

Jan. 12, 1937.

W. I. SALLEE

2,067,417

APPARATUS FOR PREHEATING FLUIDS

Filed July 26, 1934

3 Sheets-Sheet 1

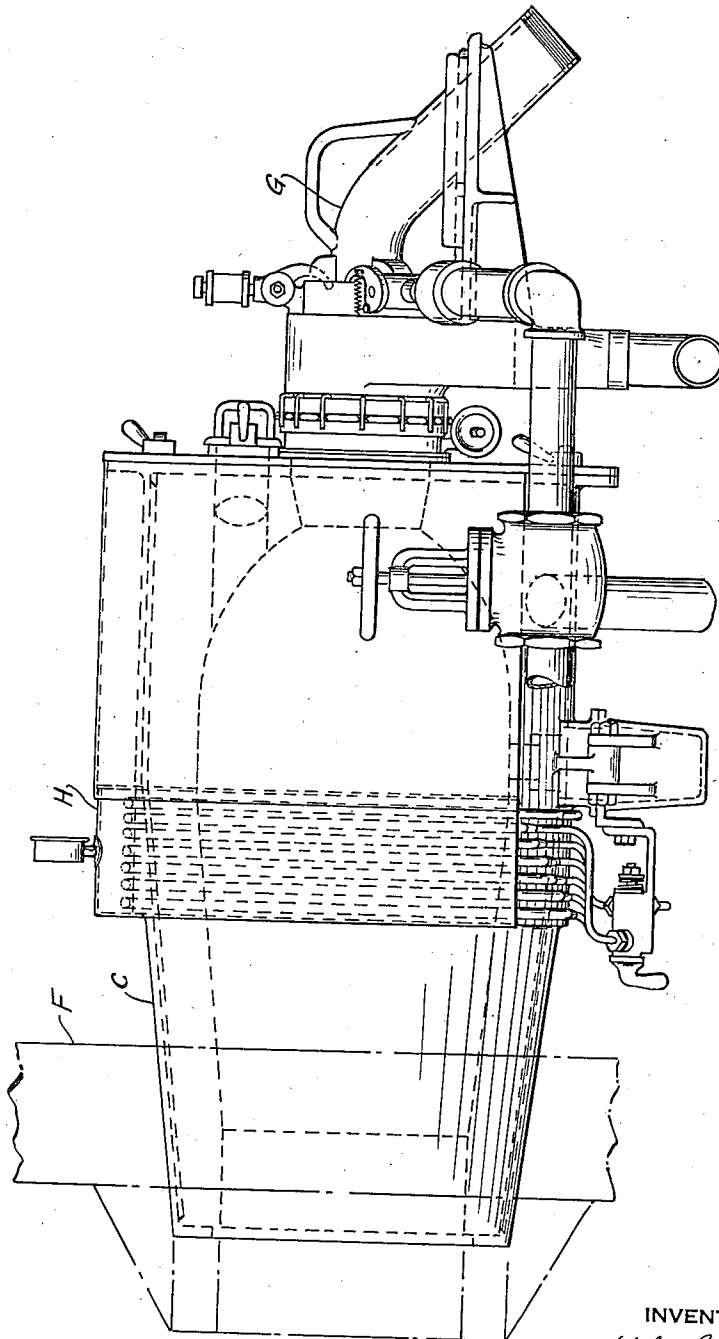


FIG. 1

INVENTOR

*Walter L. Salter,*

BY

*Soule & Leonard*

ATTORNEYS

Jan. 12, 1937.

W. I. SALLEE

2,067,417

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3 Sheets-Sheet 2

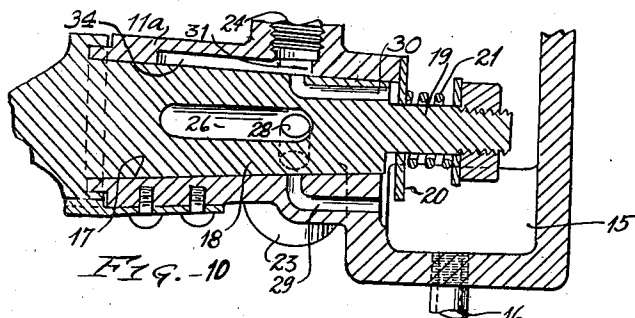


FIG. 10

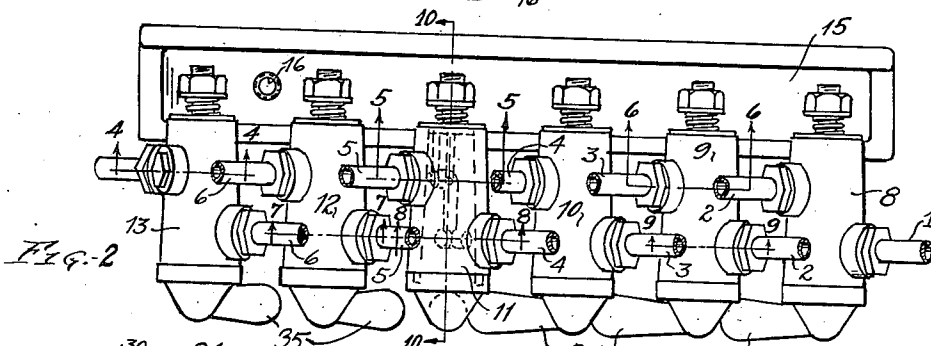


FIG. 2

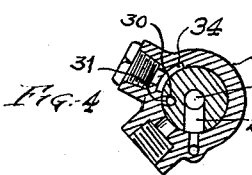


FIG. 4

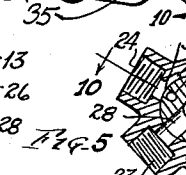


FIG. 5

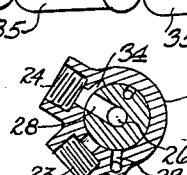


FIG. 6

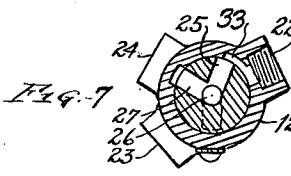


FIG. 7

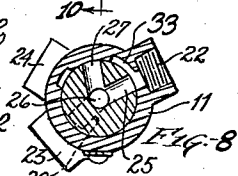


FIG. 8

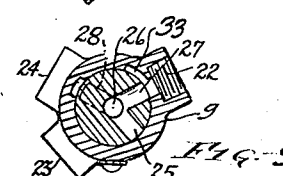


FIG. 9

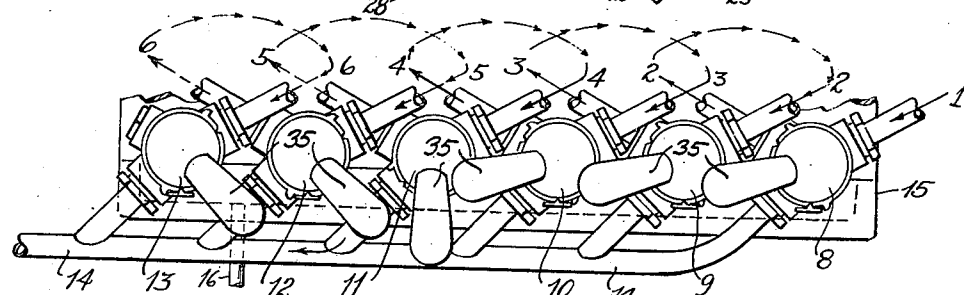


FIG. 3

INVENTOR  
Walter I. Sallee,  
BY  
Soule & Leonard  
ATTORNEYS

Jan. 12, 1937.

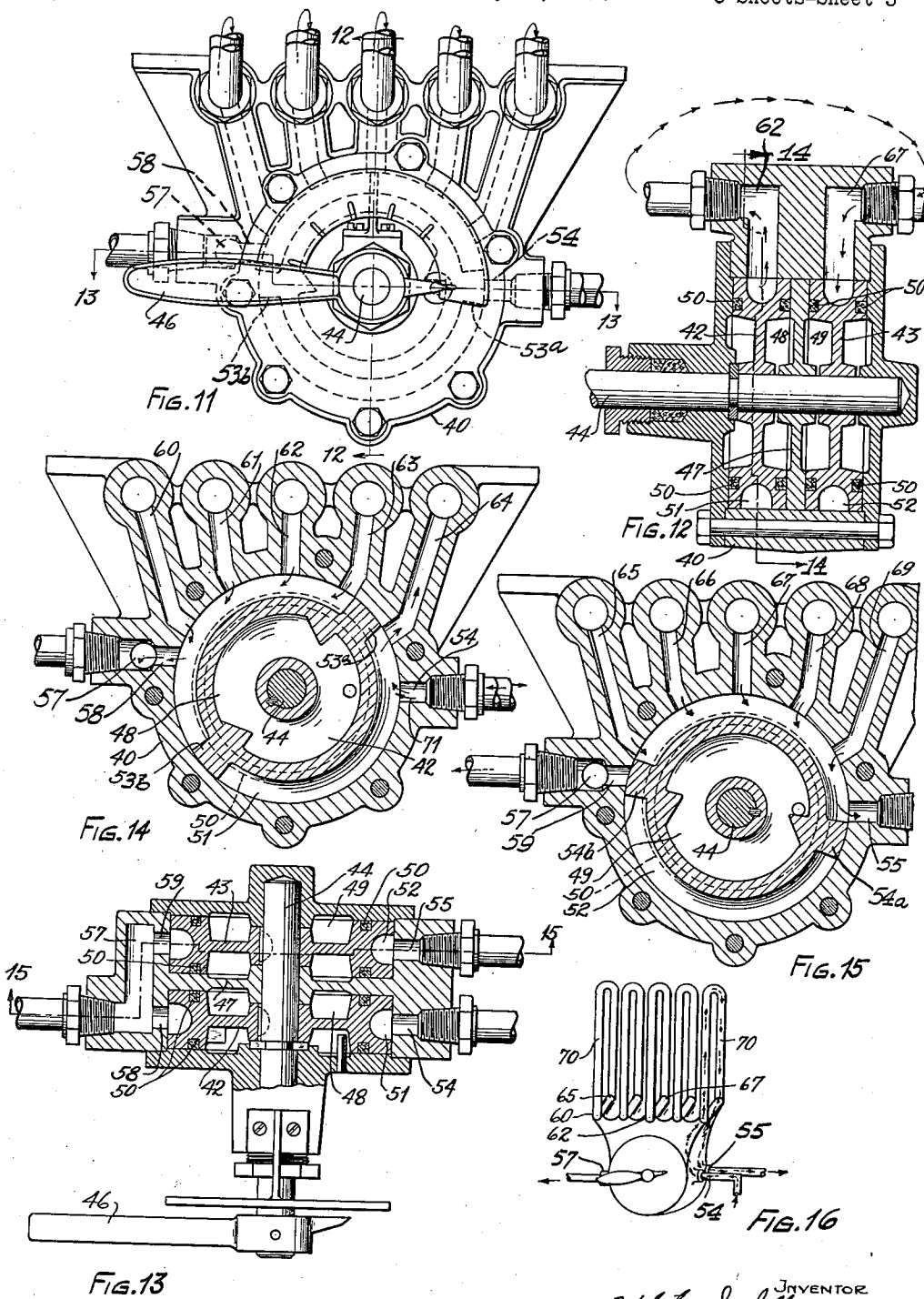
W. I. SALLEE

2,067,417

APPARATUS FOR PREHEATING FLUIDS

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3 Sheets-Sheet 3



INVENTOR  
Webster I. Sallee,  
by Soule & Leonard  
ATTORNEYS

## UNITED STATES PATENT OFFICE

2,067,417

## APPARATUS FOR PREHEATING FLUIDS

Webster I. Sallee, Cleveland, Ohio

Application July 26, 1934, Serial No. 737,134

21 Claims. (Cl. 137-21)

This invention relates to apparatus for treating fluids and particularly heating for preheating fluid fuels for use in connection with fuel oil burners.

One of the principal objects of the present invention is to provide a group of reservoirs or turns of coil for this purpose, any number of which may be connected with a source of fluid under pressure and with a discharge in such a manner that all reservoirs of the group which are not so connected with each other are connected with a drain whereby at no time is any reservoir completely blocked and sealed.

Another object is to provide a system of reservoirs for this purpose which are entirely safe in case of excessive heat or changes in temperature to which subjected.

Still another object is to provide a simple and effective apparatus for this purpose in which the repairs and replacements can be made readily in case of damage to any one of the reservoirs.

Other objects and advantages will become apparent from the following specification wherein,

Fig. 1 is a side elevation showing an installation of the invention in connection with a fuel oil burning system;

Fig. 2 is an enlarged top plan view of the valve assembly for use in connection with the heating reservoirs;

Fig. 3 is a front elevation of the valves illustrated in Fig. 2;

Figs. 4 to 9 inclusive, are cross sectional views taken respectively on lines 4-4 to 9-9 inclusive on Fig. 2;

Fig. 10 is a longitudinal sectional view taken on a plane indicated by the line 10-10 of Fig. 5;

Fig. 11 is a front elevation of a modified form of valve for use in connection with the apparatus;

Fig. 12 is a cross sectional view taken on a plane indicated by the line 12-12 of Fig. 11;

Fig. 13 is a cross sectional view taken on the plane indicated by the line 13-13 of Fig. 11;

Fig. 14 is a cross sectional view taken on a plane indicated by the line 14-14 of Fig. 12, showing the front valve plug rotated to one operative position;

Fig. 15 is a cross sectional view taken on a plane indicated by the line 15-15 of Fig. 13, but showing the rear valve plug rotated to a position different from that illustrated in Fig. 14; and

Fig. 16 is a diagrammatic perspective view showing the arrangement of the reservoirs with respect to the modified valve.

The present invention is shown in connection with a fuel burning apparatus, employing a com-

bustion chamber such as described in my copending application Ser. No. 736,212, filed July 20, 1934, and is described specifically in relation to preheating fuel oil which passes through the reservoirs, for illustrative purposes only, other uses thereof for treatment of fluids, such as for cooling or heating fluids passing through or about the outside of the reservoirs being apparent from the illustrated example.

As more fully set forth in my copending applications, a refractory lined combustion chamber C, positioned to discharge into the fire door F of a furnace, and having a fuel gun G discharging axially thereof into the opposite end and toward the fire door is provided. As a source of heat for heating reservoirs, shown as turns of a preheating coil, the precombustion chamber C itself is utilized, the chamber C being provided with a heat insulating housing H, spaced from the walls of the chamber, so that the coils may be accommodated therein in close heating relation to the combustion chamber and recuperate some of the heat which would otherwise be lost.

Referring particularly to Figs. 1, 2, and 3 inclusive, a feed pipe 1 and a plurality of coils 2, 3, 4, 5, and 6 are illustrated, each of the coils 2 to 6 inclusive extending around the combustion chamber C and within the housing H. Correspondingly, a plurality of control valves 8 to 13 inclusive are provided, all of these valves being adapted for connection with a common discharge manifold 14 which leads to the burner G in connection with which the fuel is to be utilized.

In the form illustrated, the valves 8 to 13 inclusive each comprises bodies formed integrally with a supporting trough 15, the trough 15 having a drain pipe 16 leading to the fuel supply reservoir from which the fuel is pumped through the feed conduit 1. Since the valves are the same in form and function, only one need be described, for example the valve 11.

As better illustrated in Figs. 5 and 10, the valve 11 comprises a body 11a having a tapered valve plug 18. The bore 17 extends entirely through the body 11a. At the smaller end of the plug 18 is a neck portion 19 which protrudes beyond the smaller end of the bore 17 of the body 11a. On the neck portion 19 is a slidable washer 20 which abuts a portion only of the adjacent end of the valve body 11a. The end of the neck 19 is threaded to receive a nut between which and the washer 20 is a spring 21 operable to draw the plug 18 into seated position in the bore 17. The valve body 11a is provided with an inlet passage 22, a discharge passage 23 which leads to the common

feed manifold 14, and an outlet passage 24. The plug 18 is provided with radial ducts 25 and 27, both connecting with a longitudinal duct 26. The longitudinal duct 26, in turn, connects with a radial duct 28 which is spaced longitudinally of the plug from the ducts 25 and 27. The duct 28 is positioned to connect with a drain duct 29 in the body 11a when the plug is rotated to given positions, the duct 29, in turn, connecting with the trough 15. The plug 18 is also provided with a duct 30 having a radial extension 31 positioned longitudinally of the plug to be in the plane of the duct 28 and opening onto the surface of the plug in circumferentially spaced relation to the opening of the duct 28 thereonto. The duct 31 is also spaced circumferentially of the plug relative to the duct 27.

The body 11a is provided with an internal circumferentially extending groove 33 connecting with the inlet passage 22, so that upon rotation of the plug, the duct 25 can connect with the passage 22 through the groove 33, even when out of direct axial alignment with the passage 22, or when offset a given distance therefrom. Correspondingly, a groove 34 is provided in the body 11a, connecting at one end with the outlet passage 24 and extending longitudinally of the body so as to be in a position to be connected with the ducts 25 and 27. The valve 13 corresponds to the valves above described except that the outlet passage 24 thereof is plugged so as to be inoperable.

In the operation of the device it is desirable that the coils be connected in series with each other, that is, that when the fluid is flowing through the coils it flows through them successively and from the last in the series into the manifold 14 instead of flowing through all of the operating coils concurrently or in parallel. For accomplishing this result the outlet conduit 24 of each of the valves is in connection with the inlet end of a different one of the coils and the inlet passage 22 of each valve is in connection with the discharge end of a different one of the coils. For example, the conduit 1 from the fuel pump or source of supply enters the valve 8 through the inlet passage 22 thereof and as the valve is open, as illustrated in Figs. 2 and 3, flows through the valve 8 and outlet passage 24 thereof into the inlet end of the coil 2, whereupon it passes through the coil. The discharge end of the coil 2 is connected with the inlet passage 22 of the valve 9 and discharges therein to and from the valve 9 is discharged through the outlet passage 24 thereof into the inlet end of the coil 3. The discharge end of the coil 3, in turn, is connected with the passage 22 of the valve 10 from which it discharges through the passage 24 of the valve 10 into the inlet end of the coil 4 and so on through the series.

For purposes of illustration the coil 11 has been shown in a position to connect with the discharge end of the coil 4 and is set to discharge into the common manifold 14 instead of the coil 5. Thus any fluid entering the conduit 1 passes successively through the series connected coils 2, 3, and 4 and then into the manifold 14. The valves 12 and 13, on the other hand, have been moved to off position so that coils 5 and 6 are not included in the operating series. For accomplishing this result it is necessary that when any one of the valves is operating to connect adjacent coils, the passage through such valves to the manifold 14 must be blocked. Furthermore when any valve is in position to connect the coil discharging therein to with the manifold 14, the

outlet passage 24 thereof leading to the next successive coil must be blocked. Again, when the coils with which a valve is associated are inoperable or idle, the valve must be so arranged that the coil portions beyond the operating series may drain and also that the discharge passages 23 of the valves shall be blocked so as to prevent backing up of fluid from the common manifold into the coils.

This operation can be most clearly seen by reference to Figs. 4 to 9 inclusive. For example, the valve 9 is in position for connecting the coil 2 and the coil 3 in series. Referring to Fig. 9 it will be seen that the fluid entering through the discharge end of the coil 2 will pass through the inlet passage 22 of the valve 9 and thence into the radial duct 27 and, in turn, through the longitudinal duct 26 and out through the duct 28 and discharge passage 24 of the valve. When in this position the duct 25 is closed. Likewise the ducts 30 and 31 are offset from any body openings so as to be blocked. Therefore, only one passage through the valve is provided. If the valve 9 were then turned to position to connect the discharge end of the coil 2 with the manifold 14 it would be moved to a position corresponding to the position of valve 11. In this position the relative arrangement of the ducts is illustrated in Figs. 5 and 8 wherein the duct 25 is in connection with the inlet passage 22 and the duct 27 is offset and blocked. The duct 28 on the other hand, has moved into alignment with the discharge passage 23 leading to the manifold 14 so that fluid entering the valve passes into the inlet 22 through the ducts 25, 26, and 27, in the order enumerated, and out of the outlet passage 23 to the manifold 14. At the same time the ducts 30 and 31 have moved into position to connect with the discharge outlet 24 of the valve which leads to the next successive coil. Thus the rising portion of such coil may drain back through the ducts 30 and 31 and discharge into the trough 15 and all coils from the first up to the one so disconnected are connected in series with each other and the last in the series is connected with the manifold 14.

As previously set forth, it is desirable that the remainder of the coils be disconnected from the manifold 14 so that the fluid therein will not back up through these coils. Consequently, the valves associated therewith are moved to the positions in which the valves 12 and 13 are shown in Figs. 2 and 3.

Referring to Figs. 4 and 7 it will be noted that in this position of the valves, the duct 25 is in connection with the inlet passage 22 through the medium of the groove 33. Thus the discharge end of the coil 5 is connected with the duct 25 in the valve 12 whereupon it may flow along the duct 26 and radial duct 28 which is positioned to connect with the duct 29 when the valve is in this operating position. Consequently, the discharge half of the coil 5 is in connection with the trough 15 and drains. As explained in connection with valve 11, the inlet half of the coil 5 drains through the valve 11 through the medium of the duct 30 and passage 24. At the same time the duct 27 is in connection with the rearward end of the groove 34 so that the discharge half of the coil 6 may drain into the duct 26 and through the ducts 28 and 29 into the trough 15. Meanwhile, the ducts 30 and 31 are disconnected from any of the body passages.

In order to insure proper operation of the valves for effecting the sequence described and insur-

ing complete safety, each of the valves is provided with a handle 35 and the valves are arranged in a row and positioned, as better illustrated in Fig. 3, so that, beginning with the initial valve 8, each valve in turn thereafter must be either connected with the preceding valve coil or with the manifold 14, it being impossible, because of engagement of the handles, to disconnect the last operating valve in the series, both with the manifold and with the succeeding coil. This is accomplished by making the handles of such size and proportions that they will engage each other and prevent movement in a position causing complete blocking of any one coil. For example, valves 8, 9, and 10 are open and their handles are disposed to the left, valve 11 is connected with the manifold and the inlet leading therefrom into the coil 5 is connected with the trough. Obviously, the handle of the valve 11 cannot be turned further to the right because of the handle of the valve 10. Thus the connection of the last coil in the operating series with the manifold 14 cannot be broken so that the coils are dead-ended by turning the valve 11, for example to the position in which valve 12 is operating while the valve 10 is in the open position shown. Thus any one of the valves except valve 13, may be connected through the coils successively in series with respect to each other and the last valve in the particular series connected with the discharge manifold and all other coils disconnected from the manifold and from the coils in series, but connected, both as to their inlet portions and discharge portions, with a drain, so that overheating of sealed oil with its consequent dangers of explosion and fire cannot result.

In some instances it is not necessary that the coils be connected in series so as to provide a longitudinal path for the fuel passing there-through, though such an arrangement is to be preferred as every drop of oil must make the entire transit and all are heated to substantially the same temperature. However, instead of making each drop of the fluid pass along the entire path a plurality of coils connected in parallel may be used and operated by a single valve, thus providing a path of greater volume, so that the fluid passes more slowly along the path and is exposed to the heat for substantially as long a period of time as it would at a higher speed through the longer path of the series of connected coils.

The latter is not as satisfactory, however, due to the fact that partial clogging of any one coil would not be readily apparent nor would the restriction of any coil by thick oil or by relatively cool oil prevent the passage of oil through the other coils. For example, it may be that with a plurality of coils connected in parallel, a quantity of oil may be partially obstructed in one coil until heated to an excessive degree and then suddenly break through and discharge to the displacement of other fluid temporarily so that a quantity of oil passes to the gun in a more heated condition. On the other hand, some relatively thick and cool oil in one coil may suddenly break out and go into the feed line and temporarily affect the operation of the gun. A more remote possibility is that one coil may become clogged so that all of the other coils carry all of the fluid and none of it becomes heated to the required degree. In case the coils are used for cooling, the danger is even greater.

In the particular apparatus shown for purposes

of illustration, such conditions are not apt to arise due to the fact that the coils are kept at so nearly the same temperature and consequently the valve illustrated in Figs. 11 to 16, connected with suitable coils, may be utilized to advantage.

The valve comprises a body portion 40 having an axial bore in which are mounted co-axial valve discs 42 and 43 respectively. The discs 42 and 43 are fixedly mounted on the common stem 44 which extends outside of the body and is provided with an operating handle 46 for rotating the discs to different positions. Intermediate the discs is a partition wall 47 dividing the body bore into coaxial chambers or compartments 48 and 49, which are disconnected from each other by the wall. Each of the discs is provided with suitable packing washers 50 on their exposed end faces, so as to prevent passage of oil or fluid around the outer margins of the discs into the compartments. Around the periphery of each of the valve discs 42 and 43 are annular circumferential channels 51 and 52 respectively which, with the respective circumferential walls of the compartments 48 and 49, and washers 50 form conduits. Since each of the discs 42 and 43 are identical the disc 42 only will be described in detail.

At diametrically opposite points on the disc 42 are solid portions or plugs 53a and 53b which block the conduits formed by the channel 51 so as to prevent the passage of fuel circumferentially of the discs there past. Thus the circumferential channel 51 is divided into two disconnected half portions or conduits. The forward or feed compartment 48 is provided with an inlet passage 54 which connects with the source of fluid under pressure. The receiving or rear compartment 49 is provided with an outlet passage 55 which connects with the fuel gun or points of application of the fluid. Both the passages 54 and 55 open into the interior of the respective compartments through the circumferential wall thereof in position to be connected with the channels 51 and 52 respectively.

A common passage 57 connects with both of the compartments 48 and 49 through the medium of extensions 58 and 59 opening into the respective compartments through their circumferential walls, the extensions being spaced circumferentially from the associated inlet and outlet passages 54 and 55 of the compartments 42 and 43 respectively. Through the circumferential wall of the valve body are a plurality of separate discharge ducts, designated 60 to 64, inclusive, all of which connect with the interior of the compartment 48 through the circumferential wall thereof, the openings therein being in spaced relation to each other and disposed between the openings through said wall of the passages 54 and 58. Correspondingly, leading from the compartment 49 are a plurality of inlet ducts 65 to 69 inclusive respectively, similarly positioned with respect to passages 55 and 59. Both the ducts 60 to 64 inclusive and the ducts 65 to 69 inclusive are disconnected from each other internally of the valve.

Referring to Fig. 16 the corresponding ducts in the two sets are connected to opposite ends of coils 70, that is, the duct 60 is connected with the inlet end of one of the coils 70 and the discharge end of the same coil is connected with the duct 65, there being a separate coil turn for each discharge duct of the valve and each inlet duct.

In Fig. 11, the valve is shown in the off posi-

tion in which position the plug 53a is in blocking relation to the inlet passage 54 and no fluid can enter the interior of the valve from the feed line. Correspondingly the plug 53b is disposed slightly out of line with the drain duct 58 and beyond the duct 58 in a direction away from ducts 60 to 65. Thus all of the ducts 60 to 65 may discharge into that part of the circumferential channel 51 of the compartment 48 and disc 42 which is disconnected from the inlet passage 54 but is connected to the drain passage 58. Thus the forward half of each of the coils 70 may drain through the valve and out of the drain passage 58. The disc 43 is arranged in position corresponding to the disc 42 so that with this same setting the plug 54a thereof corresponding to plug 53a blocks the outlet passage 55 and the plug 54b thereof corresponding to the plug 53b of disc 42 would be offset from the drain passage 59. The discs 42 and 43 are fixed with their plugs in alignment axially of the valve so that the relative rotated position of one is the same as the other.

Referring to Fig. 14, the discs 42 and 43 have been rotated for connecting the ducts 64 and 69 with the inlet passage 54 and outlet passage 55 respectively. Thus oil may flow into the inlet passage 54, as indicated by the arrows 71, out of the compartment 48 through the duct 54, thence into the coil 70, returning into the compartment 49 on the opposite side of the partition wall 47 through the duct 69 and flowing out of the discharge passage 55. In such position the ducts 60 and 63 inclusive and 65 to 68 inclusive are connected with those portions of the channels 51 and 52 of the respective compartments which are disconnected from the inlet and outlet passages and the ducts 64 and 69 and are connected with the drain passages 58 and 59. Thus both sides of the coils 70 associated with the ducts 60 to 63 and corresponding ducts 65 to 68 drain through the common drain 57. As both discs are moved to the position illustrated in Fig. 15, all of the coil ducts are connected with the corresponding parts of the channels 51 and 52 which are connected with the inlet and outlet passages 54 and 55 respectively. In this position, the plugs 53b and 54b of the discs block the drain passages 58 and 59. Consequently all fluid entering the inlet 54 passes concurrently through the ducts 60 to 64 around the coils 70 and into the ducts 65 to 69 from which it is discharged through the outlet passage 55.

It is apparent from the foregoing description that the valve and reservoir system described in connection with preheating fuel oil is readily adaptable to other treatment of or with fluids, without any changes in the principle of operation.

Having thus described my invention, I claim:

1. A preheating device for fluids comprising a plurality of reservoirs, a fluid feed conduit, a discharge conduit, a drain, valve means associated with said reservoirs and operable to connect any number of said reservoirs in series with each other and with the feed conduit, and to connect only the last reservoir in the resulting series to said discharge conduit and to connect with the drain the reservoirs which are disconnected from the resulting series.

2. In an apparatus for treating fluids, a plurality of reservoirs, one of said reservoirs being connected with a fluid feed conduit, a discharge conduit, valve means associated with said reser-

voirs and operable to connect any number of said reservoirs successively in series with each other and with the one of said reservoirs connected with the feed conduit and to connect the last reservoir in the resulting series to said discharge conduit, and means operable to prevent disconnecting the last reservoir in any resulting series from the discharge conduit while the valve means is operative for connecting the series with the feed conduit.

3. In a fluid treating apparatus, a plurality of reservoirs, one of said reservoirs being connected with a fluid feed conduit, a discharge conduit, valves connected to said reservoirs respectively and operable to connect said reservoirs in series with each other and with the reservoir connected with the feed conduit and to connect the last reservoir in the resulting series with said discharge conduit, and means on each valve cooperable with an adjacent valve for preventing operation of the valve means to seal a reservoir of said series intermediate the feed conduit and discharge conduit.

4. In a fluid treating apparatus, a plurality of reservoirs, a fluid feed conduit, a discharge conduit, valve means associated with said reservoirs and operable to connect any number of said reservoirs in series with each other and with the feed conduit and to connect the last reservoir in the resulting series with said discharge conduit, and means associated with said valve means operable to prevent connecting any of said reservoirs in said series with one of the reservoirs which is disconnected both from the discharge conduit and from the series.

5. In a fluid treating apparatus, a plurality of reservoirs, a feed conduit, a discharge conduit, valve bodies intermediate adjacent reservoirs, valve plugs respective to said bodies and cooperable therewith to connect the reservoirs in series with each other and with the feed conduit, and to connect the last reservoir in the resulting series to the discharge conduit, means on each valve cooperable with the adjacent valve operatively nearer the feed conduit to prevent movement of the former of said adjacent valves to a position to block the flow therethrough to the discharge conduit while the latter of said adjacent valves is in a position for connecting the reservoir with which associated with the reservoir associated with the former valve.

6. In a fluid treating apparatus, a plurality of reservoirs, a discharge conduit, valves respective to adjacent reservoirs and operable to connect the reservoirs in series with each other, to connect an end one of the reservoirs with a source of fluid, to connect the other end one of the reservoirs in the resulting series with the discharge conduit, and to disconnect the reservoirs from the discharge conduit, and means on the valves operable to prevent movement of any one valve to position to disconnect the series and discharge conduit while the series is connected with said source of fluid.

7. In a fluid treating apparatus, a coiled conduit, one terminus of the conduit being connected with a source of fluid, a discharge conduit, and valve means operable to connect any number of successive turns of the conduit in series with each other and the last in the series with the discharge conduit and to prevent any other connection between the turns of the coiled conduit.

8. In a device of the character described, a plurality of conduits, a plurality of valve bodies

connecting therewith, rotatable plugs respective to the bodies, each plug being operable to connect and disconnect certain of the conduits with which associated in different relations when the said plug is rotated to different settings, means for rotating the plugs, and means respective to the plugs operable consequent upon rotation of the plugs to different positions to prevent predetermined settings of each of the plugs relative to the adjacent plugs.

9. In a device of the character described, a plurality of conduits, a plurality of valve bodies connecting therewith, rotatable plugs respective to the bodies, each plug being operable to connect and disconnect certain of the conduits with which associated in different relations when the said plug is rotated to different settings, handles respective to the plugs for rotating the same, said handles each being operable to engage handles of adjacent plugs consequent upon rotation of the plug with which associated to certain positions to prevent predetermined settings of each of the plugs relative to the adjacent plugs.

10. In a fluid treating apparatus, a plurality of containers, a valve body, one container having an outlet connecting with the valve body and another having an inlet connecting with the valve body, a discharge conduit and a drain conduit both connecting with the said valve body, a valve plug in the said valve body operable to connect the said outlet with the discharge conduit and said inlet with the drain conduit when moved to one position, to disconnect the said outlet from the discharge conduit and the inlet from the drain conduit and to connect said outlet with said inlet conduit when moved to a different position, and to disconnect both the inlet and outlet from each other and from the discharge conduit and to connect both with the drain conduit when moved to a third position.

11. In a fluid treating apparatus, a plurality of reservoirs connected in series with each other, an end one of said reservoirs being connected with a feed conduit, a discharge conduit, valve bodies intermediate adjacent reservoirs, valve plugs respective to said bodies and operable to connect the reservoirs in series with each other beginning with the reservoir connected to the feed line and to connect the last reservoir in the resulting series to the discharge conduit, means to prevent operating the one of two adjacent valves less remote from the feed line to position to connect its reservoir with the one of said two adjacent valves more remote from the feed line while the more remote adjacent valve is operable to block the flow of fluid to the discharge conduit.

12. In a fluid treating apparatus, a plurality of reservoirs adapted to be placed in heating relation to a source of heat, each reservoir having an inlet and an outlet, valve bodies arranged one intermediate each pair of adjacent reservoirs and connecting the outlet of one reservoir with the inlet of the adjacent reservoir for connecting the reservoirs in series with each other, a discharge conduit, a drain conduit, valve plugs respective to said valve bodies, each plug being operable to connect the reservoir outlet associated therewith selectively with the discharge conduit, with the reservoir inlet associated therewith, and with the drain conduit.

13. In a fluid treating apparatus, a coil circuit, a fluid feed conduit connecting with one terminus of the conduit, a discharge conduit common to the turns of said conduit and connecting with each, a drain conduit, and valves respectively op-

eratively connected intermediate adjacent turns of said conduit, each valve being operatively connected to the discharge conduit, each of said valves being operable to connect the adjacent turns associated therewith with each other and to block the flow from said adjacent turns through the valve to the discharge conduit when moved to one position, to connect the one of said adjacent turns positioned operatively nearer the feed line terminus with the discharge conduit and the other of said adjacent turns operatively more remote from the feed line with the drain conduit when moved to a different position, and to connect both said adjacent turns with the drain conduit and to disconnect both from the discharge conduit when moved to still another position.

14. In a fluid treating apparatus, a plurality of containers, one of said containers being connected with a fluid feed line and each having an outlet and an inlet, a plurality of valve bodies respectively operably connected intermediate adjacent containers and connecting with the outlet of one of said adjacent containers and with the inlet of the other of said adjacent containers with which associated, a discharge conduit connecting with said valve bodies, a drain conduit, a plug in each body, each plug having passages operable to connect the said inlet and outlet associated therewith in series when moved to a first position, to connect the outlet with the discharge conduit and the inlet with the drain conduit when moved to a second position, and to connect both the said inlet and the said outlet with the drain conduit when moved to third position, a lug on each valve movable with the plug thereof and engageable with the lug of adjacent valves when the plug is moved to different positions, said lugs and passages being positioned relative to each other to prevent movement of any plug to third position when the plug of the adjacent valve nearer the feed line is in the first position and to prevent movement of each plug to the first position when the plug of the adjacent valve more remote from the feed line is in the third position.

15. In a fluid treating apparatus, a plurality of reservoirs, each having an outlet and an inlet, a plurality of valve bodies respectively operatively connected intermediate each two adjacent reservoirs to the outer of one of said adjacent reservoirs and to the inlet of the other of said adjacent reservoirs, a common discharge conduit connecting with said valve bodies, a drain conduit, a plug in each body, each plug having passages operable to connect the said inlet and said outlet associated therewith in series when moved to a first position, to connect the said outlet with the discharge conduit and the said inlet with the drain conduit when moved to a second position, and to connect both the said inlet and the said outlet with the drain conduit and disconnect the said inlet and said outlet from the discharge conduit when moved to third position, a lug on each valve plug movable therewith and engageable with the lug of the adjacent valve plugs when the plugs are moved to different positions, said lug and passages of said plugs being positioned relative to each other to prevent rotation of any plug to the third position when the adjacent plug nearer the feed line is in the first position and to allow movement of each plug to the second position when the adjacent plug nearer the feed line is in the first position, and to prevent movement of each plug from the second to the first

position when the adjacent plug more remote from the feed line is in the third position.

16. In an apparatus for treating fluids, a plurality of reservoirs each having an inlet and an outlet, valve body means having a feed chamber connecting with the inlets of all of said reservoirs and a receiving chamber connecting with the outlets of all of said reservoirs, a drain connectible with said chambers, a feed conduit connectible with the feed chamber and a discharge conduit communicable with the receiving chamber, plug means interiorly of the body means operable to connect any number of said reservoir inlets with the portion of the feed chamber in connection with said feed conduit and to disconnect the remainder of said reservoir inlets from said portion of said feed chamber, and to connect with the drain those of the reservoir inlets which are disconnected from the said portion of the feed chamber and operable to connect with the portion of the receiving chamber of the valve means connected to the discharge conduit the outlets of the reservoirs which are connected with said portion of the feed chamber and to disconnect the remainder of the reservoir outlets from said portion of the receiving chamber connected with the discharge conduit and connect the same with the drain conduit.

17. A valve for the purposes described comprising a body having a feed chamber, a feed conduit and a drain conduit connectible with the chamber, a plurality of outlet ducts opening into the feed chamber and having their openings spaced from each other, a rotatable plug in said chamber, and means on said plug operable consequent upon rotation thereof to connect progressively and cumulatively the outlet ducts with the feed conduit and concurrently to disconnect the feed duct and drain, and concurrently operable to connect with the drain those of the outlet ducts which are disconnected with the feed conduit.

18. A control valve comprising a body having a chamber therein, a valve disc in the chamber, a stem for rotating the disc, a circumferential trough in said disc forming with the wall of the chamber a fluid conduit, circumferentially spaced plugs on said disc dividing said trough into two disconnected segments, a plurality of ducts opening into the chamber in spaced relation to each other circumferentially of the chamber in position for connection with one of said trough segments wholly between the plugs thereof in one rotated position of the disc, a main conduit opening into the chamber and connecting with the same segment of the trough that is connected with the said ducts while the disc is in said rotated position, a drain conduit opening into the chamber in position to be blocked by one of said plugs while the disc is in said rotated position whereby said main conduit and all of said ducts

are connected together and the drain conduit is disconnected for the ducts and main conduit, said plugs being positioned relative to each other and to said conduits and ducts to disconnect progressively the ducts and main conduit and to connect the ducts progressively with the drain conduit through the other segment of the trough as said ducts are disconnected from the main conduit, consequent upon rotation of the disc in one direction from said position, and to connect progressively and cumulatively the ducts and main conduit and disconnect the ducts progressively from the drain conduit consequent upon rotation of the disc in the opposite direction toward said first position.

19. In a fluid treating apparatus, a plurality of reservoirs each having an inlet and an outlet, a single valve connected with all of the inlets and all of the outlets of said reservoir, a feed conduit connected with said valve for supplying fluid therethrough to the inlets of said reservoirs, a discharge conduit connected to the valve for discharging fluid therethrough from the outlets of said reservoirs, drain means in the valve for draining all of said reservoirs from both ends, a valve stem, plug means in the valve connected to said stem and rotatable thereby, said plug means being operative when rotated by the stem in one direction to progressively and cumulatively connect the inlets of said reservoirs with the feed conduit and the outlets of corresponding ones of the reservoirs with the discharge conduit concurrently, and when rotated in the opposite direction to progressively and cumulatively connect corresponding inlets and outlets with the drain means as the same are disconnected from the feed and discharge conduits respectively.

20. In a fluid treating apparatus, a plurality of reservoirs, a fluid feed conduit, a discharge conduit, and a drain, triple function valve means associated with said reservoirs and operable consequent upon movement in one direction to connect progressively and cumulatively any number of said reservoirs with each other, and concurrently with the discharge conduit, and concurrently with the feed conduit, and to connect all of the reservoirs which are disconnected from said feed conduit and discharge conduit with said drain concurrently with their disconnection from said feed conduit and discharge conduit.

21. In a fluid treating apparatus, a plurality of reservoirs, a fluid feed conduit, a discharge conduit, valve means associated with said reservoirs and operable to connect said reservoirs with each other, and concurrently with the feed conduit, and concurrently with said discharge conduit, and means associated with said valve means operable to prevent disconnecting from the discharge conduit any one of said reservoirs while it is connected with the feed conduit.

WEBSTER I. SALLEE.