April 10, 1928. 1,665,443

J. W. CANNON

OIL BURNING SYSTEM

Filed Jan. 30, 1928 3 Sheets-Sheet 1

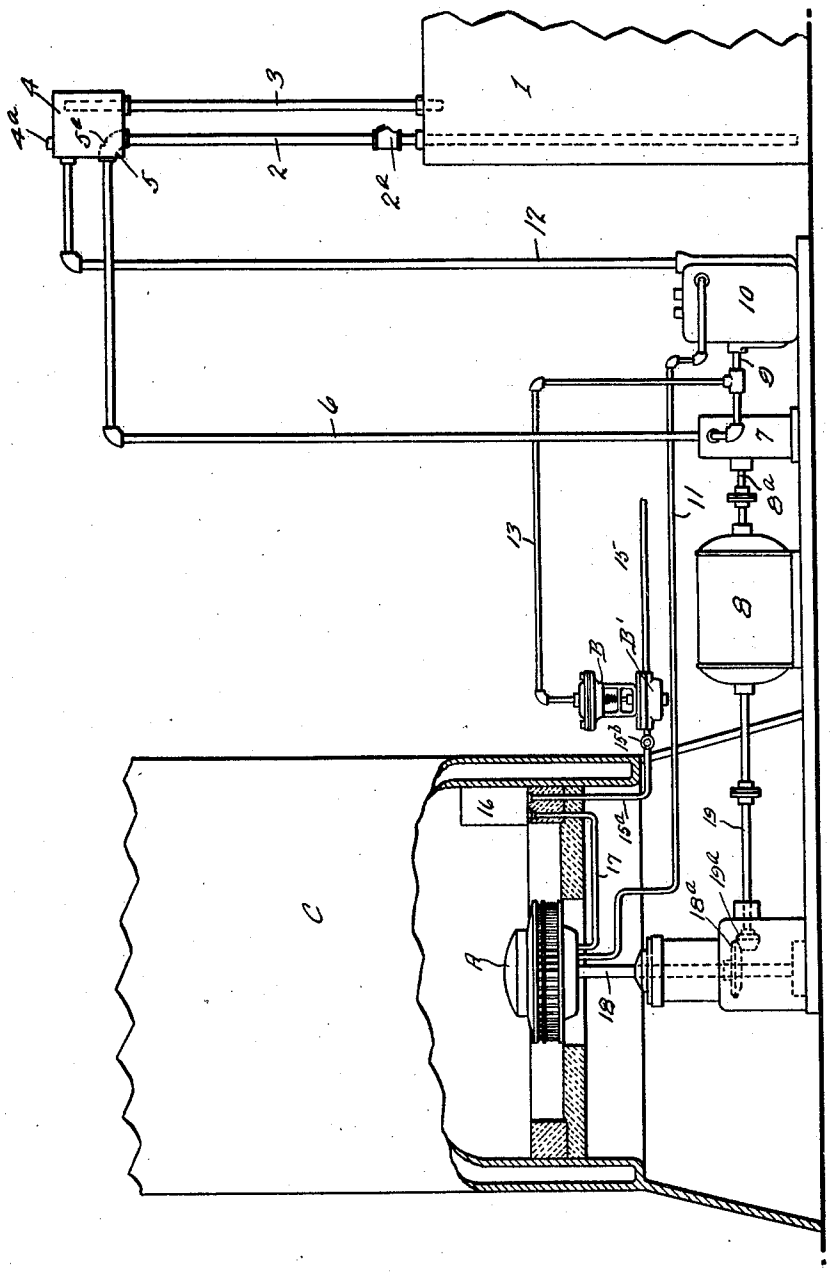

Fig. 1

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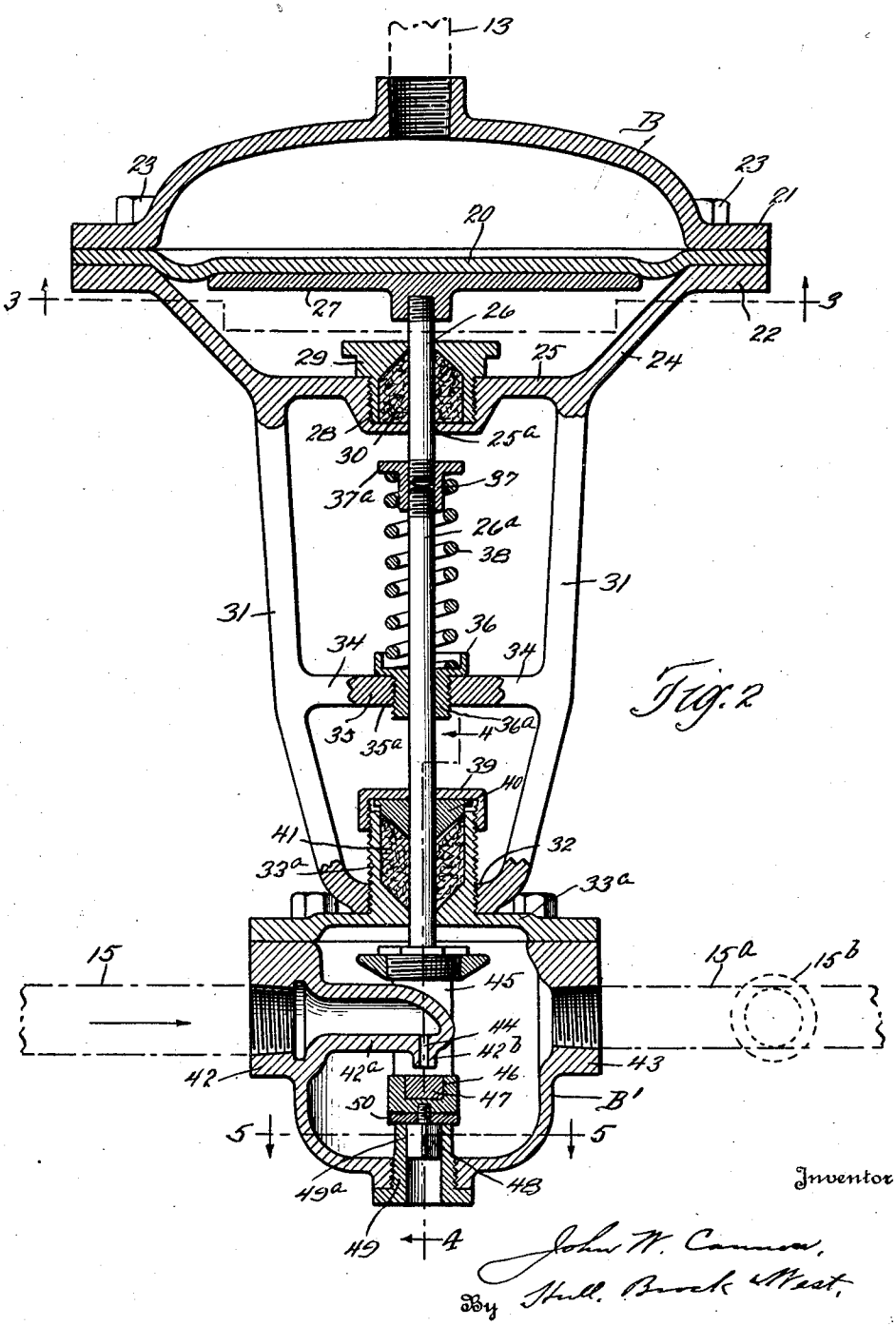

Fig. 2

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Fig. 3

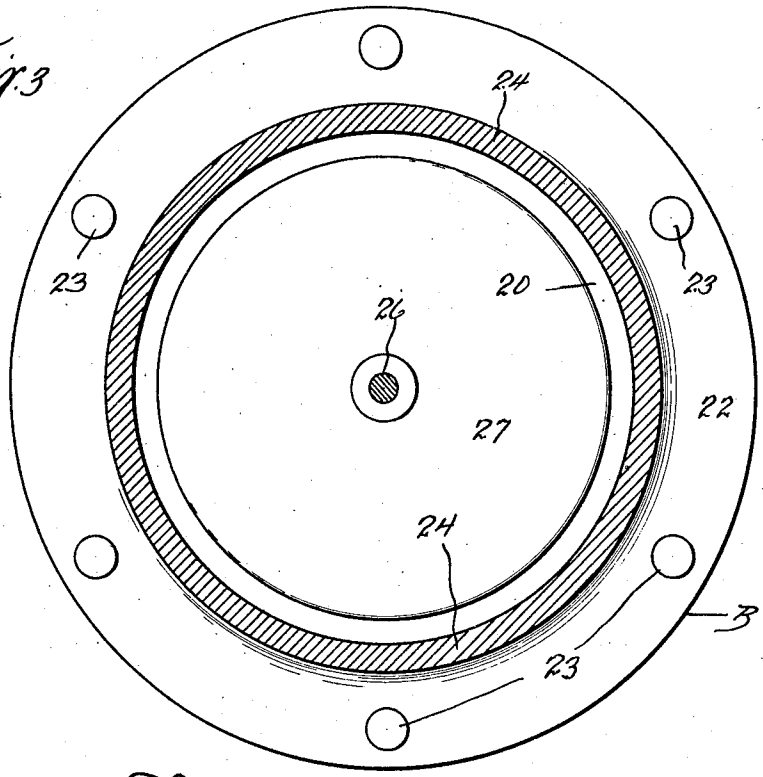
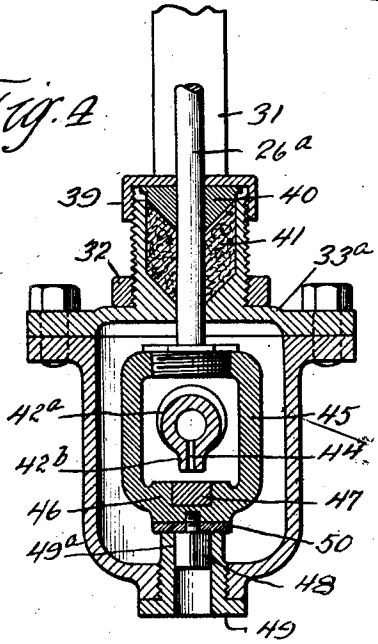


Fig. 4



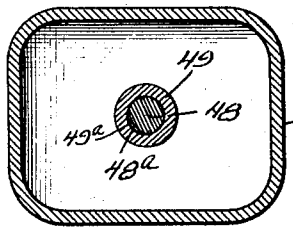


Fig. 5

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Patented Apr. 10, 1928. 1,665,443

UNITED STATES PATENT OFFICE.

JOHN W. CANNON, OF PROVIDENCE, RHODE ISLAND.

OIL-BURNING SYSTEM.

Application filed January 30, 1928. Serial No. 250,517.

This invention relates to mechanism for regulating the supply of fuel to a burner, and more particularly to the construction of a diaphragm valve and its arrangement in a system for feeding water to a generator for superheated steam and oil to an atomizer, and for delivering the mixture of atomized oil and superheated steam to a burner included in such system.

It is the general purpose and object of the invention to provide a system of the character referred to with an efficient diaphragm-valve and to arrange said valve in such manner in said system as to avoid danger of fire in the event of the rupture of the diaphragm and also to so construct and arrange said valve as to prevent water, as distinguished from steam, from being admitted to the atomizer and/or the burner, especially during the starting operation.

Further and more limited objects of the invention will appear hereinafter in the description, and all of the objects referred to will be accomplished by the construction and arrangement of parts shown in the drawings, wherein Fig. 1 represents a view, partly in section and partly in side elevation, of a system or apparatus embodying my invention; Fig. 2 is a central vertical sectional view through the diaphragm valve embraced in my system; and Figs. 3, 4 and 5 are details in section corresponding respectively to the lines 3—3, 4—4 and 5—5 of Fig. 2.

The system or apparatus shown in Fig. 1 is of the same type as shown in my Patent No. 1,572,591 issued Feb. 9, 1926, and in my application Serial No. 85,400, filed Feb. 1, 1926, of which this application is a continuation in part. The said system, as shown in Fig. 1, is a system for which my diaphragm valve is particularly well adapted, and it will be shown and described in relation to such system.

Describing in detail the parts shown in the drawing, 1 represents an oil tank connected by pipes 2 and 3 with a small siphon check tank 4 provided with a filling plug 4^a, the pipe 2 extending to the bottom of the tank 1 and the pipe 3 extending from the top of the same. The pipe 2 is provided with a downwardly seating check valve 2^a. In the tank 4, there is an elbow 5 provided with a small vent 5^a to prevent siphoning of the liquid from the tank 1, and from this elbow a pipe 6 extends to a pump 7 driven by a motor 8 through a shaft 8^a. From the pump 7 the pipe 8 delivers oil through a pipe 9 to a by-pass tank 10, which may be of the general construction shown in my aforesaid patent; and from the tank 10, a pipe 11 leads to an atomizer (not shown) preferably located within the burner A. From the tank 10 another pipe 12 leads to the top of the tank 4 for the purpose of returning excess fuel from the by-pass tank 10 to the tank 4.

A pipe 13 leads from the pipe 9 to the upper end of an upper chamber B of a diaphragm valve. A pipe 15 which is supplied with water from any convenient source, as through an ordinary valved connection with the city main (not shown), communicates with the bottom chamber B′ of the diaphragm valve. From the delivery side of the chamber B′ a pipe 15^a conducts the water passing therethrough to a steam generator and super-heater 16 positioned within the fire box of a furnace or heater C. The pipe 15^a is shown as provided with a globe valve 15^b whereby the water supplied to the super-heater 16 may be controlled by the diaphragm valve and also regulated through the manipulation of the said globe valve. From the super-heater 16 a pipe 17 conducts super-heated steam to the atomizer (not shown) within the burner A. This atomizer may be of any desired construction, but is preferably of the type shown in my patent aforesaid.

The burner shown herein is of the centrifugal type, such as shown in my patent aforesaid, being rotated by a shaft 18, having a beveled gear 18^a thereon meshing with a beveled pinion 19^a on a shaft 19 driven by the motor 8.

In the operation of this system as thus far described, the super-heater 16 will be primarily heated in any convenient manner to generate steam for the initial atomization of the oil supplied to the atomizer by the pipe 11. Water is supplied to the super-heater through the pipe 15, valve chamber B′, pipe 15^a and thence to the atomizer by the pipe 17. The valve in the chamber B′ will be opened by the pressure of oil in the pipe 13 so as to permit the flow of the water to the super-heater; in the event that the pressure should fall, the valve will close more or less thereby to reduce or cut off the supply of water to the super-heater. The oil in excess of that required for the burner will be delivered from the by-pass tank into the tank 4.

In the operation of systems of this char-

acter it is extremely desirable that, should the diaphragm in the chamber B become ruptured, there shall be no leakage of oil, with its attendant fire risk. It is also desirable that, should there be any leakage past the valve in the chamber B′ which controls the supply of water to the super-heater, such leakage should not be allowed to accumulate in the chamber, as this would result in supplying water to the super-heater at a time when not necessary or desirable, thereby flooding the furnace. Furthermore, in starting, if water should have accumulated in the chamber B′ because of such leaky condition, there will be an excess of water supplied to the super-heater at a time when the latter is not heated to full operating conditions, which would result in blowing a slug of water into the burner, causing the flame to be extinguished, or in drawing into the burner, through the atomizer, more oil than can then be consumed. Even should the fire not be extinguished, this supply of excess water from the chamber B′ will set up a pulsation in the operation of the burner which will persist until such time as the excess water can be used.

In order to overcome these difficulties I have constructed the diaphragm valve in the manner shown in Figs. 2–5 inclusive. Referring to these figures, 20 denotes the diaphragm which is clamped between flanges 21 and 22 on the upper and lower sections of the chamber B, respectively, the clamping bolts being shown at 23. It will be noted that the lower section is closed, the side 24 and bottom 25 being imperforate, except that the bottom is provided with an opening 25^a for the upper section 26 of a valve-operating stem. This upper valve-stem section is attached to a backing plate 27 which bears against the lower surface of the diaphragm 20, the said upper section extending through the opening 25^a and a stuffing box therebelow provided by a pocket 28 formed in the bottom 25 and a packing gland 29 threaded into the said pocket, the interior of the gland being filled with packing 30.

From the bottom of the chamber B there depend arms 31 which carry at their bottom a plate 32 having an opening which is threaded for a hub 33^a carried by the cover 33 of the chamber B′. 34 denotes a pair of arms carried by and extending inwardly from the arms 31 and having at their centers a disk or plate 35 provided with a threaded aperture 35^a into which the hub 36^a of a cup 36 is threaded.

The upper section 26 of the valve-operating stem is connected to the lower section 26^a by means of a sleeve 37 threaded onto the adjacent ends of said sections, said sleeve having a flange 37^a at its upper end against which the upper end of a spring 38 bears, the lower end of the spring being seated in the cup 36. The spring 38 serves to hold the valve-operating stem in elevated position whereby it closes or tends to close, the valve (to be described hereinafter) in the chamber B′. The lower section 26^a extends through a stuffing box of which the hub 33^a forms a part, the other members of the stuffing box being a cap 39 threaded on the said hub, a downwardly tapered gland 40 within the hub and pressed thereinto by the said cap, and packing material 41 in the hub surrounding the section 26^a and compacted by the gland 40.

The bottom section of the chamber B′ is provided with threaded connections 42 and 43 for the pipes 15 and 15^a, respectively, and the former connection is provided with an inward extension 42^a, which may be cast with the bottom section of the chamber B′, said extension having a downwardly-extending nipple 42^b provided with a port 44 therethrough communicating with the chamber formed within the said extension, the bottom of the nipple constituting a valve seat for the valve carried by the stem 26, 26^a.

The valve proper is carried by and forms part of a yoke 45 which is secured to the lower end of the valve-stem section 26^a, the yoke receiving the nipple 43^b therewithin. The bottom of the yoke has a cup 46 which receives a valve disc 47, cemented or otherwise secured therein, and which plug may be made of vulcanite or other suitable material. The valve is movable by the spring 38 toward the valve seat formed by the end of the nipple 42^b and is moved away from said seat by the pressure of the oil supplied on top of the diaphragm 20.

The yoke is provided at its bottom and beneath the valve 47 with a guide stem 48 which operates in a combined guide and drain sleeve 49 threaded into the bottom of the chamber B′. The guide stem is preferably formed as an enlarged extension or head of a screw 48^a which is threaded into the bottom of the yoke 45. A valve disc 50 is clamped between the head 48 and the bottom of the yoke, while the guiding portion of the head is flattened, as shown at 48^a, to provide a drain port 49^a within and through the sleeve 49 when the valve 50 is moved away from its seat on the top of said sleeve by the spring 38.

With the construction of diaphragm valve disclosed herein, it will be evident that, should the diaphragm 20 be ruptured, there can be no leakage of oil around the diaphragm valve because of the provision of the closed chamber beneath the diaphragm; hence there will be no danger of fire by virtue of such rupture. Furthermore, while it is the object to prevent leakage of water past the valve (not shown) in the pipe 15 which establishes communication between the chamber B′ and the city main, as well as

leakage past the valve 46 and its seat at the bottom of the nipple 42b, nevertheless such leakage is apt to occur, due to the wearing or deterioration of the valve members. This leakage would result in a supply of water to the super-heater 16 under conditions which might be attended with the disadvantages referred to hereinbefore. However, when the valve 46, 42b is closed by the spring 38, the valve provided by the parts 50, 49 is open, so that liquid cannot accumulate in the chamber B' to a height and under a head which will enable it to pass by leakage into the pipe 15a. Even should the ordinary hand-operated valve, which admits water to the pipe 15 from the city main, not be closed when the valve 46, 42b is closed, the worst that could happen would be a considerable discharge of water beneath the diaphragm valve. When the diaphragm is subjected to oil under operating pressure in the pipe 13, the valve 46, 42b will be open and the valve 50, 49 will be closed.

Having thus described my invention, what I claim is:

1. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising an upper diaphragm chamber having a connection for oil under pressure, a diaphragm in said chamber below said connection, a valve stem connected to said diaphragm, a water-valve chamber below the diaphragm chamber and having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in the water-valve chamber carried by said stem and controlling the supply of water from said chamber to the said outlet connection, and a lower diaphragm chamber beneath the diaphragm and above the water-valve chamber and closed except for a substantially leak-proof opening for said valve stem.

2. In a system for supplying a mixture of oil and steam to a burner, and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising an upper diaphragm chamber having a connection for oil under pressure, a diaphragm in said chamber below said connection, a valve stem connected to said diaphragm, a water-valve chamber below the diaphragm chamber and having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in the water-valve chamber carried by said stem and controlling the supply of water from said chamber to the said outlet connection, a lower diaphragm chamber below the diaphragm and above the water-valve chamber, and a stuffing box in the bottom of the last-mentioned chamber through which the valve stem passes.

3. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising an upper chamber having a connection for oil under pressure, a diaphragm in said chamber below said connection, a valve stem connected to said diaphragm, there being a chamber beneath said diaphragm and closed except for a substantially leak-proof opening through which the stem passes, a lower water-valve chamber having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in the lower chamber carried by said stem and controlling the supply of water from said chamber to and through the said outlet connection, and additional means operated by the closing movement of the said valve for permitting the escape of water from the said lower chamber.

4. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising an upper chamber having connection for oil under pressure, a diaphragm in said chamber below said connection, a valve stem connected to said diaphragm, a lower water-valve chamber having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in such water-valve chamber carried by said stem and controlling the supply of water from said chamber to and through the said outlet connection, and additional means controlled by the movement of the said valve stem for permitting the escape of water from the said water-valve chamber.

5. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising an upper chamber having a connection for oil under pressure, a diaphragm in said chamber below said connection, a valve stem connected to said diaphragm, a lower water-valve chamber having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in the lower chamber carried by said stem and

controlling the supply of water to said chamber through the said inlet, the chamber being provided with a sleeve in the bottom thereof below the said valve, and a stem projecting downwardly from said valve into said sleeve, the last-mentioned stem and the said sleeve having cooperating valve members for permitting the escape of water from the lower chamber as the valve thereabove approaches the inlet.

6. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising an upper chamber having a connection for oil under pressure, a diaphragm in said chamber below said connection, a valve stem connected to said diaphragm, a lower water-valve chamber having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in the lower chamber carried by said stem and controlling the supply of water to said chamber through the said inlet, the chamber being provided with a sleeve in the bottom thereof below the said valve, a stem projecting downwardly from said valve into said sleeve, the last mentioned stem having thereon a valve member which is adapted to seat on the top of the said sleeve when the first-mentioned valve is moved a predetermined distance from the inlet, there being a drain passage formed between the last-mentioned stem and the said sleeve, below the second-mentioned valve.

7. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising a chamber having a connection for oil under pressure, a diaphragm in said chamber, a valve stem connected to said diaphragm, a water-valve chamber having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve comprising a valve member in such water chamber carried by said stem and controlling the supply of water from said chamber through the said outlet connection, and means permitting the escape of water from the water-valve chamber when the valve is in a position other than fully open.

8. In a system for supplying a mixture of oil and steam to a burner and including a generator for steam to which water is supplied; a diaphragm valve for controlling the supply of water to said generator through the pressure of the oil in said system, the said diaphragm valve comprising a chamber having a connection for oil under pressure, a diaphragm in said chamber, a valve stem connected to said diaphragm, a water-valve chamber having an inlet for the water supplied to the generator and provided with an outlet connection for such water, a valve in such water chamber carried by said stem and controlling the supply of water to said chamber through the said inlet, and means for automatically discharging water from the water-valve chamber when the pressure of oil in the system, operating upon the diaphragm, shall have fallen below a predetermined limit.

In testimony whereof, I hereunto affix my signature.

JOHN W. CANNON.