J. J. HOPPES.

CONDENSER.

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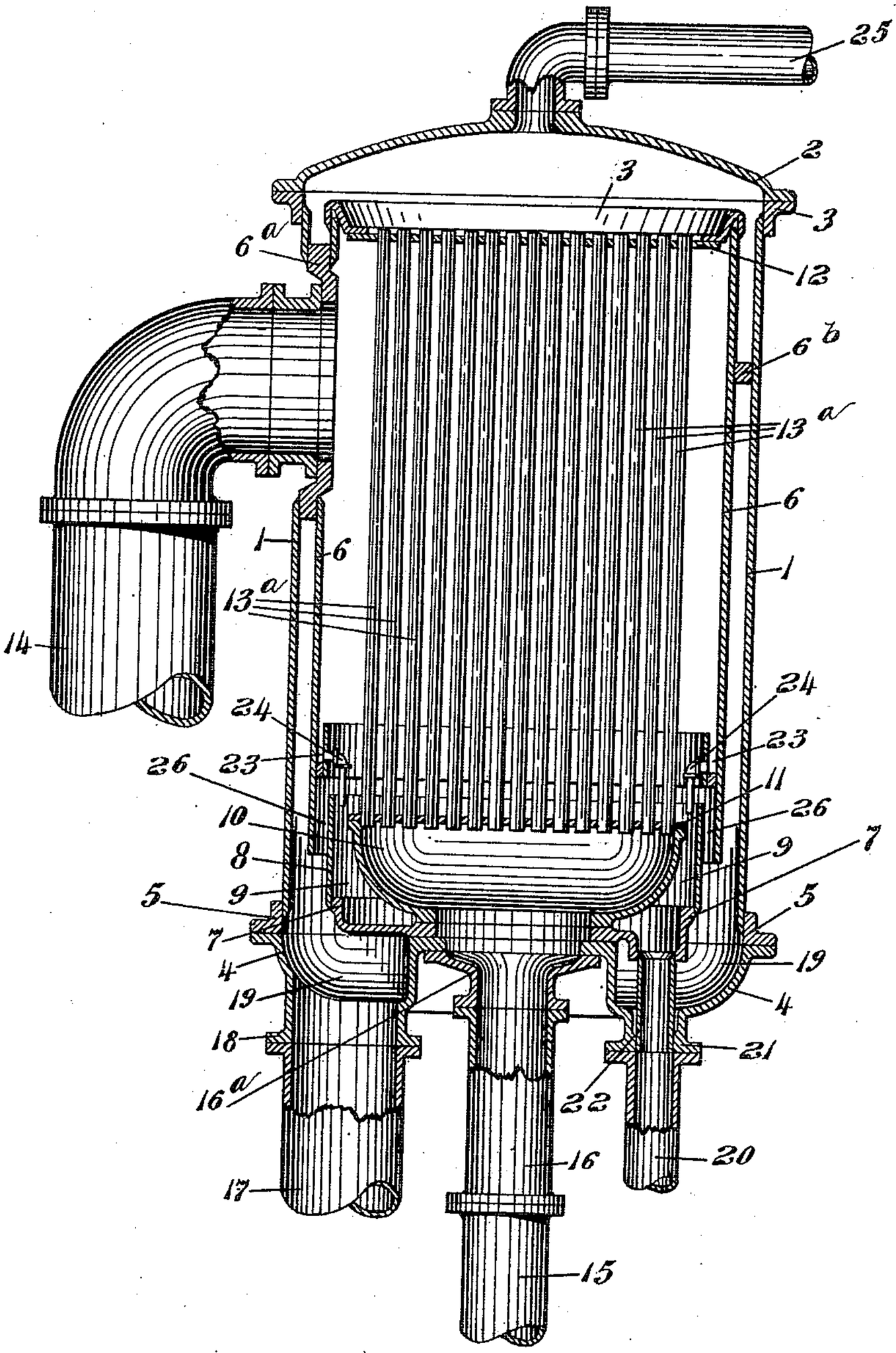
995,462.

Patented June 20, 1911.



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CONDENSER.

995,462. Specification of Letters Patent. Patented June 20, 1911.

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To all whom it may concern:

Be it known that I, JOHN J. HOPPES, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Condensers, of which the following is a specification.

This invention relates to improvements in condensers and more particularly relates to a combined surface and jet condenser.

An object of the invention is to provide a construction of condenser of the combined type referred to in which the full capacity of the surface condenser will be utilized in a more effective manner than heretofore in this particular type so that a larger proportion of the water of condensation will be saved for use again in the boilers.

A further object of the invention is to provide for a circulation of the water which will produce a more effective condensation of the steam and also cause a more uniform expansion and contraction of the tubes and tube sheets.

A further object of the invention is to provide a construction which will permit a more ready access to the interior of the device for the purpose of repairs, etc.

The invention consists in the construction and combination of parts hereinafter described and set forth in the claims.

In the accompanying drawing, the figure represents a vertical section of the condenser.

Like parts are represented by similar characters of reference in the drawing.

In the said drawing, 1 represents the outer shell or casing constructed in the usual manner, 2 is the upper head, which is removably secured to the flanged ring 3 so as to permit the ready removal of the head for the purpose of cleaning or repairing the tubes.

4 is a lower head, also removably secured to the flanged ring 5.

6 is an inner shell or casing which is secured to and supported by the collar 6^a and blocks 6^b which collars 6^a is riveted to the outer shell 1. Supported upon and secured to the lower head 4 is a trough 7 which has an upwardly projecting wall 8 of sheet metal to form a chamber 9. 10 is a basin or chamber supported upon and secured to the trough 7, the upper portion of which is closed by the tube sheet or head 11. The upper end of the inner shell 6 is closed by the tube-sheet or head 12 which is secured to the ring 13 which fits over the upper edge of the casing 6 so as to form a steam tight joint. 13^a are a series of circulating tubes extending through and supported by the respective heads or sheets 11 and 12.

14 is an exhaust steam pipe secured to the collar 6^a and communicating with the upper part of the interior of the casing 6.

16 is a section of the inlet pipe 15 for the circulating water, this section 16 being bolted to a small flanged section 16^a which is secured by bolting or otherwise to the lower head 4, and communicates through openings in said head, the trough 7 and basin 10 with the circulating pipes 13^a. These openings are made sufficiently large to permit access therethrough to the chamber 10.

17 is an outlet pipe for the circulating water, this pipe 17 being connected with a flanged projecting portion 18, of the lower head 4. This lower head 4 is so formed as to provide an annular chamber 19 which will receive the circulating water, which flows down the outside of the shell 6 in the form of a film, and will conduct said water to the outlet pipe 17.

20 is the outlet pipe for the condensate which is secured to the flanged projecting portion 21 of the lower head 4 and communicates with a short pipe 22 which extends through chamber 19 and communicates with the chamber 9. 23 is a narrow trough arranged about the lower inside of the inner casing 6 and communicates by small pipes 24 with the chamber 9, so as to conduct the condensate formed upon the inner side of the shell 6 into said chamber 9.

25 is a pipe which is connected to any suitable air pump and communicates with the upper part of the outer casing 1.

The discharge pipes 17 and 20 for the circulating water and condensate, respectively, may lead to a hot well so that a vacuum may be maintained in the condenser by the well known barometric principle or they may be connected to pumps and the water drawn off from the respective chamber in this manner.

The construction is such that a space or passage-way 26 is left between the lower end of the inner shell 6 and the chamber 9 for the escape of the air and other non-condensable gases as well as such steam as may be non-condensed. As the exhaust steam enters the upper part of the inner shell 6, the non-

condensable gases drop while the steam, being lighter than these gases, will tend to remain at the top until forced down by the incoming steam due to the volume of steam exceeding the capacity of the condensing surface, and will thus have a tendency to circulate more thoroughly throughout the entire series of tubes. This causes all the steam to condense on the tubes up to the full capacity of the condensing surface and makes the operation of condensing much more effective than in other forms of condenser of this type and effects a material saving of the condensate.

Whatever non-condensed steam escapes through the passageway 26 will meet the jet of circulating water which flows down the outside of the inner casing 6 and be condensed thereby, the condensate mingling and escaping therewith. The non-condensable gases will by the action of the air pump be caused to circulate up between the walls of the respective shells and escape through the air pipe 25.

By having the water enter at the bottom of the condenser and flow upward through the tubes it will be seen that the coldest water is brought in contact with the tubes at a point where the exhaust steam is ready to leave the inner shell where the lower temperature will be most effective for condensing the same for producing a vacuum. Further, it will be seen that by circulating the water through the tubes in one direction only a more uniform expansion and contraction of the tubes and their heads will be produced, than where the tubes are divided into separate banks with the water flowing in opposite directions through the tube of the respective banks, thus adding much to the life of the same. It will also be seen that by the construction described access is readily obtained to the tubes for the purpose of renewal or repairs. The upper head 2 is removable, as before stated, to permit access to the tube at the top, and by removing the sections 16 and 16[a] access may be obtained to the lower ends of said tubes.

In the operation of the device, the circulating water enters the chamber 10 from the supply pipe 15, flows through the series of pipes 13[a], out at their upper ends and overflowing the outer wall of the inner casing 6 in the nature of a film, and thence into the chamber 19, and leaves through the discharge pipe 17. The exhaust steam from the engine enters the upper part of the inner casing 6 from the pipe 14 and is condensed upon the tubes and inner wall of the casing 6 in the manner heretofore described, the water of condensation flowing down into the chamber 9 and being drawn off through the discharge pipe 20. The air and other non-condensable gases leave the inner casing 6 through the passageway 26 and are drawn off through the air pipe 25. Any exhaust steam which remains non-condensed, as it leaves the passage-way 26 meets the jet of water which flows down the outside of the casing 6 and is thereby condensed and carried away through the discharge pipe 17.

Having thus described my invention, I claim:

1. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same at or near the lower end of said inner casing, an exhaust steam inlet at or near the upper end of one of said casings, a surface condenser in said steam casing, an exhaust pipe connected with the other casing, a discharge pipe for the condensate, and inlet and outlet pipes for the circulating water connected to the respective casings.

2. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same at the lower end of said inner casing, an exhaust steam inlet at or near the upper end of the inner casing, a surface condenser in said inner casing, an air pipe connected with the outer casing, an outlet from said outer casing for the circulating water from said condenser, and an outlet connected with the inner casing for the condensate.

3. In a condenser, an outer casing and an inner casing spaced apart having a communication between the same, a surface condenser in said inner casing an exhaust steam inlet leading into the upper end of said inner casing, a suction pipe connected to the outer casing, a discharge pipe for the circulating water connected to the bottom of said outer casing, and a discharge pipe for the water of condensation connected to the bottom of the inner casing.

4. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same at the lower end of said inner casing, a surface condenser in said inner casing having a water supply at its lower end, said condenser discharging into the upper end of said outer casing, an exhaust steam inlet connected with the upper end of said inner casing, an air pipe connected with said outer casing, and discharge pipes connected with the respective inner and outer casings.

5. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same at the lower end of said inner casing at or near the lower end, an exhaust steam inlet at or near the upper end of said inner casing, a surface condenser located in said inner casing adapted to discharge in said outer casing, a chamber beneath said surface condenser having an outlet pipe connected therewith, a

trough located around the lower end of said inner casing adapted to discharge into said chamber, an exhaust pipe connected with said outer casing, and inlet and outlet pipes for the circulating water.

6. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same, a surface condenser in said inner casing having a water supply pipe at the lower end thereof, said condenser discharging into the upper end of said outer casing; an exhaust steam inlet connected with said inner casing, and discharge pipes connected with the respective inner and outer casings.

7. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same, an exhaust steam pipe connected with the said inner casing, a surface condenser in said inner casing discharging into said outer casing, a basin for the circulating water connected with the lower end of said condenser, a supply pipe for the circulating water communicating with said basin through the lower end of said outer casing, said condenser discharging into the upper end of said outer casing, a chamber for the condensate arranged about said basin, and discharge pipes communicating with said condensate chamber and with said outer casing, substantially as specified.

8. In a condenser, an inner casing and an outer casing spaced apart and having a communication between the same, an exhaust steam pipe entering at or near the top of the inner casing, a surface condenser in said inner casing discharging into the outer casing, a chamber for the condensate at the bottom of the surface condenser, said chamber being removed from the walls of said inner casing, and means for catching the condensate from the inside of the inner casing and discharging it into said condensate chamber.

9. In a condenser, an outer casing and an inner casing spaced apart, a communicating passageway between said casings, an exhaust steam inlet, said inlet being located above said passageway, a surface condenser in said steam casing, an exhaust pipe connected with said outer casing, a discharge pipe for the condensate, and inlet and outlet pipes for the circulating water connected to the respective casings.

10. In a condenser, an outer casing and an inner casing spaced apart and having a communication between the same, an exhaust steam inlet in said inner casing, a surface condenser located in said inner casing adapted to discharge into said outer casing, a condensate chamber beneath said surface condenser having an outlet pipe connected therewith, said chamber being removed from the walls of said inner casing, a trough located around the lower end of said inner casing adapted to discharge into said chamber, an exhaust pipe connected with said outer casing, and inlet and outlet pipes for the circulating water.

In testimony whereof, I have hereunto set my hand this 2nd day of November 1910.

JOHN J. HOPPES.

Witnesses:

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