Sept. 27, 1932. E. J. PARENT 1,879,453

HEAT EXCHANGER

Filed May 8, 1931 4 Sheets-Sheet 1

Fig. 1

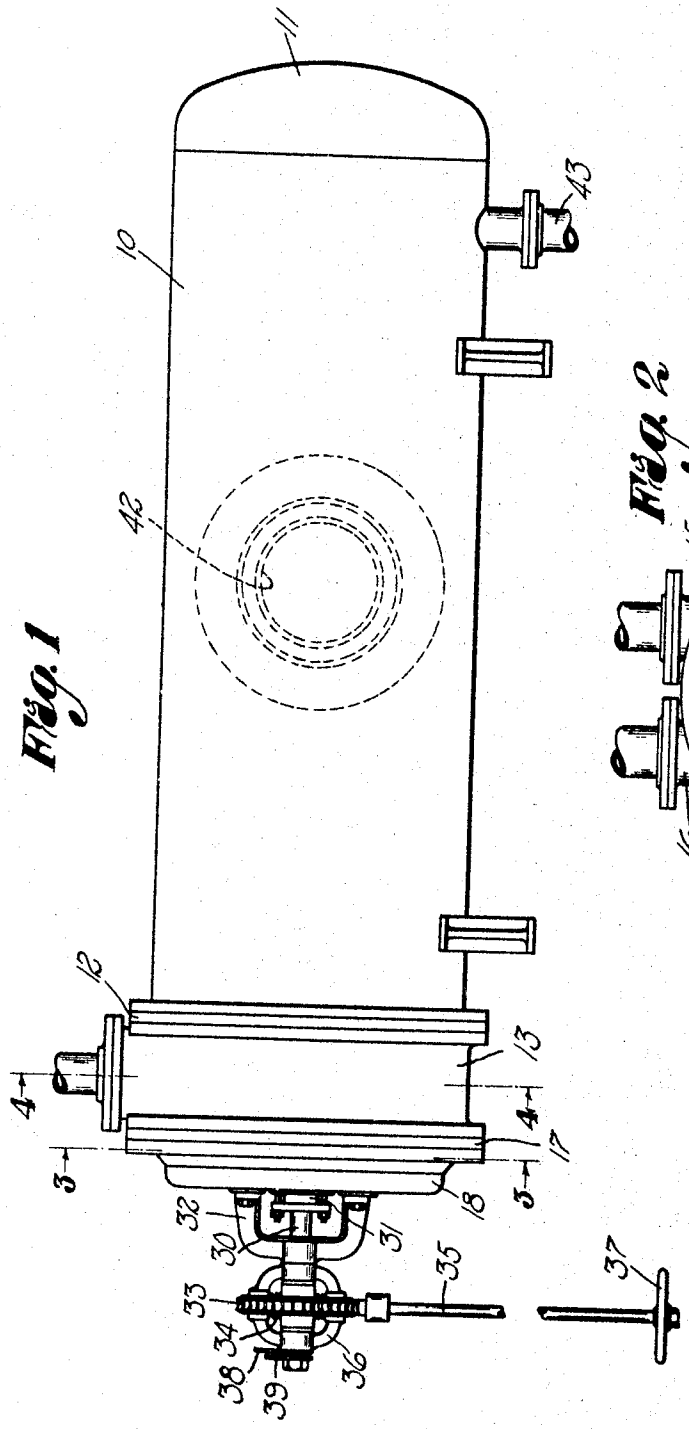
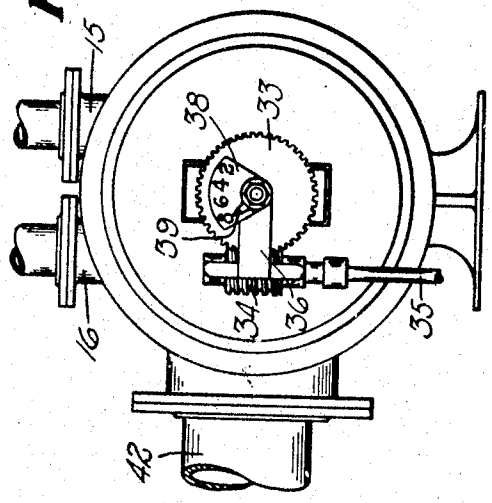


Fig. 2



Inventor
Emile J. Parent

By H. Clay Lindsey.

Attorney

Sept. 27, 1932. E. J. PARENT 1,879,453

HEAT EXCHANGER

Filed May 8, 1931 4 Sheets-Sheet 2

Fig. 3

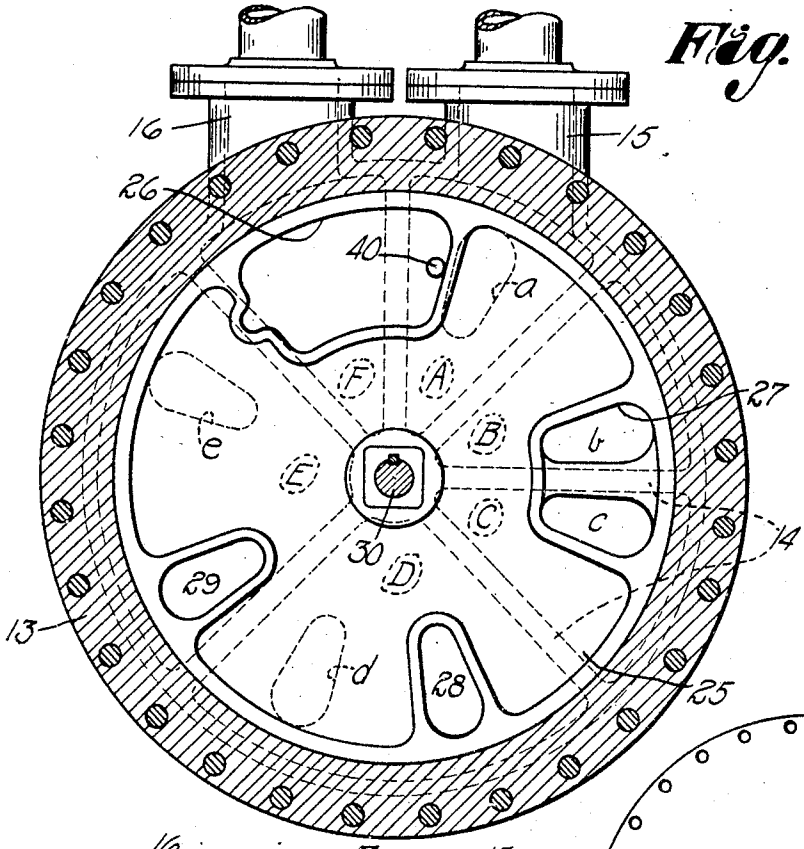


Fig. 7

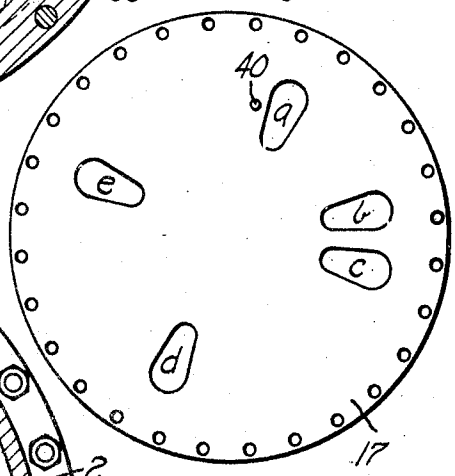
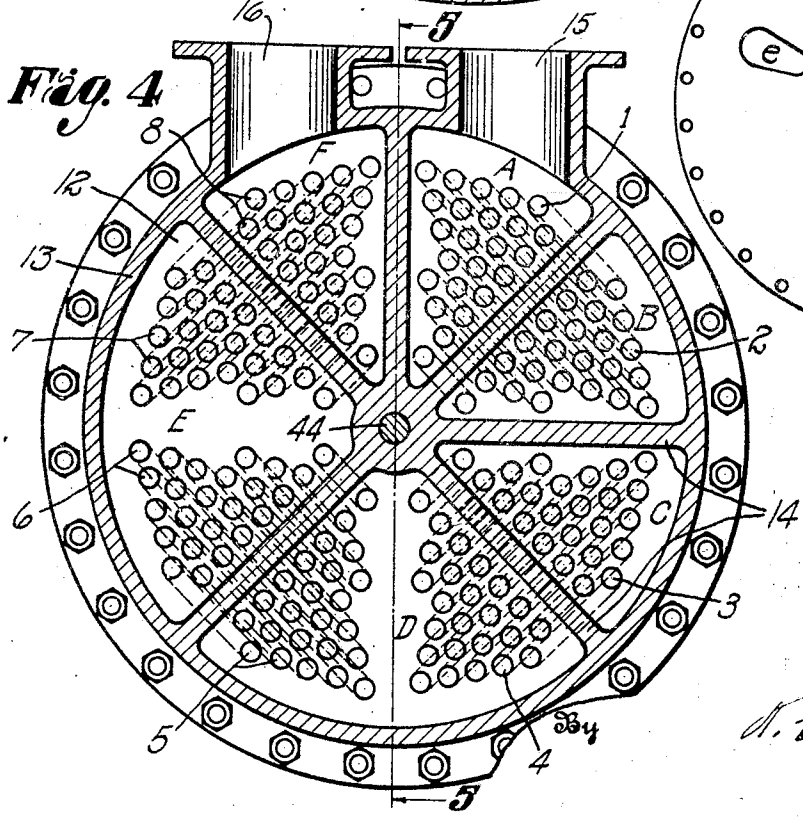


Fig. 4



Inventor
Emile J Parent

A. Clay Lenhey.

Attorney

Sept. 27, 1932. E. J. PARENT 1,879,453

HEAT EXCHANGER

Filed May 8, 1931 4 Sheets-Sheet 3

Fig. 5

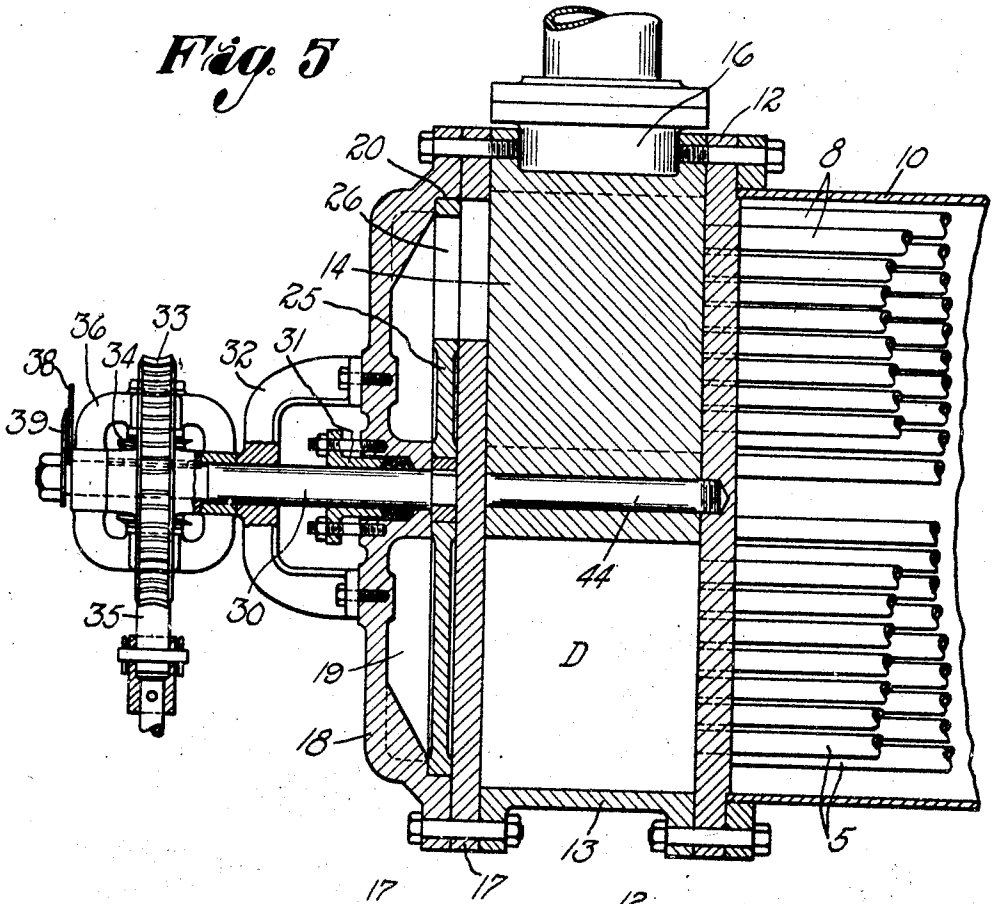
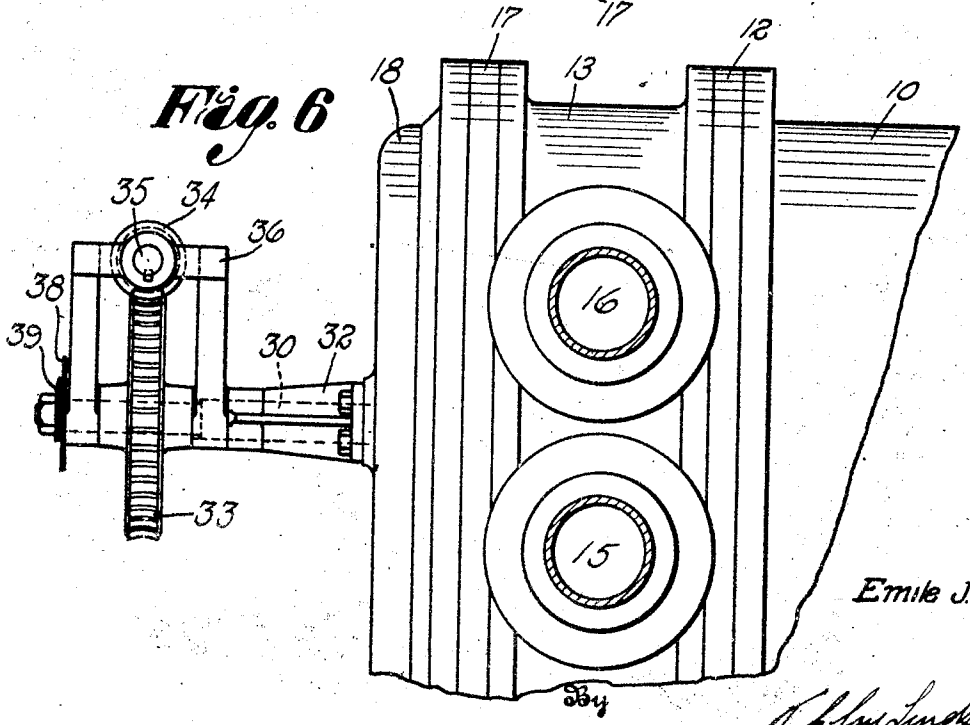


Fig. 6



Inventor
Emile J. Parent

By R. Clay Lindsey.

Attorney

Sept. 27, 1932. E. J. PARENT 1,879,453

HEAT EXCHANGER

Filed May 8, 1931 4 Sheets-Sheet 4

Fig. 8

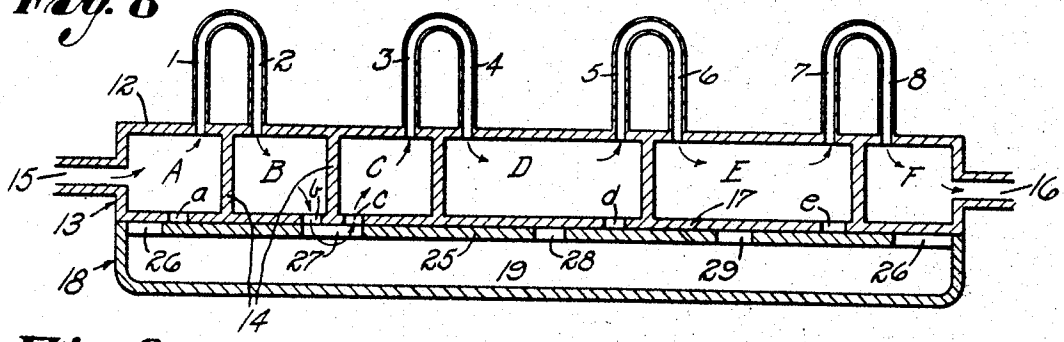


Fig. 9

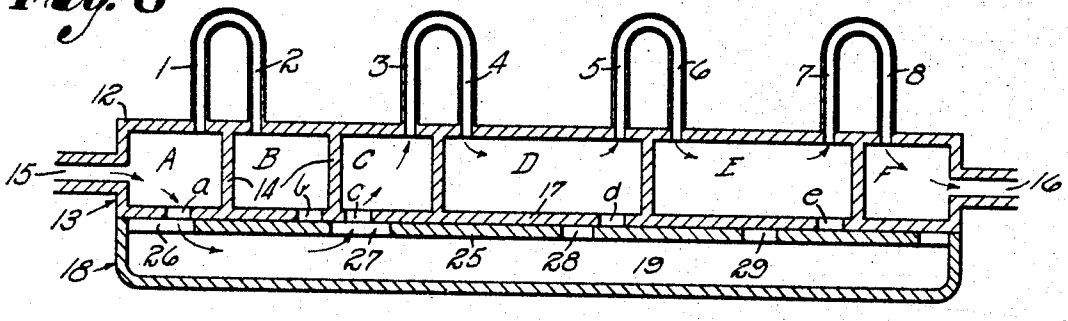


Fig. 10

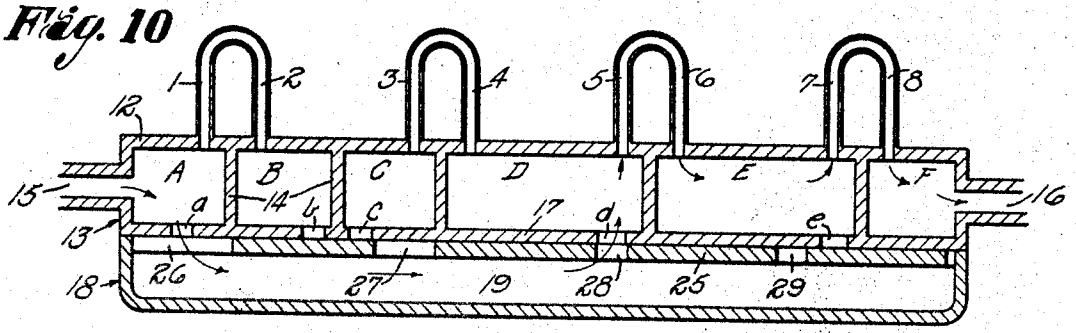
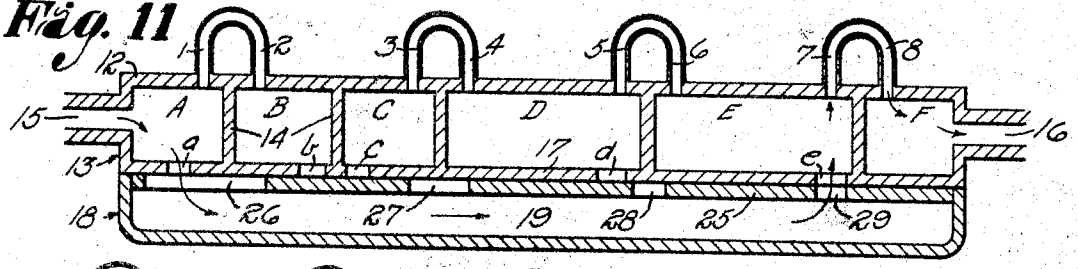


Fig. 11



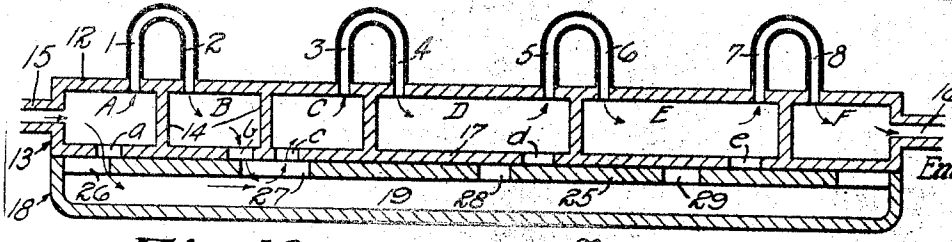


Fig. 12

Inventor
Emile J Parent

By

H. Clay Lindsey.
Attorney

Patented Sept. 27, 1932

1,879,453

UNITED STATES PATENT OFFICE

EMILE J. PARENT, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE WHITLOCK COIL PIPE COMPANY, OF WEST HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT

HEAT EXCHANGER

Application filed May 8, 1931. Serial No. 535,837.

This invention relates generally to apparatus wherein an exchange of heat is effected from one fluid to another by passing one of the fluids through a plurality of tubes in a series of passes and the other fluid about the tubes. The device may be used either as a cooler or a heater, as desired, and has a wide application in that fluids of various sorts may be cooled or heated.

The apparatus constructed in accordance with the present invention finds peculiar application in installations where it is necessary or desirable that the medium to be heated, for example, issue from the exchanger very closely to the predetermined or selected temperature and that temperature be uniformly maintained. Numerous factors influence the operation of heat exchangers of this type; among such factors are changes in temperature of the incoming medium to be heated, and the rate of flow of the water to be heated.

The aim of the present invention is to provide a heat exchanger wherein the temperature to which the medium to be heated may be controlled with great nicety within the limits of the heating capacity of the apparatus. This control may be effected very simply and with great accuracy in a very short time by changing at will the effective surface of the preheater.

In carrying out the objects of the present invention, I provide a heat exchanger having a plurality of groups of tubes arranged in series and through which the medium to be heated, for example water, may be caused to flow in a series of passes, and valve mechanism incorporated in the exchanger and arranged to select the passes of tubes through which the water is to flow in various combinations and determine the amount of flow of the water through these various passes. As hereinafter pointed out more in detail, the exchanger may have any number of passes, in the particular example illustrated there being eight. The water may be caused to flow through all eight of these passes, or through six, four or two of the passes, or wholly through certain of the passes and only partially through the other passes. The valve mechanism has a single movable valve member, the position of which controls the flow of the water, and the positioning of this member in accordance with the requirements may be very easily and quickly effected.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawings, wherein I have illustrated one of the many embodiments which the present invention may take:

Fig. 1 is a side elevational view of the exchanger;

Fig. 2 is an end view thereof;

Fig. 3 is a sectional view taken substantially on line 3—3 of Fig. 1 and illustrates the rotatable or slidable valve member in elevation;

Fig. 4 is a sectional view through the chambered casing, this view being taken substantially on line 4—4 of Fig. 1;

Fig. 5 is a longitudinal sectional view through the valve end of the exchanger, this view being taken substantially on line 5—5 of Fig. 4;

Fig. 6 is a top plan view of what is shown in Fig. 5;

Fig. 7 is a face view of the stationary valve member or disk on a smaller scale;

Fig. 8 is a schematic lay-out showing the arrangement adjusted so that the water will flow through all eight passes in series;

Figs. 9, 10, and 11 are views similar to Fig. 8 but showing the water flowing through six, four and two passes, respectively; and

Fig. 12 shows the valve set to obtain a heating effect between those afforded by the eight and six pass arrangements.

Referring to the drawings in detail, 10 designates a suitable shell closed at one end by a head 11 and having a tube sheet 12 at its other end. The numeral 13 designates

a casing or section having a plurality of radially extending partitions 14 which divide the casing into a plurality of chambers A, B, C, D, E, and F. There are six such chambers in the present instance, but it is to be understood that the number thereof may be varied as desired. The chambers A, B, C, and F are of the same size and occupy one-half of the casing. The chambers D and E are each twice the size of the chamber A and occupy the other half of the casing. The casing has an inlet 15 opening into the chamber A and an outlet 16 leading from the outlet chamber F. The partitions 14 abut against the tube sheet 12, and that sheet forms the rear wall for the chambers, so to speak. Within the shell 10, and having their forward ends supported by and extending through the tube sheet 12, are a plurality of groups of tubes designated respectively 1 to 8. These groups of tubes constitute the several passes. The tubes 1 and 2 are in the form of U-bends, and this is also true of tubes 3 and 4, 5 and 6, and 7 and 8, so that, when all eight passes are employed, the water will flow as indicated by the arrows shown in Fig. 8. Instead of having U-bends at the rear ends of the tubes, there may be a floating header suitably chambered in a manner well understood in the art.

Bolted against the forward end of the casing or section 13 is a stationary valve plate or disk 17 which forms a front wall for the chambers A, B, etc. This valve plate has ports *a*, *b*, *c*, *d*, and *e* respectively associated with the chambers A, B, C, D, and E. The ports *b* and *c* are closely adjacent to one another.

Clamped or bolted in position, and engaging the plate 17 adjacent its edge, is a valve head 18 having the by-pass chamber 19 which is adapted to selectively communicate with the chambers, A, B, C, D, and E, as hereinafter described more in detail. This head has a circular rabbet or seat 20 which is adapted to rotatably receive a movable valve member or plate 25 which abuts against the forward face of the stationary valve plate 17. The movable or rotatable valve 25 has an opening 26 adapted to register with, and considerably wider than, the port *a*. It also has an opening 27 of sufficient size to uncover both of the ports *b* and *c* at the same time, as shown in Figs. 3 and 8. The valve 25 also has openings 28 and 29 of substantially the same size as, and adapted to uncover, the ports *d* and *e*. The valve 25 is fixed to the rear end of a shaft 30 extending through and journalled in a stuffing box 31 and a bracket 32. This shaft may be turned in any suitable manner so as to adjust the valve. By way of example, the shaft is shown as having a worm wheel 33 meshing with a worm 34 fixed to the upper end of a vertical shaft 35 journalled in a bracket 36 which is suitably held against turning movement. The lower end of the shaft 35 may carry a hand wheel 37. The particular mechanism for turning the valve may be changed as desired, and the construction thereof may be varied according to the location of the heat exchanger. The arrangement shown in the drawings may be adopted where the heat exchanger is spaced considerably above the floor. In order to generally indicate the position of the valve, a dial 38 is fixed to the bracket 36, and the outer end of the valve shaft 30 carries a pointer 39. The dial bears the numerals 8, 6, 4, and 2 so as to indicate the several combinations of passes which are available. The pin 40 (see Fig. 3) is provided to limit the extent of rotation of the valve.

In the present illustrative disclosure, it may be assumed that the medium to be heated is water and the heating medium is steam. In such event, the shell 10 may have a steam inlet 42 and a drip outlet 43. Obviously, the apparatus may be provided with the usual appliances and accessories, such as safety valves, relief valves, etc., these not being shown as they form no particular part of the present invention. Passing through the hub or center of the section 13, and threaded into the tube sheet 12, is a stem 44 which is provided to facilitate assembly of the parts.

In the event that it is desired to employ the apparatus to its full capacity, the medium to be heated is passed, in whole, through all of the eight passes of tubes in succession. In such case, the movable valve 25 is set to the position shown in Figs. 3 and 8 by turning the manual controlling device which includes the hand wheel 37. The pointer 39 will then register with the number 8 of the dial 38. All of the ports in the stationary valve plate 17 are blanked or closed by the movable valve with the exception of the ports *b* and *c*, so that communication is established between the chambers B and C. The water will now flow, as indicated by the arrows in Fig. 8, through the chamber A; the first and second passes provided by the tubes 1 and 2, respectively; from the chamber B to the chamber C through the ports *b* and *c* and opening 27; through the third and fourth passes; the chamber D; the fifth and sixth passes provided by the tubes 5 and 6; through the chamber E; through the seventh and eighth passes of tubes, and into the chamber F; and then out through the outlet 16.

When the valve is set to the position shown in Fig. 9, the last six passes are employed, and the first two passes are cut out. In this case, the ports *a* and *c* are open to the by-pass compartment or chamber 19 through the respective openings 26 and 27, and all of the other ports of the stationary valve member are blanked. Water is by-passed from

the chamber A through the chamber 19 to the chamber C. When it is desired to use only four passes, the movable valve 25 is turned to the position shown in Fig. 10, and in which position the water is by-passed from the chamber A to the chamber D, thus cutting out the first four passes, namely the tubes 1, 2, 3, and 4. When it is desired to use but two passes, the movable valve is set to the position shown in Fig. 11, and wherein the water is shown as being by-passed from the chamber A to the chamber E, the first six passes being thus cut out.

It is important to note that, with my improved arrangement, a very fine or vernier control of the temperature of the medium to be heated can be effected within the heating capacity of the apparatus. The flow of the water may be split up, so to speak, in various ways so that some of it will flow through certain passes while the remainder will be by-passed about those passes, and all of the water will pass through one or more of the remaining passes. For example, if the entire use of all eight passes gives too high a temperature, and the use of but six of the passes gives too low a temperature, then the movable valve may be set so that only some of the water will flow through the first and second passes, the remainder being by-passed about those passes, and all of the water will flow through the last six passes. In that case, the valve is set as shown in Fig. 12, wherein the port *a* is only partially blanked. If the temperature to which the water to be heated is very slightly less than the maximum heating capacity of the plant, this port will be only slightly "cracked" so that a slight amount of water is by-passed around the first two passes. If a still lower temperature is desired, the port is further unblanked so a greater amount of water will be by-passed. Likewise, a vernier control may be had between the six passes and the four passes; in which instance, the valve will be set to a position intermediate those shown in Figs. 9 and 10 so as to control the extent to which the ports *c* and *d* are uncovered. Likewise, a vernier control may be had between the four and two pass set ups shown in Figs. 10 and 11; in which instances, the movable valve is set so as to uncover the ports *d* and *e* to the desired extent.

It will be seen from the foregoing description, taken in connection with the accompanying drawings, that the valve mechanism is incorporated in, and forms a part of, the heat exchanger, and this valve mechanism has but a single movable valve member the position of which controls the flow of water through the heat exchanger. The setting of this valve member may be very quickly, simply and nicely effected by the operator. In setting the valve, the operator will turn the hand wheel 37 and, without changing his position, observe the thermometer or other instrument which registers the temperature at which the water issues from the heating exchanger. When that instrument registers the proper temperature, the operator knows that the valve has been correctly set. If the conditions under which the apparatus is operating change, the valve may be re-set to take care of these changes in conditions.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. In a heat exchanger, a plurality of chambers, a plurality of groups of tubes arranged in a series of passes and respectively communicating with said chambers, a by-pass with which said chambers are adapted to communicate, and a valve for controlling communication between said chambers through said by-pass.

2. In a heat exchanger, a plurality of chambers, a plurality of groups of tubes arranged in a series of passes and respectively communicating with said chambers, a by-pass compartment, some of said chambers being provided with ports through which they are adapted to communicate with said compartment, and an adjustable valve member for controlling said ports.

3. In a heat exchanger, a plurality of chambers, a plurality of groups of tubes communicating with said chambers and arranged to provide a series of passes, a by-pass compartment, ports leading from certain of said chambers to said by-pass compartment, a rotary valve member having openings adapted to respectively register with said ports for selectively controlling communication between the chambers through said by-pass, and means for adjusting said valve member.

4. In a heat exchanger, an inlet chamber, an outlet chamber, and intermediate chambers therebetween, tubes arranged in a pair of passes leading from the inlet chamber to an intermediate chamber, tubes arranged in a pair of passes leading from one intermediate chamber to another intermediate chamber, and tubes arranged in a pair of passes leading from one intermediate chamber to the outlet chamber, a by-pass compartment, said inlet chamber and intermediate chambers having

ports through which they are adapted to communicate with said by-pass compartment, and an adjustable valve for controlling said ports.

5. In a heat exchanger, an inlet chamber, an outlet chamber, and intermediate chambers, a plurality of groups of tubes arranged in pairs each pair establishing communication between adjacent chambers, with the exception of one pair of intermediate chambers, a by-pass compartment, ports leading from the inlet chamber and the intermediate chambers to said by-pass compartment, and a rotary valve disc having openings adapted to selectively register with said ports.

6. In a heat exchanger, an inlet chamber, an outlet chamber, and intermediate chambers, a plurality of groups of tubes arranged in a series of passes, each chamber being connected to the next succeeding one by said tubes, there being no such connection between two of said intermediate chambers, a by-pass compartment, ports leading from said inlet chamber and intermediate chambers to said by-pass compartment, an adjustable valve member having an opening adapted to uncover the ports of the two intermediate chambers which are not interconnected by said tubes, said valve member also having openings adapted to respectively and selectively uncover the ports of said other chambers, and means for adjusting said valve member.

7. In a heat exchanger, a shell having a tube sheet at one end, a casing engaging said tube sheet and having a plurality of chambers, tubes connected to and leading through said tube sheet and arranged in a series of passes, a stationary valve member constituting a wall of said chambers and provided with ports, a head having a compartment with which said chambers are adapted to communicate through said ports, and a rotary valve member within said head positioned against said stationary valve member and provided with openings adapted to selectively uncover said ports.

8. In a heat exchanger, a shell, a tube sheet at one end thereof, tubes within said shell and opening through said tube sheet, a casing having a plurality of chambers and abutting said tube sheet, said tube sheet constituting the rear wall of said chambers, a stationary valve member constituting the front wall of said chambers, a head having a by-pass compartment between which and said chambers said stationary valve member is located, said stationary valve member having ports, a valve member mounted for rotatable adjustment in said head and having openings adapted to selectively register with said ports, means for rotatably adjusting said valve, and means for indicating the position of adjustment of said valve.

9. A heat exchanger of the character described having a plurality of chambers, tubes communicating with said chambers and arranged in a series of passes, and means incorporated in the heat exchanger for obtaining a vernier control of the flow of water through the passes.

EMILE J. PARENT.