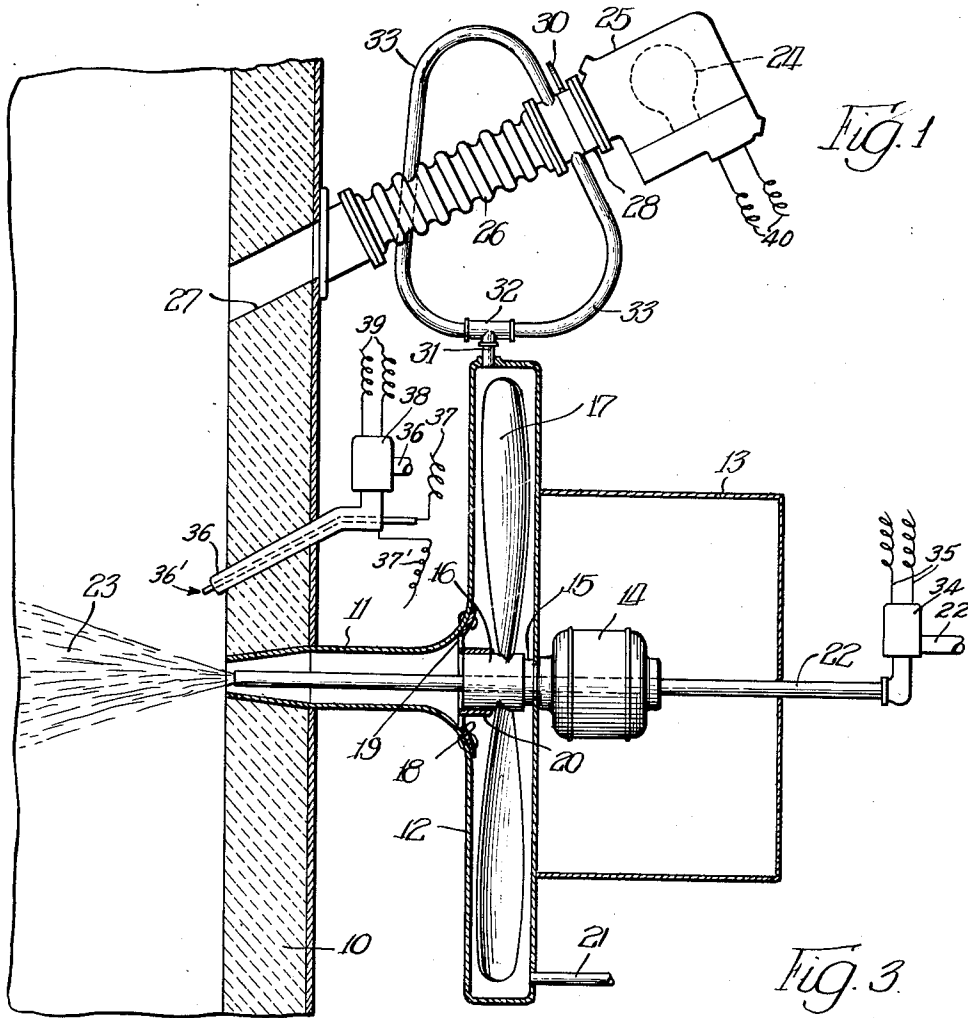
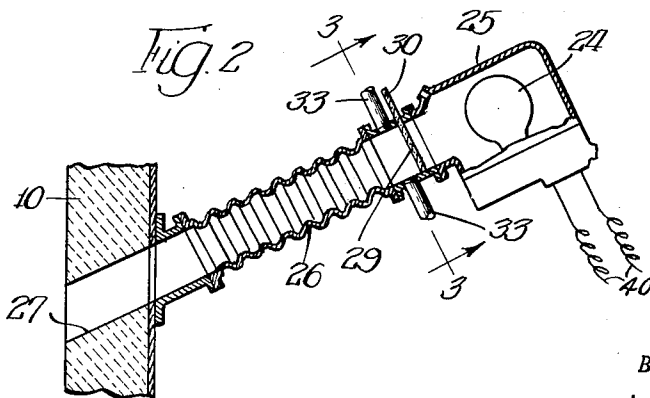
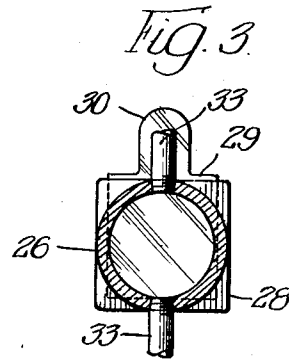


April 15, 1952

G. BABICZ
 PROTECTING SYSTEM FOR PHOTOELECTRIC CELLS
 IN LIQUID FUEL BURNER CONTROLS
 Filed Jan. 20, 1948

2,592,847



INVENTOR.
 George Babicz.
 BY
 B. Telechewicz
 Att'y.

UNITED STATES PATENT OFFICE

2,592,847

PROTECTING SYSTEM FOR PHOTOELECTRIC CELLS IN LIQUID FUEL BURNER CONTROLS

George Babicz, Chicago, Ill.

Application January 20, 1948, Serial No. 3,246

6 Claims. (Cl. 158—28)

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The present invention relates to the oil burning apparatus controlled by a photo-electric cell, for the purpose of shutting off the supply of oil and rendering the oil dispersing apparatus inoperative in the event the burning process is imperfect and as a consequence thereof excessive amount of smoke is generated or there is an absence of flame or obscuration thereof by the excessive amount of smoke. This is generally accomplished by directing a photo-electric cell upon the chamber in which the consumption of oil takes place in order to detect any undesirable degree of smoke generated in the chamber or the absence of flame or the obscuration of the latter by an excessive amount of smoke. The smoke in the chamber acting upon a photo-electric cell induces the latter to act upon suitable mechanism for shutting off the supply of oil and the motor which operates the oil dispersing mechanism, and as a result of this action the oil combustion in the chamber is stopped so as to permit proper adjustment in the mechanism supplying the oil or in the mechanism dispersing or firing the same in order to eliminate the generation of smoke or to recondition the mechanism for firing of the oil and to effect proper combustion of oil.

The beam of photo-electric cell is usually directed into and upon the fire chamber through a tube within which a glass slide is positioned in a transverse relation with the tube and intermediately between the photo-electric cell and the fire chamber. Since the tube is in communication with the chamber smoke and soot often settle upon the glass slide obscuring the beam of the photo-electric cell, thereby requiring periodic cleaning of the slide.

To prevent settling of smoke and soot upon the glass slide an air pipe was connected with the tube aforesaid in order to constantly flow from the tube into the fire chamber for preventing entrance of the smoke into the tube. However, the air flowing from the tube oftentimes generated ebb or back-flow permitting a degree of smoke and soot to enter the tube and to settle upon the glass slide. This objection was due principally to a single air pipe connecting with the tube aforesaid, and the air forced into the tube by a single pipe had a tendency of flowing within the tube along a portion of the periphery of the latter, permitting the ebb or back-flow of the combustion gases from the fire chamber into the tube aforesaid, and along the periphery of the latter along which the air did not sufficiently act to prevent the ebb or back-flow.

Therefore, the principal object of the present

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invention is the provision of efficient means for directing a flow of air in a compact mass from the tube aforesaid into the fire chamber for preventing the ebb or back-flow of combustion gases into the tube.

Another object of the present invention is the provision of simple and efficient means for directing the flow of air into the tube aforesaid from two, substantially diametrically opposite points in the periphery of the tube in order to force the flow of air in a compact mass from the tube into the fire chamber so as to prevent entrance of combustion gases into the tube.

A still further object of the present invention is the provision of at least a pair of air conduits connected with the air tube aforesaid, through which air may be fed under pressure into said air tube and expelled therefrom into the fire chamber, so as to engender a symmetrical velocity profile of air in the said air tube for preventing the combustion gases to enter said air tube and for eliminating settling of soot upon the said photo-electric cell or upon the said glass slide.

With the above general objects in view and others that will appear as the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing and pointed out in the appended claims.

In the drawing forming a part of this application, and in which like designating characters refer to corresponding parts throughout the several views:

Fig. 1 is a diagrammatic view, partly in section and partly in elevation, illustrating relative position of an oil dispersing and burning unit, a valve in the conduit supplying the oil thereto, which valve is electronically controlled by a photo-electric cell, a boiler or a similar housing defining a fire chamber in which the oil burns, a photo-electric cell directed into the fire chamber through a tube, a pair of air pipes connected with said tube and in front of a glass slide in the said tube, and an oil firing mechanism also electronically controlled by the photo-electric cell;

Fig. 2 is a longitudinal cross-sectional view through the photo-electric cell casing and the tube; and

Fig. 3 is a transverse cross-sectional view on line 3—3 of Fig. 2.

Referring in detail to the present drawing there is shown therein a boiler, including vertical wall 10 thereof which defines a fire chamber. Cooperating with said boiler is an oil dispersing and

burning unit, which includes nozzle 11, the outer free end of which is set within wall 10 in a transverse relation therewith. Said nozzle 11 is integrally formed with casing 12. Housing 13 is affixed to the opposite wall of said casing 12, and encloses electric motor 14, which drives shaft 15, passing through and supported by the rear wall of said casing 12. Connecting with shaft 15 is hub 16 which supports fan 17. Affixed to the front wall of casing 12, inwardly thereof and adjacent the inner end of nozzle 11 is spider 18. The latter is provided with a plurality of openings 19 for permitting passage of air from casing 12 into nozzle 11. Said spider 18 further carries an integrally formed tubular bearing 20 for supporting one end of hub 16.

Connecting with the rear wall of said casing 12 is air supply pipe 21, through which air is supplied into said casing 12.

Oil pipe 22 is passed through the rear vertical wall of housing 13, through motor 14, shaft 15 and hub 16, and is in a concentric relation with nozzle 11, the front end of said pipe 22 terminating a short distance rearwardly of the free open end of said nozzle 11. When electronically controlled solenoid valve 34, cooperating with said oil pipe 22 is opened, the oil is permitted to flow out of said pipe 22 through its end within nozzle 11. There it is dispersed by the air forced into nozzle 11 from the casing 12, and through openings 19, by the action of fan 17. The dispersed oil, indicated by 23, is ignited electrically by pilot burner 36' and is caused to burn within the fire chamber of the boiler defined by said wall 10.

The valve 34 for opening or shutting off oil pipe 22 is actuated automatically and electronically by well known thermostatic device, not shown in detail, which is controlled through electric wires 35 connecting with wires 40, the latter connecting with and leading from photo-electric cell 24.

Gas pilot burner 36' includes pipe 36. The latter is passed through boiler wall 10 in downwardly inclined direction. Said pipe 36 supplies the gas, which, when ignited, constitutes a pilot which is directed from above upon stream 23 of the dispersed oil. The escaping gas is electrically ignited by means of a spark engendered through electrode wire 37, concentrically positioned within pipe 36. Wire 37' connects with pipe 36. The inner end of said pipe 36 has a constricted mouth with the end of electrode 37 in a spaced relation therewith. Pipe 36 itself constitutes ground, so that when electric current is passed through electrode wire 37 and wire 37' electric spark is engendered at the inner end of pipe 36 for igniting the escaping gas through the inner open end of pipe 36.

The supply of gas through pipe 36 is controlled by valve 38 actuated either by a mercury or electronically controlled switch, with which wires 39 connect. The opposite ends of said wires 39 are connected with photo-electric cell 24 through wires 40.

In the event the dispersed oil does not properly burn and generates an undesirable degree of smoke, or in the event the flame has become extinguished for some reason, photo-electric cell 24 directed against the fire chamber, becomes in either event responsive for the purpose of automatically shutting off valve 34 which is connected with oil pipe 22 and of automatically shutting off valve 38.

Thus when photo-electric cell 24 becomes desensitized due to the obfuscation by smoke or lack of flame in combustion chamber 10, and the con-

sequent de-energization of electric circuits through wires 40, and wires 35 and 39, respectively, for actuating valves 34 and 38, respectively, the supply of oil through pipe 22 and the supply of gas through pipe 36 will be stopped. By this means the supply of oil and its dispersal and igniting in chamber 10 will be effectively arrested, thereby rendering the entire apparatus inoperative.

Said photo-electric cell 24 is positioned within casing 25, which is supported by tube 26. The opposite end of said tube 26 is affixed to wall 10, and communicates with opening 27 made in said wall 10. Said casing 25 likewise is in communication with said tube 26. Both said tube 26 and opening 27, the latter being a continuation of the adjacent end of said tube 26, are at an incline, being directed upon the fire chamber in the boiler for permitting the view of said chamber by said photo-electric cell.

Integrally formed with said tube 26, and adjacent its end which is nearest to casing 25, is a rectangular frame 28, which at one of its edges is provided with a slot through which glass slide 29 may be inserted into or withdrawn from said frame 28 and in a transverse relation with tube 26, as is clearly seen in Figs. 2 and 3. Said slide 29 is provided with ear 30 which may be manually grasped for shifting said slide 29. The purpose of said slide 29 is to keep away the heat and combustion gases from casing 25 so that photo-electric cell 24 may not become overheated and in order that the same may be maintained unobscured by smoke and soot which otherwise might enter thereto through said tube 26 and opening 27. However, smoke entering tube 26 would eventually cause the settling of soot upon slide 29, requiring periodic removal thereof from frame 28, for periodic wiping off of soot which has settled thereon. Unless this was done photo-electric cell 24 would become responsive to the obscuring film upon slide 29 and without regard to any undue degree of smoke or the absence of flame in the fire chamber, thereby rendering said photo-electric cell 24 inefficient in its operation.

In order to obviate and completely prevent entrance of any combustion gases, and consequently any solid combustion particles, into tube 26, and thereby to completely prevent settling of soot upon slide 29, the present invention was designed. The same includes manifold 31 connected with the rim wall of casing 12, adjacent the front end thereof. Said manifold 31 carries T-joint 32, with the horizontal portion of which a pair of air pipes 33 connects. The opposite ends of said pipes 33 are connected with tube 26, intermediately of slide 29 and wall 10, in the proximity of said slide 29, and at two diametrically opposite points on the periphery of said tube 26.

Tube 26 may be corrugated as shown for the purpose of causing heat radiation for maintaining tube 26 comparatively cool.

Part of the air stream driven by fan 17 is forced into manifold 31 from where it is distributed into pipes 33 and forced into tube 26 at two opposite points of the periphery of the latter. The air thus forced through said pipes 33 brings about a symmetrical velocity profile in tube 26 and opening 27 and the air is expelled through said opening 27 into the boiler or the fire chamber of any oil consuming apparatus. Due to the symmetrical velocity profile of the air engendered in tube 26 the back-flow either of air or of combustion gases from the fire chamber into tube 26 in the direction of slide 29 is effectively eliminated and pre-

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vented. In the devices wherein only one air pipe, such as pipe 33, is used, the back-flow of the air or of the combustion gases into the tube and toward slide 29 is not prevented, due to the fact that air forced through a single tube has a tendency to travel along the tube adjacent a portion of its periphery, thereby permitting the back-flow lengthwise of the tube along the remaining portion of the periphery thereof. By providing at least two air pipes, the outlets of which are preferably at diametrically opposed points of the periphery of the tube, the objections noted are effectively eliminated, with the result that there is practically no settling of the soot upon the surface of slide 29 which is exposed within tube 26, thereby eliminating frequent periodic withdrawals of slide 29 for cleaning the same.

Since switches for controlling valves 34 and 38, the thermostat, and the mechanism for thermostatically controlling the valves, are well known in the art, the same are not shown in the drawing. The invention resides entirely in the plurality of air pipes 33 connecting with tube 26 for the purpose of forcing the air into said tube 26 and effecting a symmetrical velocity profile of the air in tube 26 for the purposes indicated.

The device herein disclosed does not presuppose the use of glass slide 29 under all conditions. It may well be that the symmetrical velocity profile of air engendered in tube 26 may reduce the heat in said tube 26 to such a degree as to make it possible to dispense with slide plate 29 entirely, bearing of course in mind that the primary purpose and object of slide 29 was to protect photo-electric cell 24 from the heat engendered in tube 26. Then again, there may be means other than slide plate 29 for protecting photo-electric cell from heat. If slide plate 29 is dispensed with, it still will be necessary, and more so, to protect the photo-electric cell from the settling of soot thereon. What applicant desires to convey is the fact that slide plate 29 is not an indispensable element in his invention. The latter will work whether for the protection of slide plate 29 or for the protection of photo-electric cell 24 directly when the slide plate has been removed from the assembly.

While there is described herein a preferred embodiment of the present invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

What I claim as new is:

1. In a liquid fuel burning apparatus, a housing defining a fire chamber, said apparatus including means for supplying, dispersing and igniting the fuel for causing the same to be consumed in said fire chamber, a tube supported outwardly of said fire chamber and opening thereon, a photo-electric cell mounted at the outer end of said tube, said photo-electric cell being directed upon said fire chamber, said tube being provided with a transparent slide in a transverse relation therewith intermediately of said fire chamber and said photo-electric cell, said photo-electric cell being adapted to respond to combustion failure to render said means inoperative, and means for engendering a symmetrical velocity profile of air in said tube intermediately of said slide and said fire chamber and expelling the air into said fire chamber, said last named means including at least a pair of air conduits connected with said tube for injecting therethrough air under pressure.

2. In a liquid fuel burning apparatus, a housing defining a fire chamber, said apparatus including

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means for supplying, dispersing and igniting the fuel for causing the same to be consumed in said fire chamber, a tube supported outwardly of said fire chamber and opening thereon, a photo-electric cell mounted at the outer end of said tube, said photo-electric cell being directed upon said fire chamber, said tube being provided with a transparent slide in a transverse relation therewith intermediately of said fire chamber and said photo-electric cell, said photo-electric cell being adapted to respond to combustion failure to render said means inoperative, and means for injecting under pressure into said tube intermediately of said slide and said fire chamber streams of air from a plurality of points on the periphery of said tube in a substantially uniformly spaced relation on a transverse plane of said tube.

3. In a liquid fuel burning apparatus, a housing defining a fire chamber, said apparatus including means for supplying, dispersing and igniting the fuel for causing the same to be consumed in said fire chamber, a tube supported outwardly of said fire chamber and opening thereon, a photo-electric cell mounted at the outer end of said tube, said photo-electric cell being directed upon said fire chamber, said tube being provided with a transparent slide in a transverse relation therewith intermediately of said fire chamber and said photo-electric cell, said photo-electric cell being adapted to respond to combustion failure to render said means inoperative, and means for injecting under pressure into said tube intermediately of said slide and said fire chamber streams of air from a plurality of points on the periphery of said tube, said last named means including a plurality of air conduits connecting with said tube in a substantially uniformly spaced relation on a transverse plane of said tube.

4. In a liquid fuel burning apparatus, a housing defining a fire chamber, said apparatus including means for supplying, dispersing and igniting the fuel for causing the same to be consumed in said fire chamber, said means including an air compressing chamber, a tube supported outwardly of said fire chamber and opening thereon, a photo-electric cell mounted at the outer end of said tube, said photo-electric cell being directed upon said fire chamber, said tube being provided with a transparent slide in a transverse relation therewith intermediately of said fire chamber and said photo-electric cell, said photo-electric cell being adapted to respond to combustion failure to render said means inoperative, and means for generating a stream of air of uniform density in said tube intermediately of said slide and said fire chamber and expelling the same into said fire chamber for preventing a back-flow of combustion gases from said fire chamber into said tube, said last named means including a plurality of air conduits connecting with said tube at points in a substantially uniformly spaced relation on a transverse plane of said tube, the opposite ends of said air conduits being connected with said air compressing chamber for forcing the air from said air compressing chamber into said tube through said air conduits.

5. In a liquid fuel burning apparatus, a housing defining a fire chamber, said apparatus including means for supplying, dispersing and igniting the fuel for causing the same to be consumed in said fire chamber, said means including an air compressing chamber, a tube supported outwardly of said fire chamber and opening thereon, a photo-electric cell mounted at the outer end of said tube, said photo-electric cell being directed

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upon said fire chamber, said tube being provided with a transparent slide in a transverse relation therewith intermediately of said fire chamber and said photo-electric cell, said photo-electric cell being adapted to respond to combustion failure to render said means inoperative, and means for generating a stream of air of uniform density in said tube intermediately of said slide and said fire chamber and expelling the same into said fire chamber for preventing a back-flow of combustion gases from said fire chamber into said tube, said last named means including a pair of air conduits connecting with said tube at diametrically opposed points of the periphery thereof, the opposite ends of said air conduits being connected with said air compressing chamber for forcing the air from said air compressing chamber into said tube through said air conduits.

6. In a liquid fuel burning apparatus, a housing defining a fire chamber, said apparatus including means for supplying, dispersing and igniting the fuel for causing the same to be consumed in said fire chamber, a tube supported outwardly of said fire chamber and opening thereon, a photo-electric cell mounted at the outer end of

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said tube, said photo-electric cell being directed upon said fire chamber, said photo-electric cell being adapted to respond to combustion failure to render said means inoperative, and means for engendering a symmetrical velocity profile of air in said tube intermediately of said photo-electric cell and said fire chamber and expelling the air into said fire chamber, said last named means including at least a pair of air conduits connected with said tube for injecting therethrough air under pressure.

GEORGE BABICZ.

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