associated with each valve and projecting into said chamber, a rotary cam positioned in said chamber and having a cam surface positioned to engage said pins for the actuation of the respective valves, a shaft carrying said cam, means rotating said shaft to actuate said valves, said cam being shaped to first open and close said air control valve and then to open said gas control valve, electrical ignition means operatively associated with said igniter tube, a switch to control said ignition means, a switch cam mounted on said shaft having means to actuate said switch, said switch cam being shaped to close said switch during a period which overlaps the open periods of said air valve and of said gas valve and to open said switch in the other positions of said cam, spring means operatively associated with said shaft tending to restore said shaft to its initial position when released, and latching means positioned to latch said shaft in its fully advanced position.

5. An igniter comprising a housing having a chamber therein, an unobstructed tube communicating with said chamber and having a burnr tip at its end, an air duct and a gas supply duct communicating with said chamber, control valves in the respective ducts, ignition electrodes in said tube at a point remote from said tip, a transformer mounted in said housing having a secondary connected to said electrodes and having a primary connected to a low tension lead, a switch in said lead and means to actuate said switch and said valves in timed sequence for actuating the purge air valve, the combustible gas valve, and the igniter switch so as to first purge the igniter tube with air, then supply combustible gas thereto and energize said ignition electrodes for thereby starting ignition at the zone of said electrodes and causing the flame to travel to said tip.

6. A gas igniter comprising an igniter tube having a tip, a source of purge air and a source of combustible gas for ignition, ignition electrodes disposed in said igniter tube, a switch connected to control the supply of current to said electrodes, valves connected to control the passage of purge air and combustible gas from the respective sources to said igniter tube, and a timed control having means operable in sequence for actuating the purge air valve, the combustible gas valve, and the igniter switch for first purging, then supplying combustible gas and ignition, said tip being remotely located with respect to said electrodes.

7. An igniter comprising a housing, an igniter tube having a tip, said tube being carried by said housing, a chamber in said housing communicating with said igniter tube, an air supply duct and a gas supply duct communicating with said chamber, a shaft extending through said chamber, a cam on said shaft rotating in said chamber, a pair of valves disposed on opposite sides of said cam adapted to control the communication between said ducts and said chamber and having actuating pins positioned to engage said cam at diametrically opposite points, a switch housing attached to said first housing, said shaft extending through said switch housing and carrying a cam to rotate in said switch housing, and switch means in said last housing actuated by said last cam.

8. In an igniter, as set forth in claim 7, packing means around said shaft sealing said chamber from said last housing, a collar on said shaft to engage said packing means and spring means holding said collar in sealing engagement with said packing means.

9. In an igniter, as set forth in claim 7, an actuating handle on said shaft and spring means to restore said shaft to its initial position after actuation by said handle.

10. An igniter comprising a housing having a chamber therein, an unobstructed tube communicating with said chamber and having a burner tip at its end, an air duct and a gas supply duct communicating with said chamber, control valves in the respective ducts, ignition electrodes in said tube at a point remote from said tip, a switch connected to control the supply of current to said electrodes, and means to actuate said switch and said valves in timed sequence for actuating the purge air valve, the combustible gas valve, and the igniter switch so as to first purge the igniter tube with air, then supply combustible gas thereto and energize said ignition electrodes for thereby starting ignition at the zone of said electrodes and causing the flame to travel to said tip.

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