Y. WADAGAKI.

SURFACE CONDENSER.

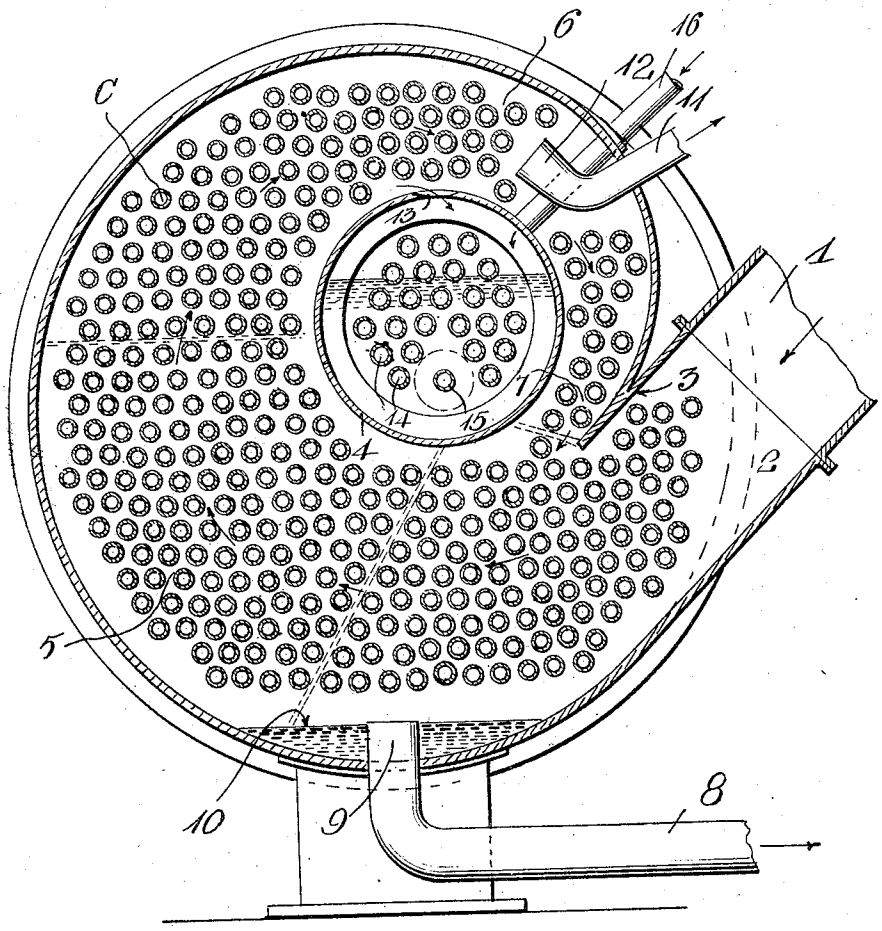
APPLICATION FILED OCT. 7, 1908.

942,423.

Patented Dec. 7, 1909.

2 SHEETS—SHEET 1.

FIG. 1



Witnesses

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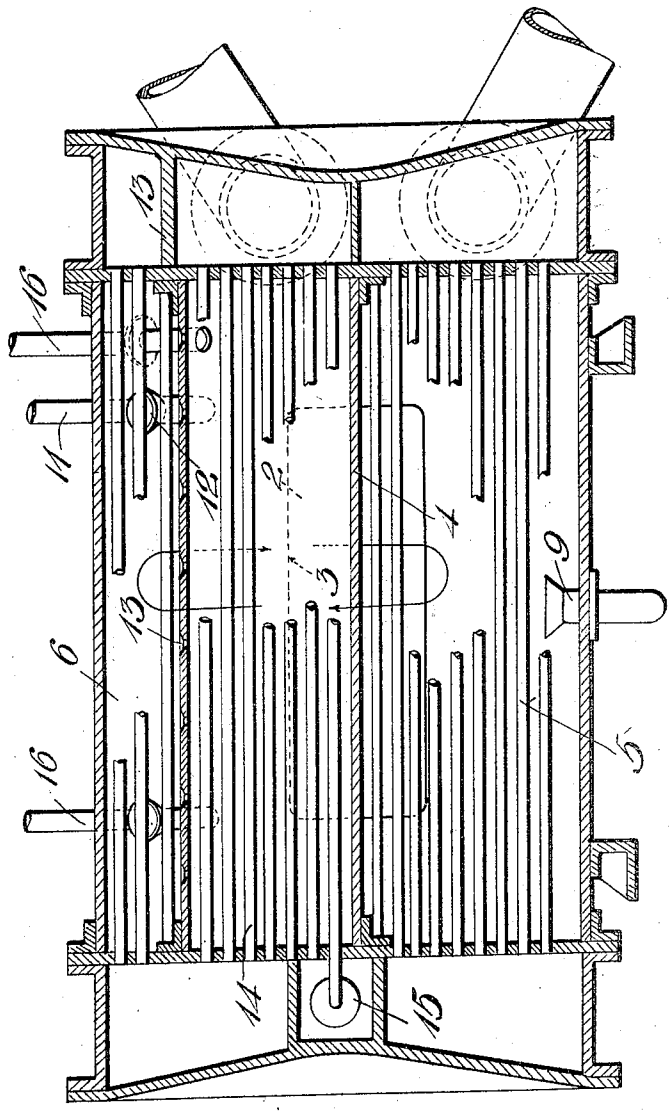
2 SHEETS—SHEET 2.

FIG. 2



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UNITED STATES PATENT OFFICE.

YASUZO WADAGAKI, OF SASEBO, JAPAN.

SURFACE CONDENSER.

942,423. Specification of Letters Patent. Patented Dec. 7, 1909.

Application filed October 7, 1908. Serial No. 456,595.

To all whom it may concern:

Be it known that I, YASUZO WADAGAKI, a subject of the Emperor of Japan, and a citizen of Nojeo village, Kinosaki, Hyogo Ken, residing at Sasebo, Hizen, Japan, have invented certain new and useful Improvements in Surface Condensers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the improvements of surface condensers to be used in connection with steam engines and consists in the novel construction, combination and arrangement of parts hereinafter described and claimed.

One object of the invention is to promote the flow of steam among the nest of condensing tubes in order to facilitate the transmission of heat through the tubes.

Another object of the invention is to separate water already existing in exhaust steam before reaching the condenser and to prevent, as far as possible, its being thrown down upon the nest of condensing tubes.

A further object of the invention is to remove the water of condensation from the surface of tubes as soon as possible after its formation, in order to avoid its insulating effect on the surface of tubes, and also to prevent its temperature falling unduly low.

A still further object of the invention is to reheat the water of condensation that trickles down from the upper portion of the tube nest by its direct contact with the influx of exhaust steam at the lower part of the condenser.

A still further object of the invention is to assist the work of "dry" air-pump in drawing the air existing in the condenser into the suction pipe of this pump by taking advantage of the velocity of influx of exhaust steam from the engine into the condenser.

A still further object of the invention is to provide the surface condenser of the kind to be hereinafter described with means to prepare and supply the cold spray water required in the operation of the "dry" air pump.

The above and other objects which will appear as the nature of my invention is better understood are accomplished by means of the construction illustrated in the accompanying drawing in which—

Figure 1 is the cross sectional view of my improved surface condenser. Fig. 2 is a longitudinal, sectional view of the same.

In the drawings, the numeral 1 denotes the after end of the exhaust pipe, which is connected to the exhaust inlet 2 secured to the condenser C. The numeral 3 shows a guide plane provided at the exhaust inlet in order to direct the influx of exhaust steam tangentially on the inner surface of the condenser shell, near its bottom. This will have a beneficial effect of separating the water already existing in the exhaust steam and casting it down upon the bottom of the condenser, before it can have much time to travel across a large portion of the cooling surface.

The numeral 4 represents a large pipe fitted parallel to the axis of the condenser between the tube plates, but the axis of this large pipe is not concentric with the axis of the condenser shell, so that, the annular space (5—6) thus formed between them is not constant in its width all around, but tapers gradually from the exhaust inlet inward, in due proportion to the amount of condensation effected among the nest of condenser tubes fitted in this annular space. The inner or narrower end of this annular space is not closed. It has an open communication with the exhaust inlet through the passage 7. The top of the eccentrically mounted large pipe 4 is perforated with a number of small holes as shown at 13; so that a part of the vapor circulating through the annular tube-nest (5—6) can also enter the inner space of this cylinder 4. This inner space is traversed with another set of cooling tubes 14. The function of these cooling tubes is to make and supply a quantity of cold spray water required in the work of "dry" air pump. The course to be followed by steam is indicated by the arrows. Any portion of steam which remains uncondensed at the end of one turn around the nest of the condensing tubes is not obliged to come to a standstill. On the contrary, it is induced to rejoin the fresh influx of exhaust steam at 7.

The water chambers at the ends of condensers may be divided into any number of parts desired, as shown by dotted lines in the accompanying drawings. The cooling water is first introduced to the tubes 14 fitted within the eccentrically mounted pipe 4. It is then taken to the top of the condenser, where the temperature of the vapor

is the lowest among the tube-nest (5—6). It may be made to flow through the tubes any number of times as desired. The circulating water is finally discharged after passing through the tubes situated at the lower part of the condenser, where the temperature of the vapor is the highest.

On the vacuum side, a water pump suction pipe 8 is fitted to the bottom of the condenser with a short length of pipe 9, protruding into it, so as to maintain a certain area of water surface 10 directly exposed to the influx of the exhaust steam. The "dry" air-pump suction pipe 11 is connected to the condenser near the narrower end 6 of the annular space (5—6), where the temperature of the vapor and air is the lowest, and it is fitted with an internal funnel mouth 12 into which the air is compressed by the flow of vapor, established within the condenser, as shown. The spray water required to facilitate the work of "dry" air-pump is taken from the inner cylinder 4 by way of pipe 15 arranged in any suitable manner. The water injected to the "dry" air-pump may subsequently be returned from its delivery pipe back again to this inner cylinder 4 by a pipe as shown at 16.

The operation and advantages of this invention will be readily understood from the foregoing description, taken in connection with the accompanying drawing. The following are the principal advantages resulting from the use of my improved condenser:—

In ordinary condensers, the momentum of exhaust steam is uselessly destroyed, its only effect on the performance of the condenser being an undesirable augmentation of back pressure. With my improved condenser, however, all the energy due to the velocity of exhaust steam is profitably employed in maintaining brisk circulation of steam among the nest of condensing tubes.

In my improved condenser, there is absolutely no sharp turn of directions, no diaphragm plate, nor any other obstruction in the course of steam except cooling tubes which can impede the speed of its flow. Neither is there any short circuit, dead corner or stagnant recess that would detract from the general efficiency of the cooling surface, involving unnecessary augumentation to the weight and cost of the condensing apparatus. The area of the steam passage at every point in its course can be made in exact proportion with its requirement, taking into consideration the amount of steam condensed at each point.

In all steam engines or turbines, there is always a large amount of drain water produced after doing useful work within the cylinders. With ordinary condenser, all this water existing in the exhaust steam is directly thrown over the nest of the condensing tubes. Not only is the surface efficiency of the condensing tubes thus impaired, but this has a pernicious effect of uselessly lowering the temperature of the feed water. With my improved condenser, this drain water is deposited on the bottom of the condenser soon after its entry at 2. Water resulting from the condensation of steam is rapidly separated from the surface of tubes and is promptly removed to the outside of the nest of condensing tubes by virtue of the centrifugal force arising from the circular course taken by steam. Work of the "dry" air-pump is considerably assisted by the flow of vapor established within the condenser.

This invention gives us not only a very good condenser but also a very cheap and efficient apparatus in itself for heating the feed water, the water drawn from the bottom of the condenser being almost as hot as the exhaust steam itself.

Various changes in the form, proportion and minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A surface condenser comprising a cylinder having a condensed water pocket, a steam inlet adapted to cause the exhaust steam entering the cylinder to directly impinge against the water in said pocket and to travel in a rotary direction.

2. A surface condenser comprising a cylinder, a steam inlet adapted to throw the vapor for condensation to the periphery of the cylinder, a condensing water pocket formed in the line of travel of the vapor and adapted to be engaged thereby and means arranged adjacent the inlet for restricting the passage of the vapor.

3. A surface condenser comprising a casing, means to direct steam thereinto, cooling means arranged in the cylinder, means to form a restricted passage in the cylinder for the vapor, and a dry air pump supply pipe arranged in the restricted passage with its mouth open to the flow of vapor.

4. A condenser comprising a cylindrical body, a tangential inlet pipe, a hollow cylinder mounted eccentrically in the condenser, adjacent the pipe, cooling tubes arranged around said cylinder and means to direct the vapors whereby they will pass around the cylinder.

5. A condenser comprising a cylindrical body, a tube mounted eccentrically in said body, cooling tubes around said eccentrically mounted tube, and a tangentially disposed guiding vane.

6. A condenser comprising a cylindrical body, a tangential inlet tube connected there-

to, a condensed water pocket in line with said tube, a guiding vane in line with said inlet tube, means arranged adjacent said vane for forming a restricted steam channel in the cylinder, and cooling tubes surrounding said means.

7. A condenser comprising a cylindrical body, a tangential inlet tube connected thereto, a guiding vane in line with said inlet tube, means for forming a restricted steam channel in the cylinder and adapted to contain spray water, cooling tubes surrounding said means and cooling tubes arranged in said means.

8. In a condenser, a casing, means to direct steam thereto, a cooling element directly engaged by the steam, a liquid container in the casing and having an inlet and outlet, a cooling element arranged therein, and a connection between the casing and container whereby the cooling element in the container is indirectly traversed by the vapor in the casing.

9. In a condenser, a casing, means to direct steam thereto, a cooling element directly engaged by the steam, a liquid container in the casing and having an inlet and outlet, a cooling element arranged therein, a connection between the casing and container whereby the cooling element in the container is indirectly traversed by the vapor in the casing, and an air pipe arranged in the restricted channel with its mouth directed in opposition to the flow of vapor.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

YASUZO WADAGAKI.

Witnesses:
TSUNEZO SHIGIO,
CARLETON MILLER.