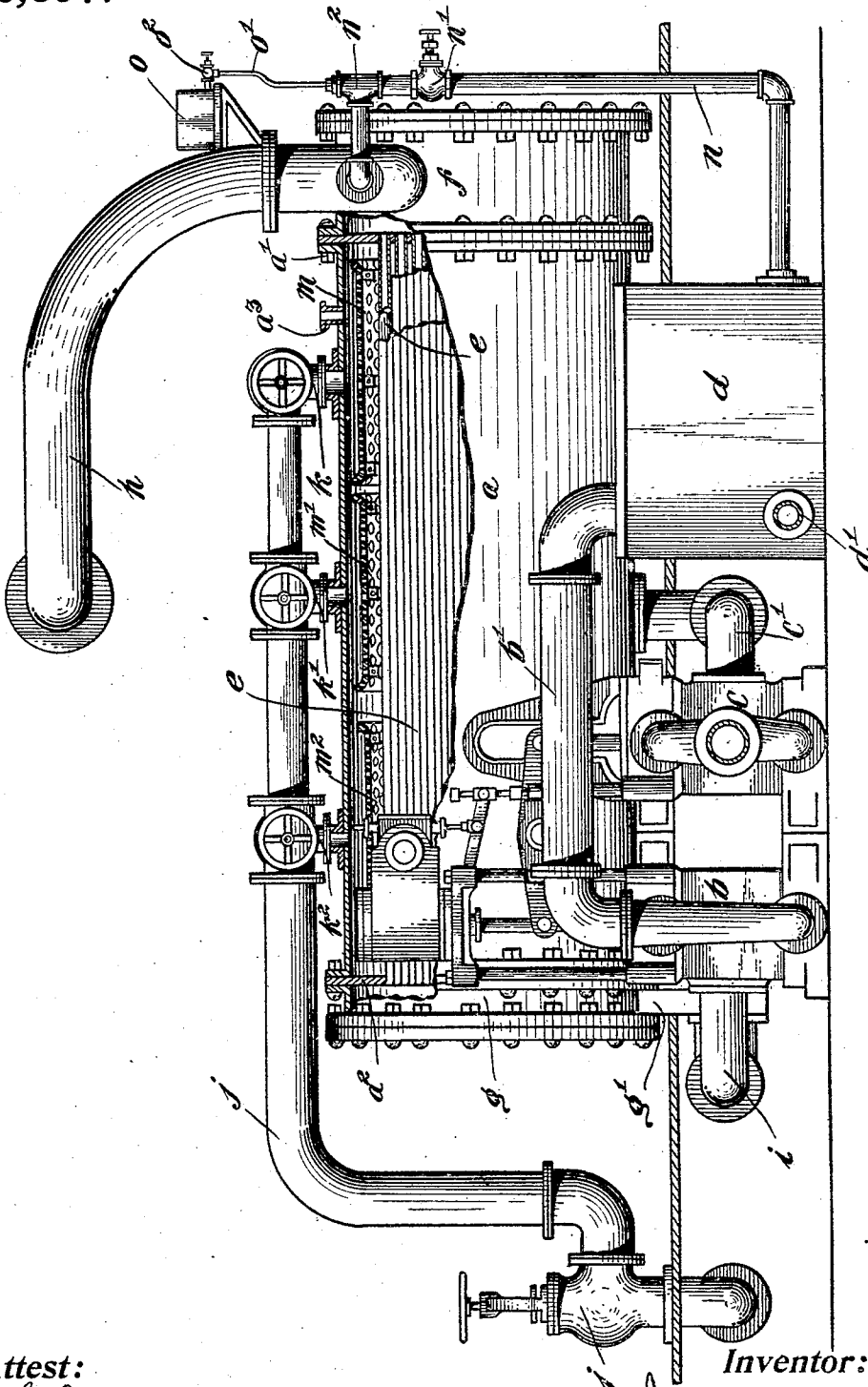


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CONDENSER.

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CONDENSER.

936,397.

Specification of Letters Patent.

Patented Oct. 12, 1909.

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To all whom it may concern:

Be it known that I, JAMES ANDERSON, a citizen of the United States, residing at the borough of Manhattan, in the city, county, and State of New York, have invented certain new and useful Improvements in Condensers, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to condensers, and more particularly to a class of surface condensers.

The main object of the invention is to provide a condenser wherein the electrolytic action of the cooling agent, and of the exhaust steam will be eliminated entirely, or reduced to a minimum.

A further object is to provide a condenser wherein the steam is passed through the tubes, and the tubes are cooled in a manner to insure high efficiency and avoid the deposit of foreign matter on the outside of the said tubes, and a resultant pitting through electrolytic action.

A still further object is to provide a condenser wherein the quantity of cooling agent acting on the tubes will be graduated proportionately to the temperature of the steam as it passes through the length of the tubes, thus insuring the proper condensation of the steam without lowering the temperature in the hot well materially.

A still further object is to provide a condenser wherein steel tubes may be employed, thus materially reducing the cost of production without affecting the efficiency or durability of the condenser.

A still further object is to provide a condenser wherein the exhaust steam is passed through tubes, in which said steam will, before entering said tubes, be subjected to the action of a reagent, neutralizing the oils or other impurities in suspension in the steam and modifying the steam, thus preventing the deposit of such matter in the tubes and avoiding the pitting of the inside of said tubes. And a still further object is to provide a condenser which will be simple in construction and design, and durable and efficient in use.

The invention consists in the novel features of construction and combination of

parts hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

The accompanying drawing shows a side elevation of a condenser embodying my invention, the upper part thereof being broken away and shown in section to disclose the details of the tubes and circulating water distributors as to their construction and arrangement, and the relation of the tubes to the chambers at the opposite ends thereof.

Referring to the said drawing, *a* indicates the condenser casing; *b*, the air pump; *c*, the circulating pump, and *d* the hot well. The casing *a* has oppositely disposed parallel head plates *a'* *a''* therein, in which are fitted a plurality of tubes *e* opening outwardly of said plates respectively. Beyond said head plate *a'* is a closed steam drum *f* forming a chamber common to all said tubes and adapted to receive and distribute the exhaust steam. The plate *a''* has a similar drum *g*, beyond same in communication with all the tubes *e* so as to accumulate the water of condensation and partially condensed vapors from said tubes.

The chamber *f* is in communication with the engine exhaust port through a steam pipe *h* and the head *g* is in communication with the air pump *b* through a pipe *i* and a well *g'* in the bottom of the drum *g*. The water of condensation is discharged from the pump *b* into the hot well *d* through a pipe *b'* and it is drawn from said well for use in the boiler, through a pipe *d'*. The tubes *e* are cooled by having their exteriors subjected to the action of a cooling agent circulated thereabout, the steam being passed or drawn through said tubes. Inasmuch as it is impracticable to maintain such a circulation of water about the tubes by having the casing filled with water and quantities thereof constantly withdrawn and added thereto, I provide means whereby the cooling agent is discharged in a spray over said tubes and prevented from accumulating in the casing *a* through a discharge pipe *c'* communicating with the circulating pump *c*. This practice has the further advantage that, as in connection with marine engines, a type illustrated in the drawings, when the cooling agent is salt water, this spray tends to constantly wash down the tubes and prevent

the deposit of salts or other impurities thereon, which would otherwise tend to pit the tubes through electrolysis.

In the accompanying drawings, the cooling agent is shown as introduced to the casing *a* through a pipe *j* opening through the hull of a boat below the water line, and discharging into one or more spraying devices, as perforated baffle plates, disposed in the upper part of said casing, for dividing the entire volume of water into small streams. The entire condenser being below the water line, it is not required to use a pump to introduce water to said casing through said pipe, and it is required to withdraw water from said casing by means of a pump. This however is merely an adaptation of the device to this particular condition of use.

In order to regulate the quantity of cooling agent passing to the casing *a*, I extend said pipe along the top of said casing and have a plurality of short length pipes *k k' k''* extending therefrom to said casing, each said pipe having a valve therein. Below the outlet of each pipe *k k' k''* is preferably an individual baffle plate as *m m' m''*. As the temperature of the steam is highest upon entering the tubes *e* at a point adjacent to the plate *m*, and is gradually lowered as it progresses through said tubes, it is apparent that to secure a better vacuum with the presence of less water circulated with the steam and to insure increased efficiency and economy, it is desirable to have the volume of water spraying over the tubes near that end greater, and that a gradually smaller quantity of such water will be quite as efficient farther away from said ends. I therefore, so construct and arrange the pipes *k k' k''* and their respective baffle plates *m m' m''*, that the quantity of cooling agent discharged therethrough, will be proportionate to the distance of these elements from the drum *f* either by using smaller pipes or diminishing the size and number of the openings in the plates, or both. Or if desired, such may be controlled through the respective valves or in any other desired manner. A valve *j'* controls the feed of water through the pipe *j*.

To prevent that electrolytic action on the parts of the condenser due to the salts and chemicals contained in solution or suspension in the cooling agent, common to condensers of this type, I make the casing *a*, the heads *a' a''*, the tubes *e*, the baffles *m m' m''* and the various fittings and connections, of metal having the same polarity, preferably iron or steel, thus practically eliminating the evils of electrolysis in the condenser. To avoid corrosion of said tubes, I apply a suitable metallic coating thereto, as by galvanizing, which will protect the tubes from the oxids in the water and preserve the similarity of polarity which is an important feature of my invention. It is desirable that

no copper or brass fittings should be used in the circulating system and within the casing *a*, but if such be used, they should be heavily tinned. It will thus be seen that no material electrolytic action can take place within the casing *a* through the use of salt or impure water as a cooling agent. It will also be observed that the tubes *e* not being submerged in a sluggishly moving body of water, but having a continuous filament of water flowing thereover, no salts or other impurities can be deposited thereon through precipitation or otherwise, the spray of water serving to wash all such away. The tubes being galvanized prevents such corrosion as would tend to interfere with this process.

If desired an open vent *a''* may be provided in the casing *a* to permit the escape of any gases released through the partial disruption of the cooling agent through contact with the heated tubes. The tubes *e* being thus protected from agencies within the casing *a*, it is desirable to provide means whereby the inside of said tubes may be similarly protected from pitting due to the solvent properties of the steam itself and of the gases or acids released from said steam by the heat or formed from the cylinder oil or other impurities. In my Patent No. 742,954, I have shown an apparatus for accomplishing this result, and in the drawings I have shown and will now describe an adaptation of the principles involved in said apparatus to a condenser of the type heretofore described.

Leading from the hot well *d* is a pipe *n* having a valve *n'* at a convenient point of its length. This pipe opens into the exhaust steam pipe *h* at a point adjacent to its point of discharge into the drum *f* and has an elbow *n''* between this point and the valve *n'*. The discharge of said pipe *n* is an ordinary spraying nozzle not shown.

A tank *o* containing a solution of caustic soda or other neutralizing agent is arranged on a plane above the elbow *n''* and a pipe *o'* having a valve *o''* in its length, discharges said solution in the required quantities into the stream of water passing through the pipe *n* with which it is mixed and discharged into the steam passing through the pipe *h* to the condenser. This mixture comingling with the steam acts as a reagent to destroy the oils or other impurities and modify the properties of the steam itself, which through condensation would be otherwise deposited in the tubes *e* or carried from the condenser to the well *d* and the boiler; thus serving to purify both the steam and the water, and avoid the pitting of the condenser tubes and the boiler.

From the foregoing description, the operation of the condenser is apparent, and is substantially as follows: The condensing

water or cooling agent passes through the pipe *j* to the various discharge pipes *k k' k''* and is distributed into a plurality of small jets by the baffle plates *m m' m''* the volume and velocity of these jets being graduated with a diminishing volume and velocity proportionate to the distance from the head *f*. The water sprays directly upon the various tubes and flows thereover in a continuous film until reaching the bottom of the casing *a*. The pump *c* draws the water through the pipe *c'* from the casing *a*, and discharges it as waste, thus preventing an accumulation of such water in the casing *a*. The exhaust steam passes through the pipe *h* and entrains a mixture of pure water from the hot well and the neutralizing agent, which as heretofore stated, acts as a reagent to destroy the impurities in said steam and modify the properties of the steam itself in a manner to prevent any injury to the tubes. The steam then passes to the head *f* where it is divided into a plurality of minute streams by the tubes *e*. The pump *b* acts continuously to maintain a partial vacuum within the condenser tubes and the head chambers, thus not only inducing a circulation of the steam and water of condensation through the condenser and removing same, but drawing the supply of neutralizing agent from the pipes *n* and *o'* into the pipe *h*. As the steam passes through the tubes *e* its temperature is suddenly lowered and thereafter still further gradually lowered, the variance in the volume of water passing over the different parts of said tubes being proportionate to the loss of temperature in the steam. This rapid condensation at the entrance end of the said tubes provides sufficient additional water to insure a more perfect vacuum without introducing a sufficiently large volume of well water to materially lower the temperature of the feed water in said well. This variance also permits the water and vapors discharged into the hot well being maintained at such a temperature as will best suit it for feed water.

The employment of condenser parts having a similar polarity increases the durability and strength of the condenser, and lowers the cost of production materially. The use of a spray instead of a permanent or changeable body of water as a cooling agent not only lends added efficiency through a constant and rapid change of the cooling agent acting on each tube, but prevents the deposit of injurious substances on the outside of the tubes. The general construction and arrangement of the condenser is such as to insure strength, cheapness and durability.

It is not my intention to limit the invention to an apparatus embodying a system for circulating the cooling agent such as is shown in the drawings, it being apparent

that such is but a convenient manner of securing such circulation under one condition of use and not material to the invention. Nor is it my intention to limit the invention to the precise details of construction shown in the drawings, such being susceptible to various changes and modifications to adapt the invention to different conditions of use.

Having described the invention, what I claim and desire to have protected by Letters Patent is:

1. In a condenser, a casing, tube heads therefor, a plurality of tubes mounted in said heads, means whereby exhaust steam may be passed through said tubes including an exhaust steam pipe, and means circulating a cooling agent within said casing and about said tubes, of a source of pure water supply, and means whereby water is drawn from said source of supply and discharged into said exhaust steam pipe.

2. In a condenser, a casing, tube heads therefor, a plurality of tubes mounted in said heads, means whereby exhaust steam may be passed through said tubes including an exhaust steam pipe, and means circulating a cooling agent within said casing and about said tubes, of a source of pure water supply, a pipe leading therefrom and discharging into said exhaust steam pipe, and a controlling valve whereby the volume of water passing through said pipe is regulated.

3. In a surface condenser, a casing, tube heads therefor, a plurality of tubes mounted in said heads, means whereby exhaust steam may be passed through said tubes, one or more spraying devices disposed above said tubes, means whereby a cooling agent is continuously supplied to said device or devices and means whereby the cooling agent is discharged from said casing in quantities sufficient to prevent an accumulation of water therein.

4. In a surface condenser, a casing, tube heads therefor, a plurality of tubes mounted in said heads, means whereby exhaust steam may be passed through said tubes, a plurality of spraying devices arranged longitudinally of said casing, having graduated openings therein whereby the quantity of said cooling agents will be graduated in a ratio diminishing with the distance from the entrance to said tubes, means whereby a cooling agent is continuously supplied to said device or devices and means whereby the cooling agent is discharged from said casing in quantities sufficient to prevent an accumulation of water therein.

5. In a surface condenser, a casing, tube heads therefor, a plurality of tubes mounted in said heads, means whereby exhaust steam may be passed through said tubes, a pipe extending longitudinally of said casing, a plurality of discharge pipes leading from

said pipe and opening into said casing, valves for said discharge pipes respectively, a plurality of perforated baffle plates disposed below said discharge pipes respectively, said pipes and said baffle plates or either of them having openings therein graduated in a ratio diminishing with the distance from the entrance to said tubes, means whereby a cooling agent is continuously supplied to said pipe, and means whereby the cooling agent is discharged from said casing in quantities sufficient to prevent an accumulation of water therein.

6. In a surface condenser, a casing, tube heads therefor, a plurality of tubes mounted in said heads, means whereby exhaust steam may be passed through said tubes, a pipe extending longitudinally of said casing, a plurality of discharge pipes leading from said pipe and opening into said casing, valves for said discharge pipes respectively, a plurality of perforated baffle plates disposed below said discharge pipes respectively, said pipes and said baffle plates or either of them having openings therein graduated in a ratio diminishing with the distance from the entrance to said tubes, means whereby a cooling agent is continuously supplied to said pipe, and means whereby the cooling agent is discharged from said casing in quantities sufficient to prevent an accumulation of water therein, said casing, said heads therefor, said piping, and said baffle plates all being of material of similar polarity whereby electrolytic action of the cooling agent is prevented.

7. In a surface condenser, a casing, tube

heads therefor, a plurality of tubes mounted in said heads, an exhaust steam distributing chamber beyond one of said heads and common to all said tubes, an exhaust steam pipe discharging into said chamber, a similar chamber beyond the other of said heads, means whereby the water of condensation is drawn from said last mentioned chamber, a pipe extending longitudinally of said casing, a plurality of discharge pipes leading from said pipe and opening into said casing, valves for said discharge pipes respectively, a plurality of perforated baffle plates disposed below said discharge pipes respectively, said pipes and said baffle plates or either of them having openings therein graduated in a ratio diminishing with the distance from the entrance to said tubes, means whereby a cooling agent is continuously supplied to said pipe, means whereby the cooling agent is discharged from said casing in quantities sufficient to prevent an accumulation of water therein, said casing, said heads therefor, said piping and said baffle plates all being of material of similar polarity whereby electrolytic action of the cooling agent is prevented, a source of water supply, and a pipe leading from said source of water supply.

In witness whereof, I have hereunto affixed my signature, this 2nd day of October, 1906, in the presence of two witnesses.

JAMES ANDERSON.

Witnesses:

F. T. WENTWORTH,
GEORGE McCAY.