No. 658,697. Patented Sept. 25, 1900.

J. BOYLE.

APPARATUS FOR BURNING LIQUID FUEL.

(Application filed Oct. 13, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 3.

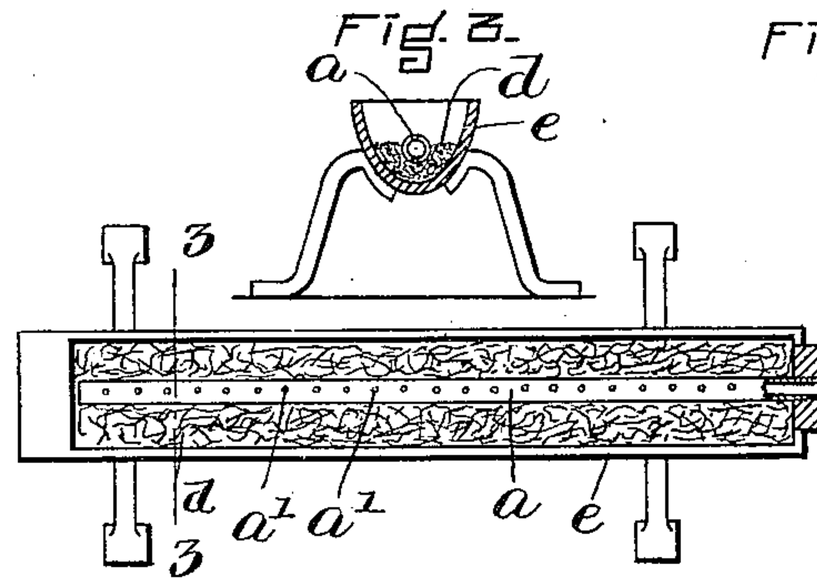

Fig. 1.

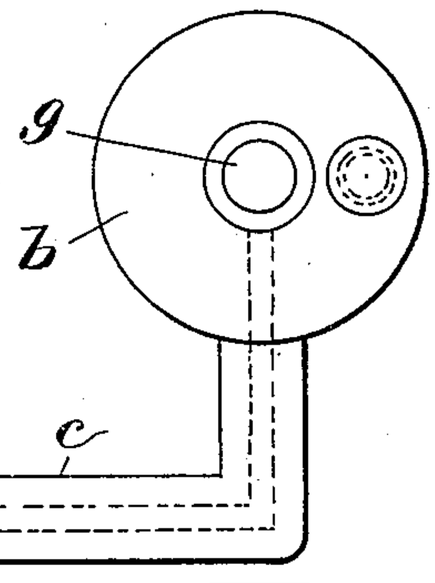

Fig. 2.

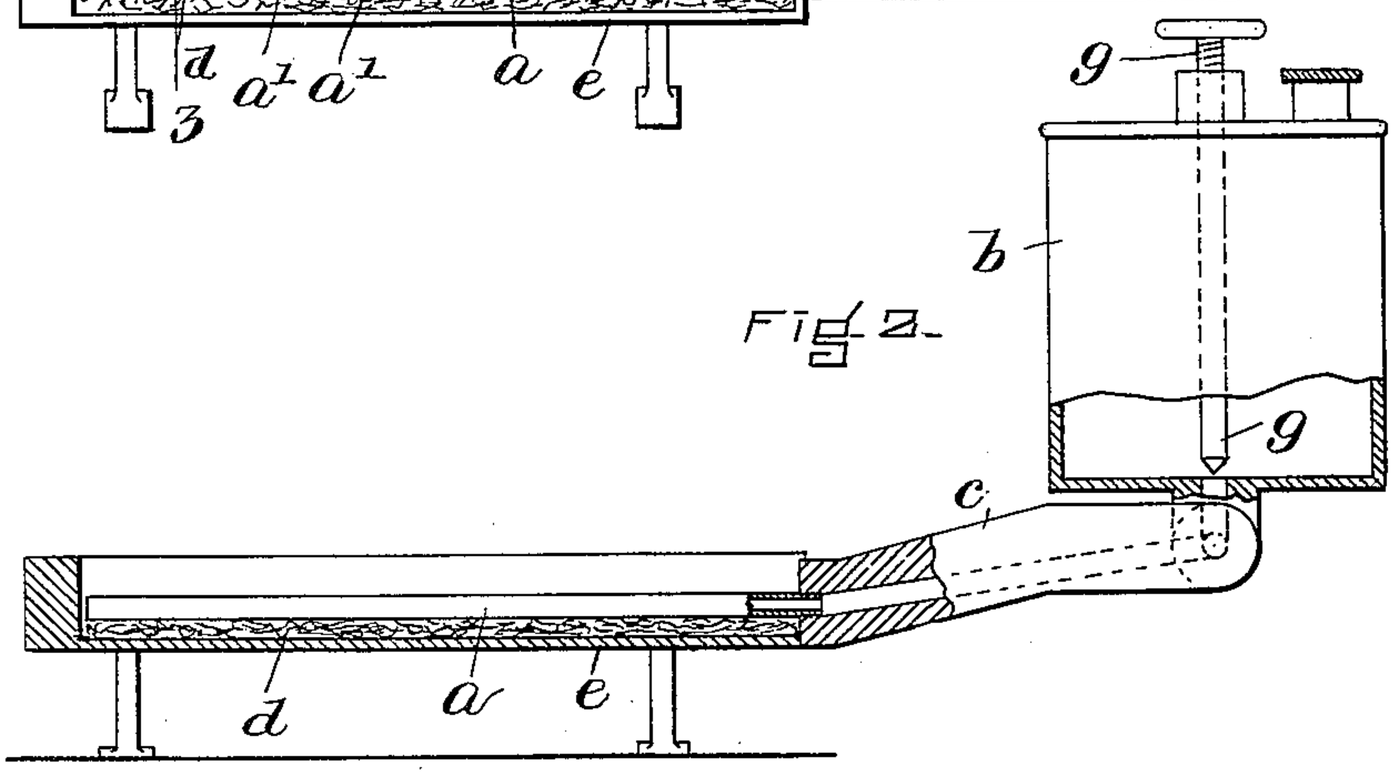

Fig. 4.

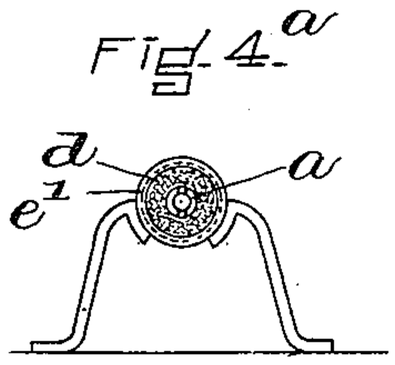

Fig. 4.

Fig. 5.

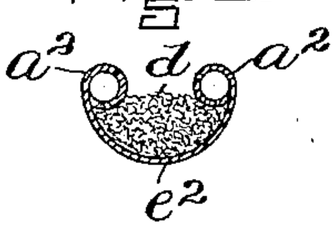

Fig. 6.

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FIG. 7.

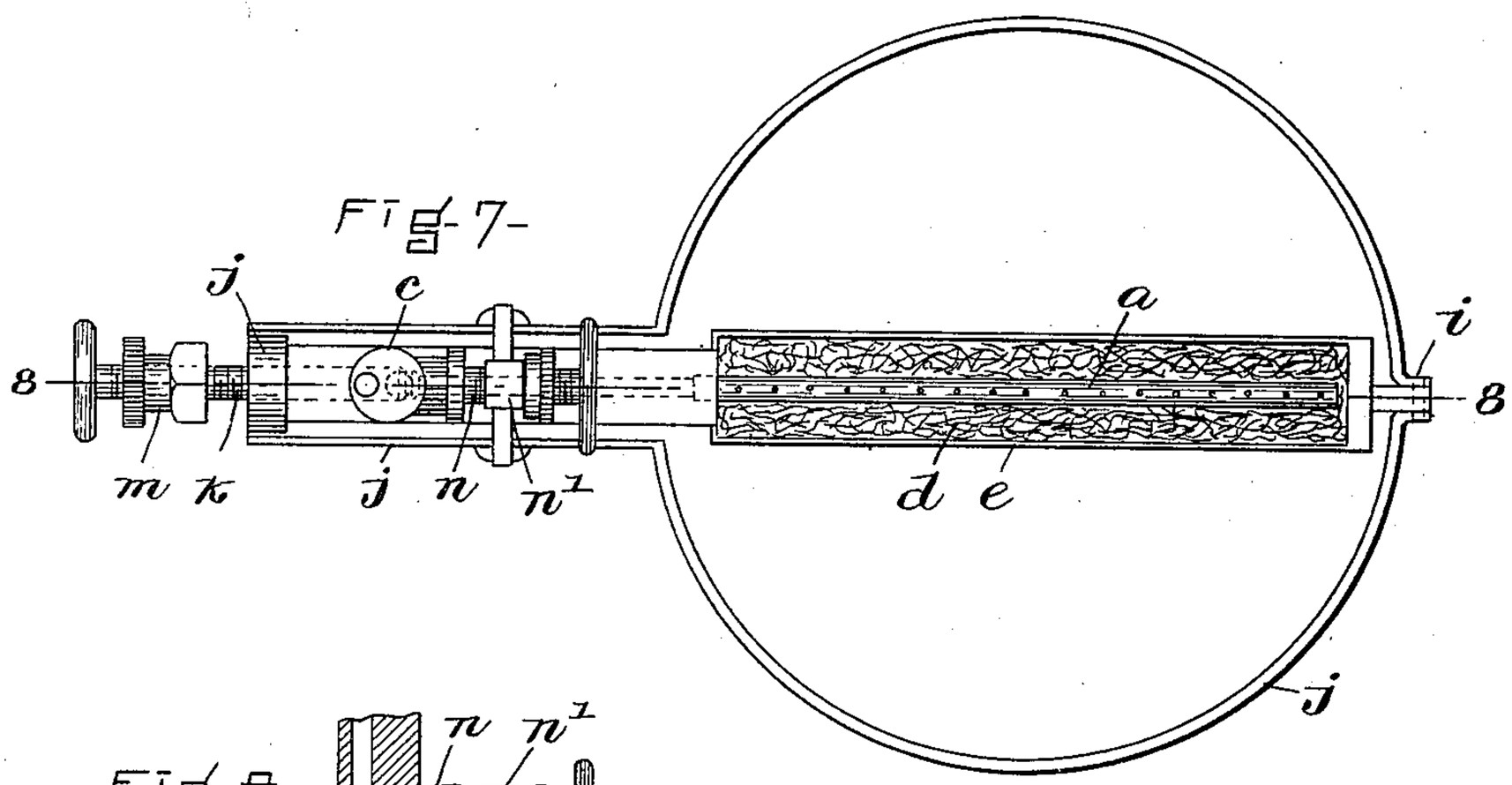


FIG. 8.

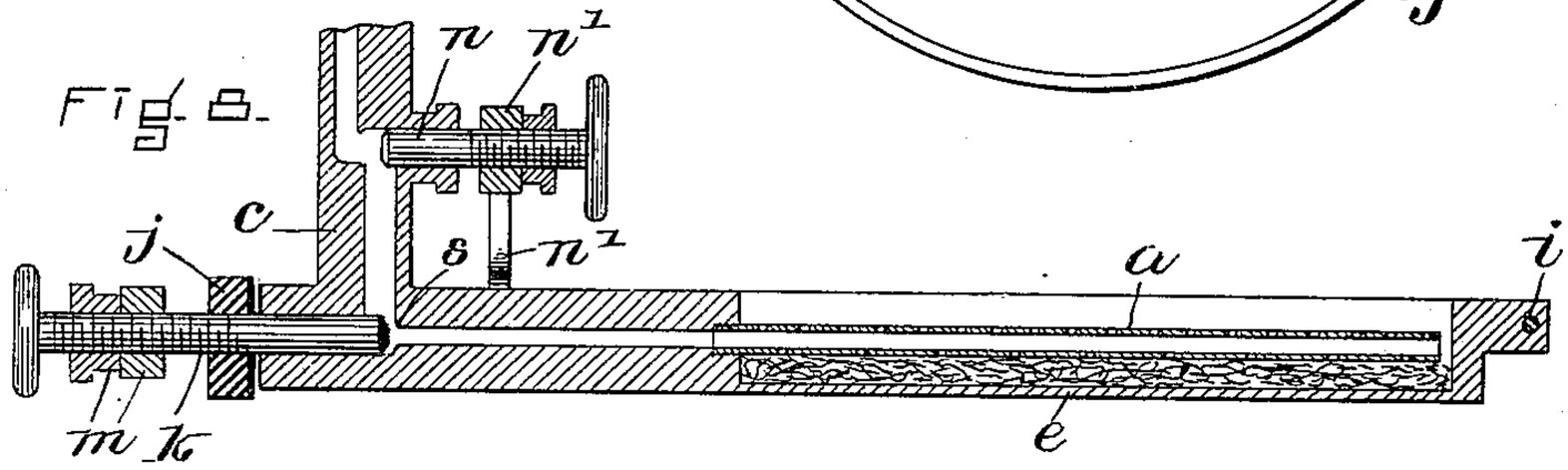


FIG. 9.

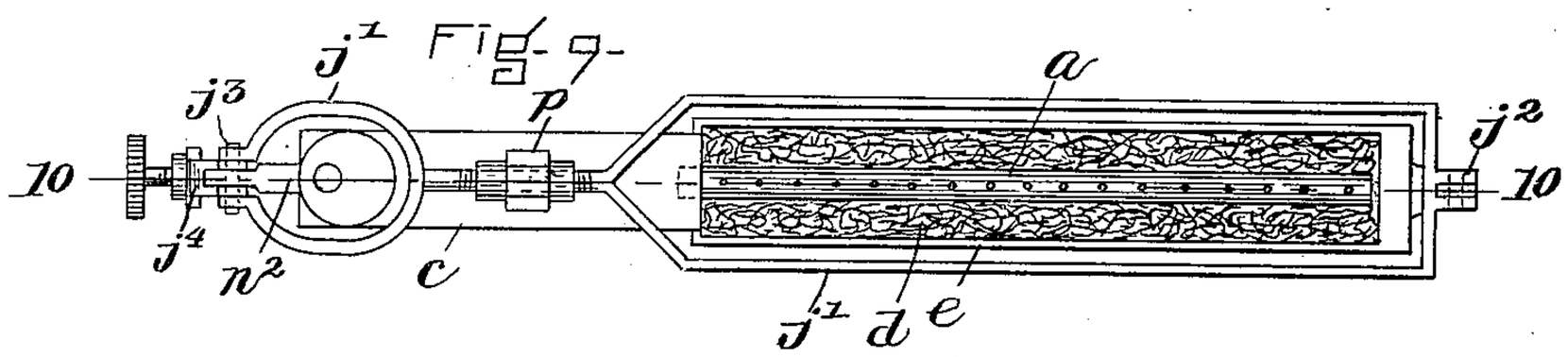
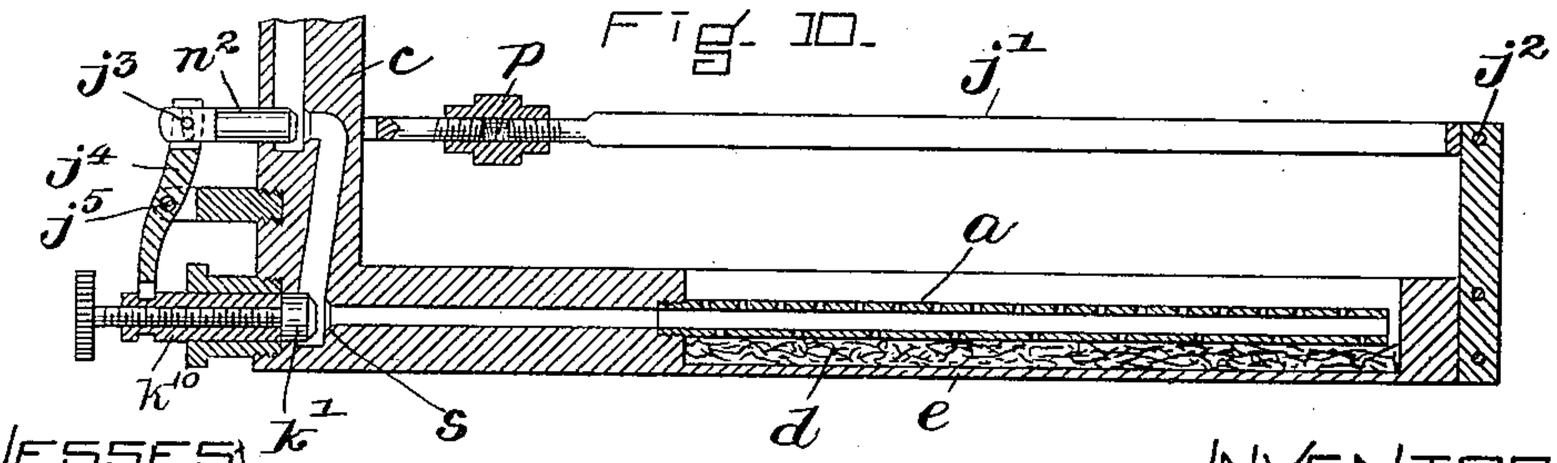


FIG. 10.



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UNITED STATES PATENT OFFICE.

JOHN BOYLE, OF PEABODY, MASSACHUSETTS.

APPARATUS FOR BURNING LIQUID FUEL.

SPECIFICATION forming part of Letters Patent No. 658,697, dated September 25, 1900.

Application filed October 13, 1899. Serial No. 733,485. (No model.)

To all whom it may concern:

Be it known that I, JOHN BOYLE, of Peabody, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Burning Liquid Fuel, of which the following is a specification.

This invention has for its object to produce an efficient apparatus for burning liquid fuel, such as alcohol or hydrocarbon liquid, either for heating or for illuminating or for both purposes, my improved apparatus being intended to quickly generate vapor from the liquid fuel supplied or from a portion of it and to operate with safety and without danger of explosion.

The invention consists in the several improvements, which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a top plan view of one form of apparatus embodying my invention. Fig. 2 represents a side elevation of the same, the burner being represented in longitudinal section. Fig. 3 represents a section on line 3 3 of Fig. 1. Fig. 4 represents a side elevation showing a modified form of the holder for the absorbent material hereinafter described. Fig. 4^a represents a section on line 4^a 4^a of Fig. 4. Figs. 5 and 6 represent views, similar to Fig. 3, showing modifications hereinafter referred to. Fig. 7 represents a top view of an apparatus embodying my invention provided with means for controlling, by varying degrees of temperature the supply of liquid fuel to the burner. Fig. 8 represents a section on line 8 8 of Fig. 7, the parts being shown in position, with the valve *k* open. Figs. 9 and 10 are similar views, showing a modification of the apparatus shown in Figs. 7 and 8, Fig. 10 being a section on line 10 10 of Fig. 9.

The same letters of reference indicate the same parts in all the figures.

My invention in its simplest form includes a tube *a* of small diameter, preferably about one-sixteenth of an inch, having numerous small perforations *a'*, through which the liquid fuel employed can exude and at which the fuel can be ignited, the tube *a* constituting a burner.

b represents a tank or reservoir for liquid fuel, which is connected by a suitable conduit *c* with the perforated burner-tube *a*.

In accordance with my invention I confine in contact with the burner-tube *a* and preferably along the sides and under the bottom of the same (although not covering its top) a body *d* of absorbent incombustible material, such as asbestos, which receives a portion of the liquid fuel that escapes through the perforations of the tube *a* and constitutes an auxiliary burner, the fuel absorbed by the body *d* burning outside the tube *a* and heating the latter, so that a portion of the liquid fuel entering it is converted into a vapor, which passes through the perforations in the upper portion of the tube and burns in a series of jets. The fuel which is burned in the asbestos body *d* forms a flame which mingles with the flame issuing directly from the tube, both forming an extremely-hot and efficient flame, the length of which is determined by the length of the perforated tube *a* and the mass of absorbent material *d*. The absorbent material *d* is confined by a holder, which in Figs. 1, 2, and and 3 is a trough *e*, closed at its bottom and sides and open at its top above the level of the tube *a*. In Fig. 4 I show the holder as a tube *e'*, of wire netting, which surrounds the tube *a*, the flame in this case issuing through the meshes of the wire.

As above stated, the absorbent incombustible material *d* constitutes an auxiliary burner. This material is confined by the holder *e* or *e'* or the equivalent thereof, hereinafter mentioned. It will thus be understood that the perforated fuel-supply tube *a*, the end of the conduit *c* adjacent thereto, the incombustible material *d*, and the holder for the latter constitute the different parts of the burner proper, all of said parts coacting to form a burner of the type mentioned.

In Fig. 5 I show a modification in which instead of the central tube *a* two tubes a^2 a^2 are formed at opposite edges of a trough or holder e^2, the absorbent body *d* being placed in the trough between the two tubes.

In Fig. 6 I show a modification in which the perforated tube, here lettered a^4, is made trough-shaped and contains the body *d*, of asbestos, the inner wall of the trough-shaped

tube a^1 being suitably perforated to permit the escape of liquid fuel either above or below the asbestos body or at both points.

I have shown the tank b provided with a valve g, which is preferably a needle-valve, and is adapted to vary the quantity of fuel passing through the conduit c to any desired extent or to entirely shut off the flow of the fuel through said conduit.

My invention includes the provision of means for varying the quantity of fuel supplied to a tube a by variations in the temperature produced by the combustion of the liquid fuel, the supply of fuel being decreased when the temperature exceeds a predetermined degree. The invention also includes the provision of a safety-stop operated by a decrease of temperature, which will cause the total cessation of the flow of liquid fuel and the extinguishment of the flame, so that in case the fuel is entirely cut off by the expansion of the parts due to an increase of heat the subsequent contraction will again cut off the flow of fuel, so that waste of the fuel in case it is not relighted will be automatically prevented.

In Figs. 7 and 8 I show one form of apparatus embodying the provisions above described. In said figures the tube a and holder e for the absorbent body are as already described, one end of the holder e being rigidly attached at i to a rigid frame or holder j. The opposite end of said holder j is provided with a valve k, which enters and has a sliding fit in the conduit c, which supplies the tube a with liquid fuel. The arrangement of the valve k is such that when the parts of the burner are expanded by heat a valve-seat s within the conduit will be moved toward the valve k, thus contracting the flow of liquid fuel through the conduit and causing a decrease of temperature, and a contraction of the tube a and the connected parts causes a separation of the valve-seat from the valve and an increase of the flow of liquid fuel. This alternate expansion and contraction is maintained, the result being a practically-uniform flow of fuel to the burner-tube a. The valve k is adjustable, and in this case the adjusting means are a screw-thread formed on the valve and a nut engaged with said thread formed in the frame or holder j. A jam-nut m is provided to secure the valve k at any position to which it may be desired. By adjusting the valve k the sensitiveness of the apparatus to variations of heat may be regulated, as will be readily seen. In case the expansion of the burner is sufficient to entirely shut off the flow of liquid fuel and thus extinguish the flame, the supply of liquid fuel is entirely shut off in the conduit c by the excessive contraction which follows the extinguishment of the flame through the medium of a safety-stop n, which is here shown as a valve affixed to the frame or holder j and having a sliding fit in the conduit c, the valve being arranged to close the said conduit when the contraction of the tube a has moved the said conduit to predetermined extent. The safety-stop n is adjustable, like the valve k, it being screw-threaded and engaged with a nut or screw-threaded orifice formed in a frame n', attached to the holder j. This construction avoids the necessity for the employment of a separate thermostatic device for controlling the supply of fuel to the burner, the burner itself constituting said thermostatic device.

In Figs. 9 and 10 I show a modification of the construction shown in Figs. 7 and 8, in which the expansion and contraction of a separate piece or frame j' exposed to the heat from the burner-tube is caused to close and open a sliding valve k', which controls the flow of fuel through the conduit c to the tube a. The frame or bar j is rigidly attached at j^2 to one end of the holder e, its other end being branched to embrace the conduit c and connected at j^3 with a lever j^4, which is pivoted at j^5 and is loosely connected with a sleeve k^{10}, in which the valve k' is adjustably carried. The expansion of the frame j' moves the lever j^4 in the direction required to push the valve k' toward a seat s in the conduit c, thus contracting the conduit and decreasing the flow of liquid fuel. In this modification the safety-stop is a sliding valve n^2, which is connected with the upper end of the lever j^4 and with the movable end of the frame j', so that when said frame contracts to a predetermined extent the valve n^2 entirely closes the conduit c. The frame j' is preferably made in two parts, connected by an elongated nut p, which has two threads, one right and one left, the parts of the frame j' having corresponding threads, so that by rotating the nut p the frame j' can be either lengthened or shortened to adjust the valves k' and n^2.

I do not limit myself to the particular devices and details of construction here shown and described, as the same may be variously modified without departing from the spirit of my invention.

In Fig. 4 I show an opening o formed in the conduit c. A section p of glass (shown in dotted lines) forms a part of the conduit and is visible through the opening o. The glass section p and opening o constitute a sight-feed.

While I have hereinbefore used the word "vapor" as the substance generated from the fuel preferably employed with my improved apparatus, it is to be understood that I do not limit myself to the use of such fuel as is to be converted into vapor.

So far as some of the novel features of my invention are concerned, they may be employed in apparatus designed to burn a fixed gas.

I claim—

1. In a fuel-burning apparatus, the combination of a burner, a source of fuel-supply, and means operated by an increase of temperature of the burner, for diminishing the fuel-supply.

2. In a fuel-burning apparatus, the combination of a burner, a valve device regulating the flow of fuel thereto, and means operated by variations in temperature of the burner for imparting positive valve opening and closing movements to said device.

3. In a fuel-burning apparatus, the combination of a burner, a valve device regulating the flow of fuel thereto, and means operated by an increase in temperature of the burner for imparting a positive valve-closing movement to said device.

4. In a fuel-burning apparatus, the combination of a burner, a valve device regulating the flow of fuel thereto, and means operated by an increase in temperature of the burner, for imparting a positive valve-opening movement to said device.

5. In a fuel-burning apparatus, the combination of a burner, two valve devices both of which control the flow of fuel to the said burner, a connection whereby a valve-opening movement of one device occurs coincidently with a valve-closing movement of the other device, and a thermostat operatively related to said valve devices and in heating proximity to the burner.

6. In a fuel-burning apparatus, the combination of a burner, a valve device for regulating the flow of fuel thereto, means operated by an increase in the temperature of the burner for imparting a positive valve-opening movement to said device, and means for adjusting said device whereby it may act at any desired degree of temperature.

7. In a fuel-burning apparatus, the combination of a burner, a source of fuel-supply, a device operated by an increase of temperature of the burner for decreasing the supply, and means for adjusting said device, whereby it may be actuated for different variations of temperature.

8. In a fuel-burning apparatus, the combination of a thermostatic device subject to movement by variations in temperature, a burner mounted on and movable with said device, a fuel-duct extending through said device and having a valve-seat which moves with the device, and a stationarily-mounted valve coacting with said valve-seat.

9. In a fuel-burning apparatus, the combination of a burner, a thermostat arranged in heating relation thereto, a fuel-duct movable by the thermostat and having a valve-seat, and a stationarily-mounted valve coacting with said valve-seat.

10. In a fuel-burning apparatus, the combination of a burner, a thermostat arranged in heating relation thereto, a fuel-duct movable by the thermostat and having two oppositely-directed valve-seats, and two stationarily-mounted valves coacting with said valve-seats and directed through opposite walls of the duct.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN BOYLE.

Witnesses:
C. F. BROWN,
A. D. HARRISON.