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 [21] Appl. No. **743,492**  
 [22] Filed **July 9, 1968**  
 [45] Patented **Oct. 20, 1970**  
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 [32] Priority **Aug. 24, 1967**  
 [33] **Austria**  
 [31] **A 7,770/67**

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[54] **GAS-HEATED HEAT EXCHANGER AND CONTROL MEANS THEREFOR**  
**16 Claims, 3 Drawing Figs.**

[52] U.S. Cl..... **165/140,**  
**165/146, 122/32**  
 [51] Int. Cl..... **F28d 7/10**  
 [50] Field of Search..... **165/1, 86,**  
**146, 140, 141, 160, 142, 103; 122/32**

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**ABSTRACT:** A heat exchanger which extracts heat from a hot gas. The heat exchanger includes an outer pressure vessel within which a gas-guiding means is located for directing a hot gas along a predetermined path in the pressure vessel. This gas-guiding means includes a cylindrical portion surrounding a steam outlet means in the form of a high pressure pipe, the latter outlet means extending through the wall of the outer pressure vessel into the gas-guiding means together with a water inlet means which extends into the gas-guiding means. Within the space which is defined between the gas-guiding means the high pressure steam outlet means there is a conduit means in the form of an assembly of heat-exchanging tubes having inlet ends communicating with the water inlet means and outlet ends communicating with the steam outlet means, so that the hot gas flowing through the space within the gas-guiding means will engage these tubes of the conduit means to convert the water therein into steam which flows out under pressure through the high-pressure steam outlet means.

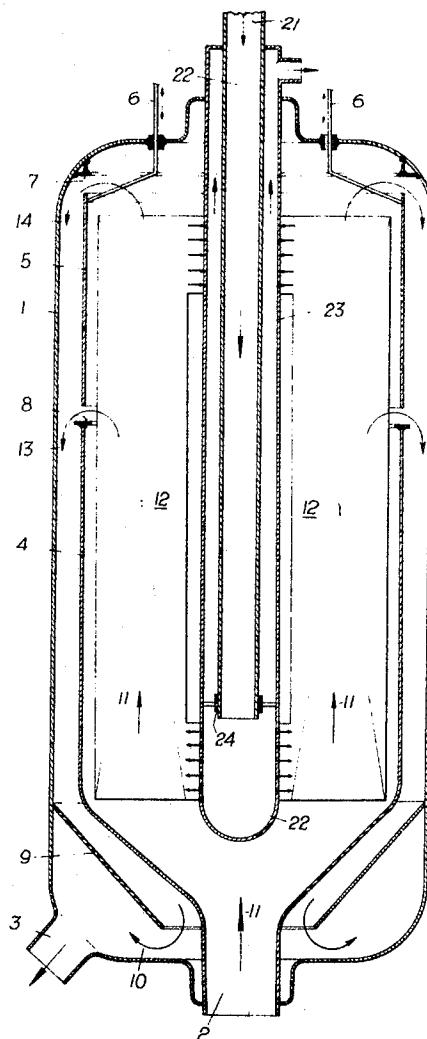
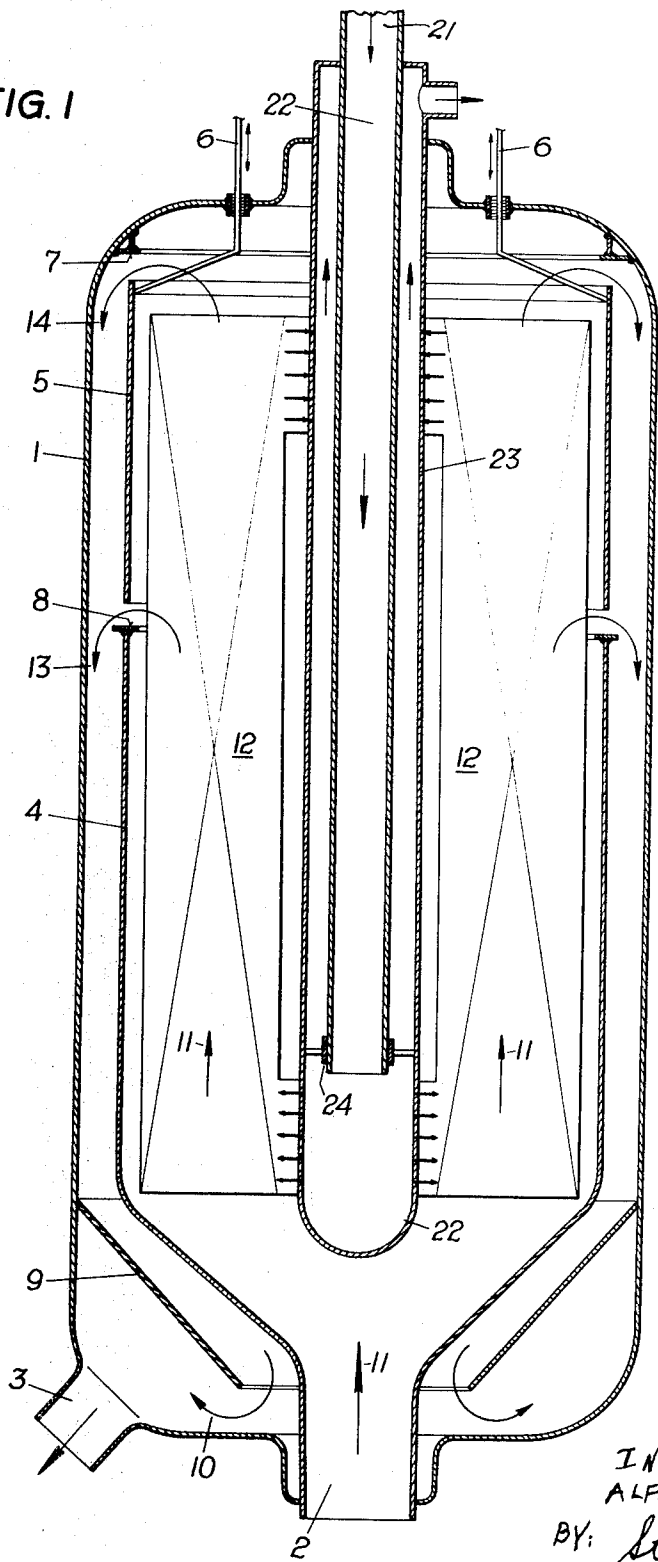
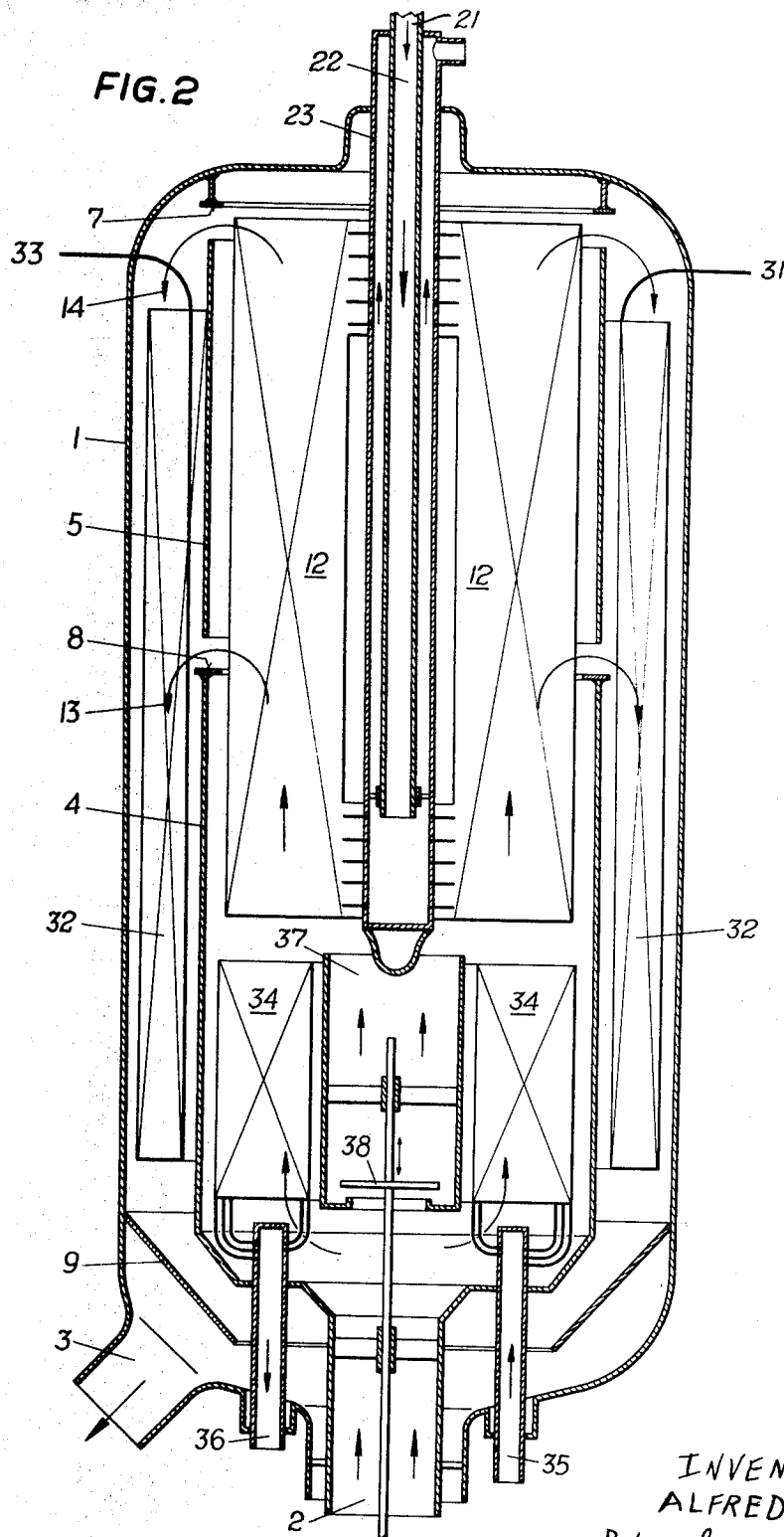


FIG. 1

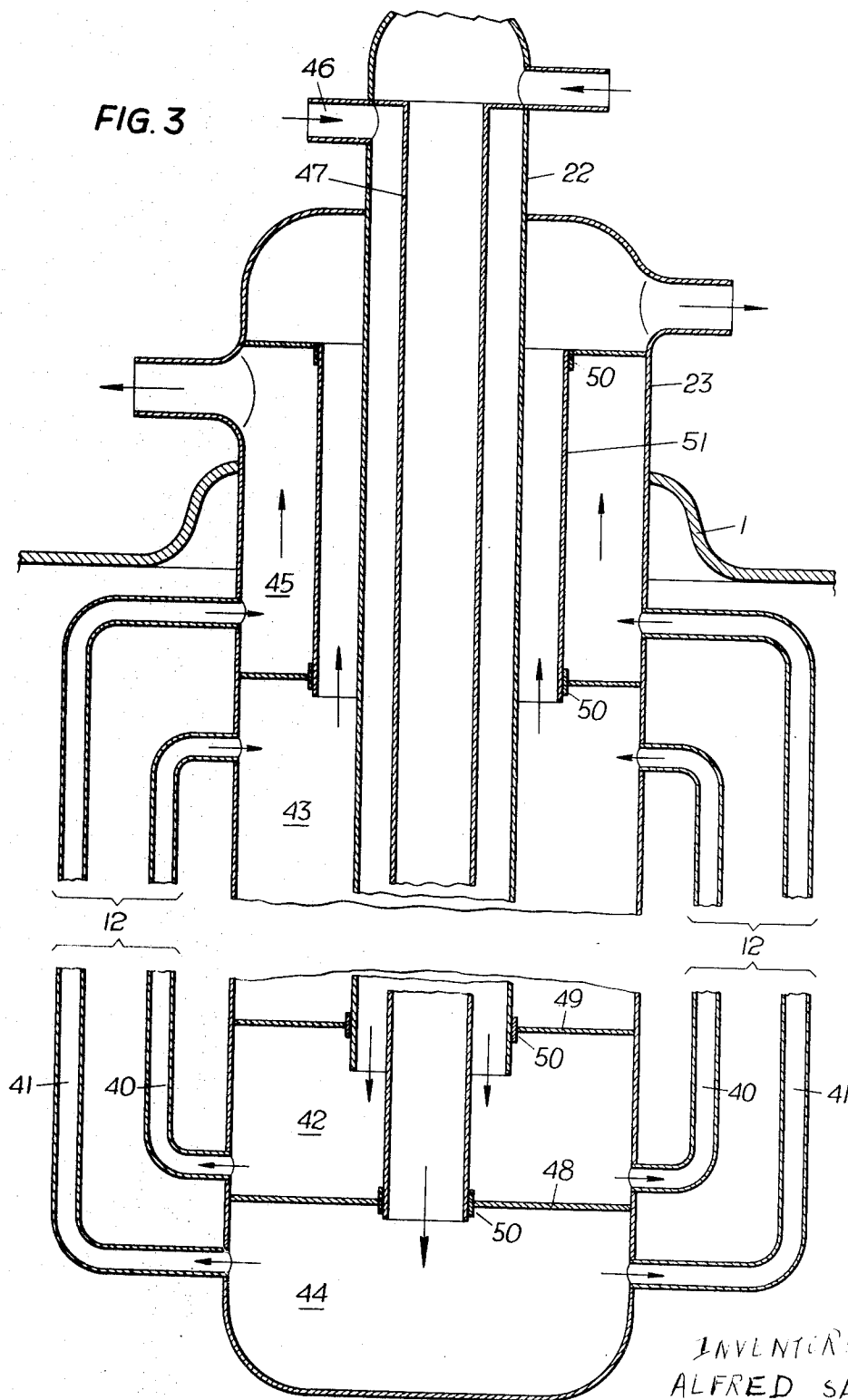


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FIG. 3



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# GAS-HEATED HEAT EXCHANGER AND CONTROL MEANS THEREFOR

## BACKGROUND OF THE INVENTION

The present invention relates to heat exchangers.

In particular, the present invention relates to gas-heated heat exchangers, particularly of the type used in the chemical industry for generating steam. Preferably the heat exchanger of the present invention surrounds a central axis and has in any radial plane which contains this axis a construction which is the same as that of the heat exchanger in any other such radial plane.

There are known heat exchangers used particularly in the chemical industry for cooling process gases which have relatively high pressures, wherein the sensible heat as well as part of the chemical heat liberated during cooling of such gases are used for generating high-pressure steam. In such heat exchangers, generally referred to as waste-heat boilers, it is also possible, according to the particular chemical process, to build into the heat exchanger either a preheater and/or superheater.

Known heat exchangers of this general type suffer from several drawbacks. In the first place they are not as compact and simple as desired. In the second place they are incapable of controlling the manner in which the hot gas flows through the heat exchanger so as to extract from the hot gas the largest possible amount of heat. Furthermore, difficulties are encountered in conventional heat exchangers of this general type because tubes in which water is converted into steam are exposed to different extents of heating while delivering all of their output to a common receiving chamber with the result that problems arise due to the different temperatures of the fluids issuing from all of these heat-exchanging tubes into a common chamber.

## SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a heat exchanger, as well as means for operating and controlling the same, which will avoid all of the above drawbacks.

In particular, it is an object of the invention to provide a heat exchanger which can be readily regulated so as to control the flow of hot gases in such a way that heat can be extracted from the hot gases at various parts of the path of travel thereof through the heat exchanger in a highly efficient manner.

Furthermore, it is an object of the invention to provide a heat exchanger structure of this general type which, while being of a relatively short length, nevertheless is capable of providing a sufficiently long path of flow for the hot gases while controlling the rates and amounts of gas flow along the path to achieve the best possible heat extraction.

Furthermore, it is an object of the present invention to provide a heat exchanger of this type which is capable of utilizing the heat from the hot gases to provide heat for a plurality of different units which are incorporated into the heat exchanger.

In addition, it is an object of the present invention to provide a construction which can coact with a number of different tubes of a heat exchanger in which water is converted into steam with these tubes being of different lengths while at the same time preventing any difficulties because of the fact that certain tubes of the heat exchanger may be subject to more or less heat than other tubes thereof.

According to the invention a cylindrical gas-guiding component is situated within an outer pressure vessel and surrounds a high-pressure steam outlet pipe which in turn surrounds a water inlet pipe. The gas-guiding component directs a gas first in one direction axially along the interior of the pressure vessel and then in an opposite direction therealong in a space between the cylindrical component and the outer pressure vessel. A conduit means communicates with the water inlet and the steam-outlet and includes a plurality of tubes for receiving water from the water inlet and delivering steam to the steam-outlet, these tubes being exposed to the heat in the

gas which flows between the cylindrical gas-guide component and the high-pressure steam outlet pipe. The gas-guide is composed of a pair of cylindrical components one of which is axially movable with respect to the other. In this way the gas flow is divided into a pair of gas streams which can be regulated one with respect to the other. According to the means for operation of the heat exchanger part of the heat from the gas is given up while it flows within the cylindrical components of the gas-guiding means while part of the gas stream is reversed to flow between the cylindrical components and the outer pressure vessel, and this reversed part of the gas stream can give up further heat to a component such as a preheater. In order to control the extent to which various units are exposed to the heat from the hot gas, an adjustable bypass valve means is provided for directing more or less of the hot gases to the various units which are to be heated.

## BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a schematic sectional elevation of one embodiment of a heat exchanger of the invention, the section of FIG. 1 being taken in a vertical plane which contains the central axis of the heat exchanger;

FIG. 2 is a schematic sectional elevation of another embodiment of a heat exchanger according to the invention, the section of FIG. 2 also being taken in a vertical plane which contains the central axis of the heat exchanger; and

FIG. 3 is a fragmentary sectional elevation of a further embodiment of a heat exchanger of the invention showing only that part thereof where tubes of a conduit means which communicates with the water inlet means and steam outlet means are shown connected to the latter pair of means at a scale which is enlarged as compared to FIGS. 1 and 2.

## DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 illustrates the basic construction of a saturated steam generator of the invention. The structure illustrated in FIG. 1 includes an outer pressure vessel 1 of cylindrical configuration having a central axis which extends vertically in FIG. 1. Situated coaxially within the outer pressure vessel 1 of the heat exchanger of FIG. 1 is a gas-guiding means which includes an inner cylindrical component 4 provided with a gas inlet 2 which extends through the bottom wall of the vessel 1 in a fluidtight manner. The hot gases from which heat is to be extracted enter through the inlet 2 in the direction of the arrow 11, and these hot gases continue to flow upwardly in the directions indicated by the arrows 11 within the stationary cylindrical component 4 of the gas-guiding means housed within the outer pressure vessel 1. After heat has been extracted from the hot gases, these gases discharge out of the vessel 1 through the outlet 3 indicated at the lower left corner of FIG. 1. The gas-guiding means includes, in addition to the stationary cylindrical component 4, a movable cylindrical component 5 which is coaxial with the component 4 and which is axially movable toward and away from the latter. For this purpose a hoist mechanism 6 is operatively connected with the movable component 5 for raising and lowering the latter with respect to the stationary component 4 of the gas-guiding means. These components 4 and 5 as well as the cylinder 1 may be made of a suitable sheet metal. The hoist mechanism 6 can be actuated from the exterior of the heat exchanger so as to regulate the elevation of the movable component 5. This movable component 5 of the gas-guiding means is movable between an upper end position where it engages a seat 7 and a lower end position where it engages a seat 8. Thus, this construction provides a control means for controlling the flow of hot gas from the interior of the gas-guiding means into the annular space between the latter and the cylinder 1. The hoist mechanism 6 can be actuated so as to situate the component 5 in either of its opposed end positions

respectively engaging either the seat 7 or the seat 8, or in an intermediate position, this component 5 being illustrated in such an intermediate position in FIG. 1. A frustoconical baffle member 9 is fixed in the outer pressure vessel 1 surrounding and spaced from the lower tapered portion of the component 4 so as to direct the hot gases from which heat has been extracted in the direction of the arrows 10 to the outlet 3.

A conduit means 12 which is in the form of an assembly of tubes in which the fluid which is heated flows is situated within the gas-guiding means 4, 5 in the path of flow of the hot gases determined by the gas-guiding means, so that heat will be extracted from the hot gas as it flows in the direction of the arrows 11. These hot gases will have their flow divided in accordance with the position of the movable component 5 so that, for example, when this component is in an intermediate position spaced from and situated between the seats 7 and 8 a part of the hot gases will flow in the direction of the arrows 14 and part will flow in the direction of the arrows 13 into the space between the vessel 1 and the gas-guiding means 4, 5 to have the direction of flow reversed, so that the reversed hot gases will now flow along the exterior of the gas-guiding means 4, 5 into the baffle 9 and out through the bottom open end of the latter to the outlet 3. The position of the movable component 5 with respect to the seat 8 will determine the size of the gap through which the gases flow in the direction of the arrows 13, and thus by adjusting the component 5 that portion of the gases which flow through the gap between components 4 and 5 and that portion which flows around the top end of component 5 can be regulated, so that the division of the gas stream can be regulated by adjusting the position of the component 5. When the latter engages the seat 8 all of the gas will flow around the top end of the component 5, while when the component 5 engages the seat 7 all of the gas will flow through the gap between the components 4 and 5. On the other hand, between these extreme end positions, the gas flow can be divided in any preselected manner to provide a pair of streams one of which will flow only around the component 4 and the other of which will continue from the interior of the component 4 along the interior of the component 5 and around the latter before being reversed. A considerable constructive advantage resides in the fact that the seat 8 which forms a sealing surface when engaged by the component 5 is engaged only by gases which have already been cooled to a substantial extent after having passed upwardly along the interior of the stationary component 4.

Because the gas which reaches the annular cylindrical space between the gas-guide means 4, 5 and the pressure vessel 1 has already been cooled before reaching this annular cylindrical space, the outer pressure vessel 1 is only engaged by gases which have already been substantially cooled. Therefore, the required strength of the outer pressure vessel 1 need only be calculated in connection with relatively low temperatures.

The boiler water which is to be heated by the hot gases is derived from a suitable drum which is not illustrated, or this water can be derived from an unillustrated circulating pump. This water is introduced into the heat exchanger in the direction of the arrow at the top of FIG. 1 along the interior 21 of a water inlet means which is formed by the inlet pipe 22 which extends coaxially into the interior of the vessel 1 into the space surrounded by the gas-guide means 4, 5. This water inlet means 22 is coaxially supported within a thick-walled high-pressure pipe 23 which forms a steam outlet means. Thus, the pipes 22 and 23 coact with each other to define a central chamber for the downwardly flowing boiler water and a concentric annular chamber for the upwardly flowing steam-water mixture. The pipe 22 which forms the water inlet means is advantageously connected only at the region of its upper end to the high-pressure steam outlet pipe 23. At the region of its lower end, the inlet 22 has the space between the inlet 22 and the pipe 23 closed off by a fluid-tight slidable connection 24 formed between a horizontal annular ring which is fixed at its outer periphery to the interior of the pipe 23 and which at its inner periphery has the sealed slidable engagement with the pipe 22 provided by way of the slidable connection 24.

The conduit means 12 is formed by an assembly of tubes formed into a bundle and through which the water flows while extracting heat from the hot gases. Thus, the bundle of tubes which form the conduit means 12 all have their inlet ends connected to and communicating with the water inlet means 22 at the lowermost part thereof which is situated beneath the seal 24 and which in fact forms a lower extension of the steam outlet 23. All of these tubes of the conduit means 12 extend upwardly from the water inlet 22 along the interior of the space through which the gas is guided, and all of the upper ends of these tubes communicate with the interior of the steam outlet 23, the water introduced into the tubes of the conduit means 12 having been changed into steam or a mixture of steam and water before reaching the outlet 23. Thus, the boiler water which rises upwardly in the tubes of conduit means 12 is converted into a mixture of steam and water flowing into the annular space between the pipes 22 and 23, so that the inlet pipe 22 need only withstand the pressure differential between the fluids respectively flowing down the interior of the pipe 22 and upwardly along the exterior thereof.

In the simplest case the bundle tubes which form the conduit means 12 are made up of straight parallel tubes which extend parallel to the central axis of the heat exchanger. However, these tubes of the conduit means 12 can also consist of interested helically curved tubes. This latter arrangement is of particular advantage in connection with forced circulation systems where the cross section of flow at the water side is extremely small.

With the above conduit means 12, those tubes which are relatively close to the central axis will tend to be shorter than those which are relatively distant from this axis. In order to compensate for the difference in length between such tubes, it is possible to arrange the tubes which are closer to the axis along a relatively steep helix which will not undesirably influence the natural circulation, while the outer tubes can remain straight. In this way all of the tubes may have approximately the same length, and thus the same resistance to flow and the same heating area per tube can be achieved.

The central water inlet tube 22 can be fixed in the region of its top end to a cover which is removably connected with the top end of the steam outlet tube 23. Thus, together with this cover the central tube 22 can be raised out of the tube 23 so that access may be had to all of the boiler tubes of the conduit means 12 from the interior for purposes of inspection, for example, or in order to plug up any tubes of the bundle which forms the conduit means 12 which have started to leak.

FIG. 2 illustrates a further embodiment of the invention which follows the same basic principles utilized in the embodiment of FIG. 1 described above. However, with the embodiment of FIG. 2 a preheater means 32 is situated in the unit and a superheater 34 is also located within the same pressure vessel 1, so that the embodiment of FIG. 2 can be used for extracting from the hot gases entering through the inlet 2 heat which is delivered to a multiplicity of different units. FIG. 2 utilizes the same reference characters as FIG. 1 for indicating the same structures. The schematically illustrated preheater 32 includes inlet tubes 31 and outlet tubes 33 which respectively extend fluid-tightly through the wall of the outer pressure vessel 1. The inlet tubes 31 can at the same time act as a support from which the helically curved tubes which form the preheater bundle 32 are suspended. The inlet tubes 31 extend through the bundle of tubes from the top to the bottom and at the bottom end of the preheater these inlet tubes 31 are bent at approximately a right angle to communicate with the lower ends of the helically curved tubes. Thus, the water delivered to the preheater 32 flows upwardly along the tubes thereof. The hot gas, on the other hand, flows downwardly along the cylindrical annular space defined between the outer pressure vessel 1 and the gas-guiding means 4, 5, this space having in the embodiment of FIG. 2 a radial dimension greater than in the case of FIG. 1 in order to accommodate the preheater 32, so that the countercurrent principle is used for heating the fluid in the preheater 32.

The superheater 34, which is also made up of an assembly of helically curved tubes, is situated in the annular space formed between the inner surface of the gas guide 4 and an inner gas-guiding cylinder 37 which provides a path of flow for gases upwardly along the interior of the gas guide 4 at the axis of the latter. A collector 35 serves to direct saturated steam to the superheater 34. This superheater 34 delivers the superheated steam to an outlet collector 36.

At its bottom end the inner gas guide 37 has an inwardly directed flange forming a seat for a valve plate capable of being moved along the axis of the heat exchanger by actuation of a rod 38, so that this construction forms a bypass valve means to regulate the steam temperatures. In other words, by suitable adjustment of the bypass valve means a selected division of the incoming hot gases can be achieved to direct a preselected part thereof to the superheater 34 and the remainder thereof to the conduit means 12 and the preheater 32.

Of course, it is also fundamentally possible to situate the preheater 32 at another location as, for example, above the conduit means 12 within the gas-guide means 4, 5. Also, it is possible for the superheater 34 to be divided into several components with only one of these components of the superheater situated in the direction of gas flow upstream of the conduit means 12.

In the case where the bundle of boiler tubes which form the conduit means 12 is acted upon by forced through flow or forced circulation at its steam end, the construction of a waste heat boiler can also have a horizontal position. Also, without altering the basic principles of the invention, it is possible to direct the hot gases into the heat exchanger from above. With such a construction the high-pressure steam outlet pipe 23 must be arranged concentrically within the gas inlet tube 2 which in this case would be situated at the top end of the heat exchanger.

In the case of natural circulation, problems can be encountered where the boiler tubes which form the conduit means 12 have widely different final steam contents and lead from one and the same entrance chamber to one and the same outlet chamber.

FIG. 3 illustrates a construction which eliminates these problems. In accordance with the invention a separation is provided between the entrance and discharge chambers for the boiler tubes which are near to the axis and those which are distant from this axis, inasmuch as the inner group of tubes will be loaded thermally in a different manner than the outer group of tubes. According to the invention the central pipe houses in its interior coaxial pressureless guide-tubes which provide communication between chambers of the central pipe separated from each other by suitable partition walls.

The boiler tubes 40 of the conduit means 12 which are near to the axis communicate at their lower ends with a water inlet chamber 42 and at their upper ends with a steam outlet chamber 43, while the tubes 41 of the conduit means 12 which are distant from the central axis of the heat exchanger communicate at their bottom ends with a water inlet chamber 44 and at their top ends with a steam outlet chamber 45. The supply of water to the chamber 42 takes place through the inlet 46 which communicates with the elongated annular space formed between the inlet tube 22 and an interior guide tube 47 situated coaxially within the tube 22. The chamber 42 is defined between and limited by a pair of partitions 48 and 49 which engage, through fluidtight annular seals 50, the tubes 47 and 22, respectively. Thus, these tubes 22 and 47 can be moved upwardly out of the central tube 23 whenever desired.

The remaining guide tubes and partition walls for the inlet and outlet of the fluid are constructed in an analogous manner. Thus, a pair of upper partitions have through seals 50 a slidable fluidtight engagement with an outer tube 51 which surrounds the tube 22 between the latter and the tube 23 to define the chamber 45 for the steam extracted from the outer tubes 41. The steam delivered from the inner tubes 40 passes upwardly along the interior of the tube 51 between the latter

and the tube 22 in the manner indicated in FIG. 3. Thus, the construction and manner of operation of this embodiment is apparent from FIG. 3. It should be noted, however, that with this embodiment the outer pipe or tube 51 can be axially pushed downwardly, so as to render the locations where the boiler tubes are rolled inaccessible from the interior.

Instead of coaxially arranged fluid-conducting pipes or tubes, it is also possible to use other types of pipes or tubes so long as they provide the required communication between the separate chambers defined by the partition walls.

I claim:

1. In a heat-exchanger, an outer pressure vessel having opposed ends and a tubular wall extending therebetween, a tubular gas guiding means coaxially arranged within and spaced from said tubular wall of said outer vessel for guiding along a predetermined path in the interior of said outer pressure vessel a hot gas from which heat is to be extracted, said tubular gas-guiding means defining with said tubular wall of said outer pressure vessel an elongated annular space extending along the common axis of said vessel and gas-guiding means and said gas-guiding means coacting with said outer pressure vessel for first guiding the hot gas in one axial direction along the interior of said gas-guiding means and for then directing the hot gas to said annular space defined between said tubular wall of said outer pressure vessel and said gas-guiding means to flow in an opposite axial direction along the interior of said annular space, control means coacting with said gas-guiding means and with said vessel for controlling the flow of hot gas from the interior of said gas-guiding means into said annular space, water inlet means communicating with the interior of said vessel for introducing water into the latter, steam outlet means also communicating with the interior of said vessel for directing out of the latter water which has been changed to steam with heat extracted from said hot gas, and conduit means situated within said gas-guiding means in the path of flow of hot gas along the interior of said gas-guiding means before the hot gas reaches said annular space and engages said tubular wall of said outer pressure vessel, said conduit means communicating with said water inlet means to receive water therefrom and with said steam outlet means to deliver steam thereto, so that said conduit means will provide a heat-exchanging relationship between the water introduced through said water inlet means and the hot gas to heat the latter into steam which is discharged through said steam outlet means and so that said tubular wall of said outer pressure vessel is engaged only by gas which has initially been cooled with the extraction of heat by the fluid in said conduit means.

2. The combination of claim 1 and wherein said water inlet and steam outlet means are in the form of a pair of coaxial pipes situated one within the other along the axis of said outer pressure vessel with said pipes respectively forming chambers communicating with said conduit means, the chamber formed by said water inlet means supplying water to said conduit means to be converted into steam therein and the chamber formed by said steam outlet means forming a collection chamber to collect the steam from said conduit means.

3. In a heat exchanger, an outer pressure vessel, a gas-guiding means for guiding along a predetermined path in the interior of said outer pressure vessel a hot gas from which heat is to be extracted, water inlet means communicating with the interior of said vessel for introducing water into the latter, steam outlet means also communicating with the interior of said vessel for directing out of the latter water which has been changed to steam with heat extracted from said hot gas, and conduit means situated at least in part in the path of flow of hot gas in said outer pressure vessel determined by said gas-guiding means and communicating with said water inlet means to receive water therefrom and with said steam outlet means to deliver steam thereto, so that the conduit means will provide a heat-exchanging relationship between the water introduced through said water inlet means and the hot gas to heat the water into steam which is discharged through said steam outlet means, said gas-guiding means including a pair of

cylindrical components situated within said outer pressure vessel surrounding a central axis of the latter with one of said cylindrical components being movable along said axis with respect to the other of said components to divide the flow of hot gas through said components in a preselected manner.

4. The combination of claim 3 and wherein said outer pressure vessel is cylindrical and said cylindrical components of said gas-guiding means are coaxially arranged therein, the other of said cylindrical components terminating in a seat to be engaged by said one movable component in one end position thereof for directing substantially all of the hot gas through both of said components, and said pressure vessel having in its interior a second seat to be engaged by said movable component when it is displaced away from said other component to an opposed end position to provide between said components a maximum gap through which substantially all of the hot gas flows, said movable component when situated between said end positions thereof dividing the hot gas flow in a preselected manner.

5. In a heat exchanger, an outer pressure vessel, a gas-guiding means for guiding along a predetermined path in the interior of said outer pressure vessel a hot gas from which heat is to be extracted, water inlet means communicating with the interior of said vessel for introducing water into the latter, steam outlet means also communicating with the interior of said vessel for directing out of the latter water which has been changed to steam with heat extracted from said hot gas, and conduit means situated at least in part in the path of flow of hot gas in said outer pressure vessel determined by said gas-guiding means and communicating with said water inlet means to receive water therefrom and with said steam outlet means to deliver steam thereto, so that the conduit means will provide a heat-exchanging relationship between the water introduced through said water inlet means and the hot gas to heat the water into steam which is discharged through said steam outlet means, said gas-guiding means including a hot gas inlet leading into said pressure vessel and an inner cylindrical component coaxial with said pressure vessel and through which the hot gas flows, superheater means situated in said cylindrical component to be engaged by the hot gas flowing in the interior thereof, and an inner cylindrical gas-guiding member surrounded by said superheater means with the latter surrounded by said cylindrical component so that said superheater means is situated in an annular space defined between said inner gas-guiding member and said cylindrical component.

6. The combination of claim 5 and wherein a bypass valve means coacts with said inner cylindrical gas guide member for controlling the portion of the hot gas which flows along the interior thereof and a portion which flows into contact with said superheater means.

7. The combination of claim 1 and wherein a preheater means is situated within said annular space defined between said gas-guiding means and said tubular wall of said outer pressure vessel so that said preheater means is situated in the direction of hot gas flow subsequent to said conduit means, to extract additional heat from the hot gas.

8. The combination of claim 1 and wherein said water inlet and steam outlet means are in the form of a pair of coaxial pipes situated one within the other, and said pipe of said water inlet means being fixed only at the region of one end thereof with said pipe of said steam outlet means and having at the re-

gion of its other end a slidable connection with said pipe of said steam outlet means.

9. The combination of claim 1 and wherein a superheater means is situated in said pressure vessel with at least part of said superheater means and said conduit means situated one after the other in the direction of gas flow provided by said gas-guiding means.

10. The combination of claim 1 and wherein said conduit means forms at least part of an assembly of heat-exchanging surfaces in said pressure vessel, and said latter surfaces being, at least in part, of a helical configuration.

11. The combination of claim 1 and wherein said outer pressure vessel has a predetermined central axis and said conduit means includes a plurality of straight, parallel tubular portions extending parallel to said axis of said pressure vessel.

12. The combination of claim 1 and wherein said pressure vessel has a central axis, said conduit means including a plurality of straight tubes which are parallel to said axis and also including a plurality of curved tubes which extend helically about said axis.

13. In a heat exchanger, an outer pressure vessel a gas-guiding means for guiding along a predetermined path in the interior of said outer pressure vessel a hot gas from which heat is to be extracted, water inlet means communicating with the interior of said vessel for introducing water into the latter, steam outlet means also communicating with the interior of said vessel for directing out of the latter water which has been changed to steam with heat extracted from said hot gas, and conduit means situated at least in part in the path of flow of hot gas in said outer pressure vessel determined by said gas-guiding means and communicating with said water inlet means to receive water therefrom and with said steam outlet means to deliver steam thereto, so that the conduit means will provide a heat-exchanging relationship between the water introduced through said water inlet means and the hot gas to heat the water into steam which is discharged through said steam outlet means, said water inlet and steam outlet means each including a pair of coaxial conduits one of which is located within the other and spaced therefrom and partition means coacting with said pair of conduits of said water inlet means for defining a pair of inlet chambers which are separated from each other, said partition means also having portions coacting with the conduits of said steam outlet means for defining a pair of steam outlet chambers which are separated from each other, and said conduit means including one group of conduits communicating with only one of said inlet chambers and only one of said outlet chambers and a second group of conduits communicating only with the other of said inlet chambers and the other of said outlet chambers.

14. The combination of claim 13 and wherein the partitions which coact with said water inlet means have a fluidtight slidable engagement therewith.

15. The combination of claim 13 and wherein said conduit means includes boiler tubes which form the connections between said chambers.

16. The combination of claim 4 and wherein said seat which coacts with said movable component of said gas-guiding means when said gap is closed is situated at a part of the path of gas flow where the gas has already been cooled so that the latter seat is situated at a relatively low temperature region to be engaged only by gas which has already been at least partially cooled.