

Oct. 8, 1929.

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PREHEATER FOR BOILER FEED WATER

Filed Feb. 19, 1925

2 Sheets-Sheet 1

FIG. 1.

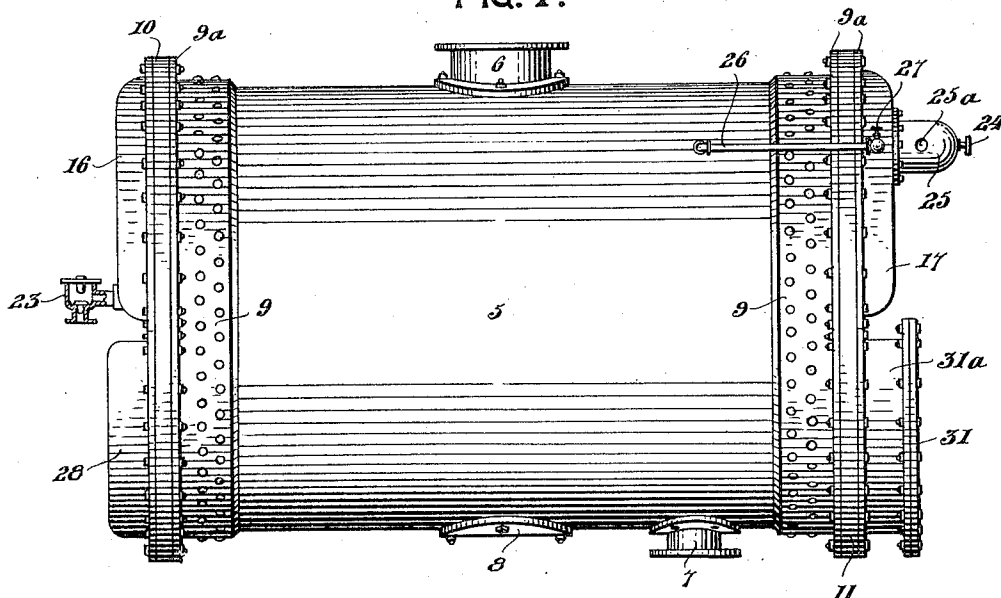
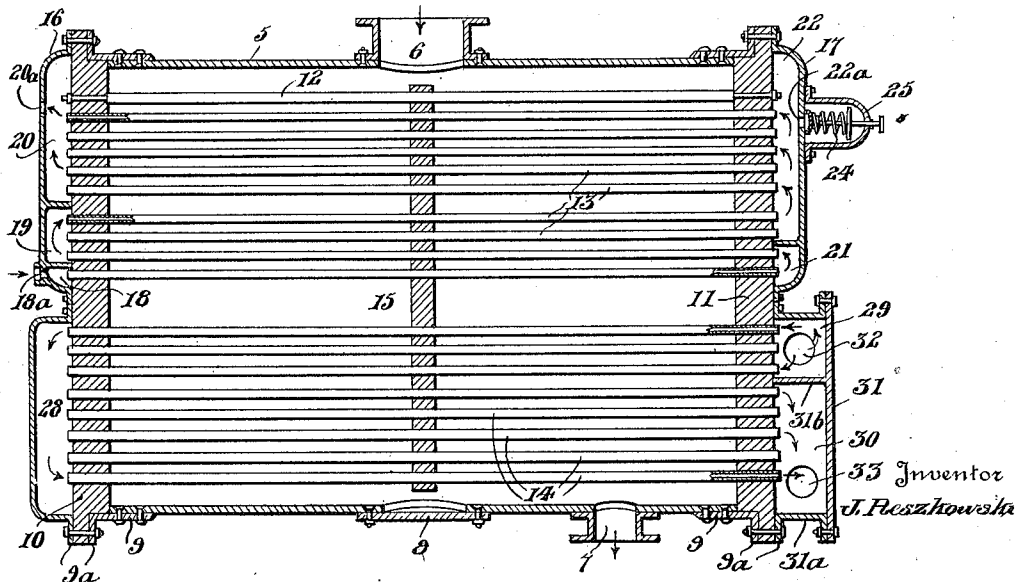


FIG. 2.



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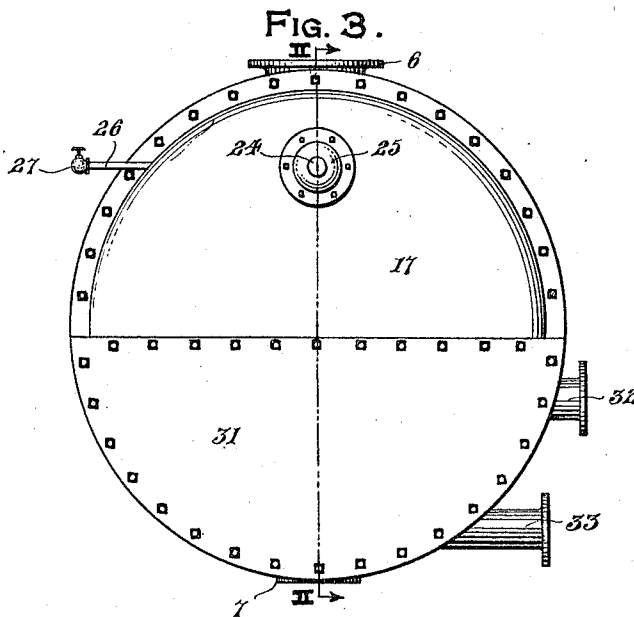
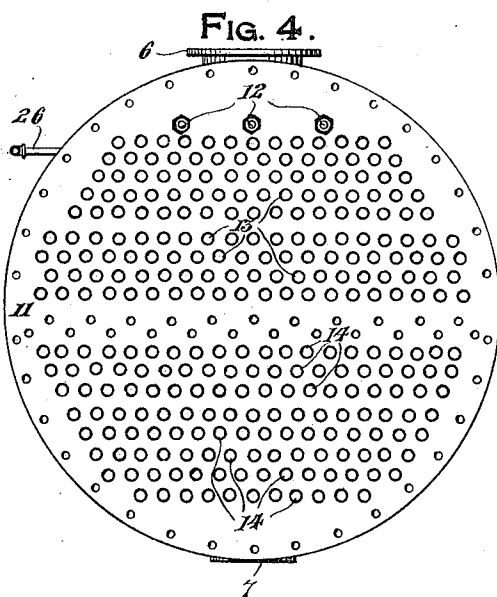
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PREHEATER FOR BOILER FEED WATER

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PREHEATER FOR BOILER-FEED WATER

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This invention relates to new and useful improvements in pre-heaters for steam boilers.

In generating steam for power purposes and utilizing the said steam for driving machinery, or the like, it is the general practice to feed substantially cold water to a steam boiler wherein steam is generated. This steam is then fed to machinery and after being utilized for running the same, the said steam is generally exhausted into the atmosphere. The exhaust from the machinery does not consist of entirely spent steam, or in other words, the steam is not entirely condensed when it leaves the machinery. It has been found that this exhaust medium, which would otherwise be lost, may still be used successfully for heating purposes.

It is, therefore, the primary object of this invention to utilize the exhaust from such machinery for heating the water fed to the steam boiler or generator and, thereby, greatly reduce the cost of producing the motive power previously referred to.

A further object of the invention is to provide an improved form of pre-heater for accomplishing this purpose.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevational view of the pre-heater embodying this invention,

Figure 2 is a longitudinal vertical sectional view of the preheater taken upon line II—II of Fig. 3,

Figure 3 is an end elevational view of the preheater taken at the right hand end of the view illustrated in Fig. 1, and

Figure 4 is an end elevational view of the preheater with the heads removed for showing the open ends of the two separate nests of tubes.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of this invention, the numeral 5 design-

ates the cylindrical shell portion of the device which is provided with a steam inlet 6 at its upper side and a water outlet 7 at its lower side. The lower side is further provided with a removable man-hole cover 8 which permits the said shell to be cleaned out by removing the sediment from the bottom wall of the same. Securely riveted to the opposite open ends of the cylindrical shell 5 are the angular bands 9 having the outwardly directed annular flange portions 9^a to which are riveted the tube sheets 10 and 11, as best illustrated in Figs. 2 and 4. The tube sheets 10 and 11 are suitably connected by a series of through stay bolts 12 which are best illustrated in Figs. 2 and 4.

Extending longitudinally through the cylindrical shell 5 and terminating outwardly of the tube sheets 10 and 11 are two separate nests of tubes which I will designate by the numerals 13 and 14. It will be seen by this construction that the nests of tubes 13 and 14 do not in any way communicate with the interior of the cylindrical shell 5. Positioned within the cylindrical shell 5 and extending transversely thereof substantially midway between the tube sheets 10 and 11, there is provided a tube spacer disk 15 which is employed for preventing buckling or warping of the central portions of the tubes and thereby retains the same in their proper spaced relation to each other.

The ends of the nest of tubes 13 which project through the tube sheet 10 are associated with a three compartment head 16 which is suitably bolted or riveted to the said tube sheet 10 and angular band 9, as best illustrated in Fig. 2. The opposite ends of this nest of tubes are provided with a two compartment head 17 which is also suitably bolted or riveted to the tube sheet 11 and angular band 9. It is to be understood that the three compartments 18, 19 and 20 formed in the head 16 and the two compartments 21 and 22 formed in the head 17 extend transversely the full width of the structure. By inspecting Figs. 1 and 2, it will be seen that the compartment 18 is provided with an opening 18^a to which is attached the check valve and casing 23. This compartment 18

communicates with the lowest layer of tubes in the nest of tubes 13. The compartment 21, formed in the head 17, communicates with the two lower layers of tubes in this nest 13 and the upper of these two layers opens into the compartment 19, formed in the head 16 and into which two other layers of tubes open. It will be seen that these last two layers of tubes communicate at their opposite ends with the compartment 22, formed in the head 17. This last compartment 22 is provided with four layers of tubes which extend longitudinally through the cylindrical shell and open into the compartment 20 formed in the head 16. This compartment 20 is provided with an outlet opening 20^a, as best illustrated in Fig. 2, and to which any suitable system of piping may be connected. By inspecting Figs. 1 and 2, it will be seen that the compartment 22 is provided with an opening 22^a which is intended to be normally closed by the safety valve 24 which is housed within the dome 25. This dome 25 is provided with an outlet 25^a to which any suitable system of piping may be connected. In Figs. 1 and 3, there is illustrated a branch pipe 26 which connects the compartment 22 with the interior of the cylindrical shell 5 and the said branch pipe 26 is provided with a valve 27 which permits the said communication to be controlled manually.

The ends of the nest of tubes 14 which project through the tube sheet 10 all communicate with the single compartment head 28 which is suitably bolted or riveted to the said tube sheet 10 and the annular band 9 carried by this end of the cylindrical shell 5. The opposite ends of the nest of tubes 14 communicate with the two compartments 29 and 30 formed in the two compartment head 31 which is suitably secured to the tube sheet 11 and annular band 9 carried by this end of the cylindrical shell 5. It will be seen by inspecting Figs. 1 to 3 inclusive, that this two compartment head 31 is formed by a channel-shaped side wall 31^a and a cover plate having an inwardly projecting partition 31^b which forms the two compartments 29 and 30. It will be seen that this cover plate is suitably connected to the outer flange portion of the channel-shaped side wall 31 by suitable means such as rivets or bolts. The compartment 29 is provided with an inlet opening 32 while the compartment 30 is provided with an outlet opening 33. It will be seen, by inspecting Fig. 2, that the three upper layers of the nest of tubes 14 communicate with the compartment 29 in the head 31 and with the compartment formed in the head 28. The remaining layers of tubes in this nest 14 communicate with the compartment 30 in the head 31.

By inspecting Fig. 2, it will be seen that the

circulation established through the nest of tubes 13 is as follows:

Water is intended to be pumped through the check valve casing 23 and the inlet opening 18^a into the compartment 18 from which it will flow through the lowest layer of tubes into the compartment 21. The next highest layer of tubes will convey this water from the compartment 21 into the compartment 19 from which two layers of tubes will convey the water into the compartment 22. The four uppermost layers of tubes will then convey the water from the compartment 22 into the compartment 20 from which it will be discharged through the opening 20^a. The circulation through the nest of tubes 14 may be described as follows: Water may be fed through the inlet opening 32 into the compartment 29 from which the three upper layers of tubes will convey the said water into the single compartment in the head 28. The remaining layers of tubes will convey the water from the compartment in the head 28 to the compartment 30 in the head 31 from which the water will be discharged through the opening 33.

The operation of this pre-heater for heating water to be fed to a steam boiler is as follows:—

Steam, such as that exhausted from steam driven machinery, is fed through the inlet 6 into the cylindrical shell 5 and from which the condensed steam or water is discharged through the outlet 7. The water to be fed to the steam boiler and to be heated by the steam within the cylindrical shell 5 is fed through the opening 18^a into the compartment 18 from which it will be conveyed longitudinally through the cylindrical shell 5 and discharged into the compartment 21. The water from the compartment 21 will again be conveyed through the cylindrical shell 5 and discharged into compartment 19 and then into the compartment 22. The water in the compartment 22 will be conveyed through the shell 5, by the four upper layers of tubes in the nest of tubes 13 and discharged into the compartment 20, formed in the head 16 and from which it will be allowed to escape through the opening 20^a and conveyed to the steam boiler by any suitable system of piping. It will be seen by this arrangement that the water to be fed to the steam boiler will pass through the cylindrical shell 5 four different times and will be greatly heated by the steam within the cylindrical shell. Should the water pressure within the nest of tubes 13 and the heads 16 and 17 become too high, the safety valve 24 will operate for permitting discharge of the said water. If it is desired to feed some of this water from the nest of tubes 13 into the interior of the cylindrical shell 5, for the purpose of aiding in condensing the steam therewithin, the valve 27 may be operated for establishing communication

between this compartment 22 and the steam chamber within the cylindrical shell 5.

For the purpose of completely condensing the steam within the lower portion of the cylindrical shell 5, so that the same may be discharged as water through the outlet 7, a supply of cold water is fed to the opening 32 into the compartment 29 formed in the head 31 and this cold water is conveyed by the three upper layers of tubes in the nest of tubes 14 through the interior of the shell 5 and discharged into the compartment formed in the head 28 from which it will be discharged into the remaining layers of tubes in the nest of tubes 14 and conveyed to the compartment 30 from which it will be discharged through the outlet 33.

It is to be understood that the water intended to be fed to the steam boiler or generator may first be passed through the nest of tubes 14 and the outlet 33 for the compartment 30 may be connected with the check valve casing 23 which communicates with the inlet opening 18^a for the compartment 18. This water may then perform the operation of condensing the steam in the lower part of the cylindrical shell 5 and the heat taken from this steam during the operation of condensing the same will aid in raising the temperature of the water that is to be fed to the steam boiler. It is now believed that the operation of this pre-heater will be understood, by those skilled in the art, from the above detail description.

It is to be understood that the form of this invention herewith shown and described is to be taken as the preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claim.

Having thus described the invention, I claim:—

In a preheater for boiler feed water, a cylindrical shell, tube sheets connected to the open ends of said shell, tubes extending between said sheets and opening on the outer sides of said sheets, upper and lower recessed heads attached to each of said sheets, the upper head at one end of the shell being partitioned to form three superposed compartments, and the lower head at the same end being without partition, and constituting a single chamber, the upper head at the other end of the shell being partitioned to form two superposed compartments, while the lower head at the same end is partitioned into two superposed compartments, the said tubes being disposed in a plurality of groups, the compartments in the two upper heads being connected by certain groups and the compartments in the two lower heads being connected by other groups, a water inlet in the lower compartment and an outlet in the upper com-

partment of one upper head, a water inlet in the upper compartment and an outlet in the lower compartment of one lower head, means providing communication between one compartment of an upper head and the interior of the shell, means to control flow of water through said means, an inlet in the shell for steam and an outlet for condensate.

In testimony whereof I affix my signature.

JÓZEF RESZKOWSKI.