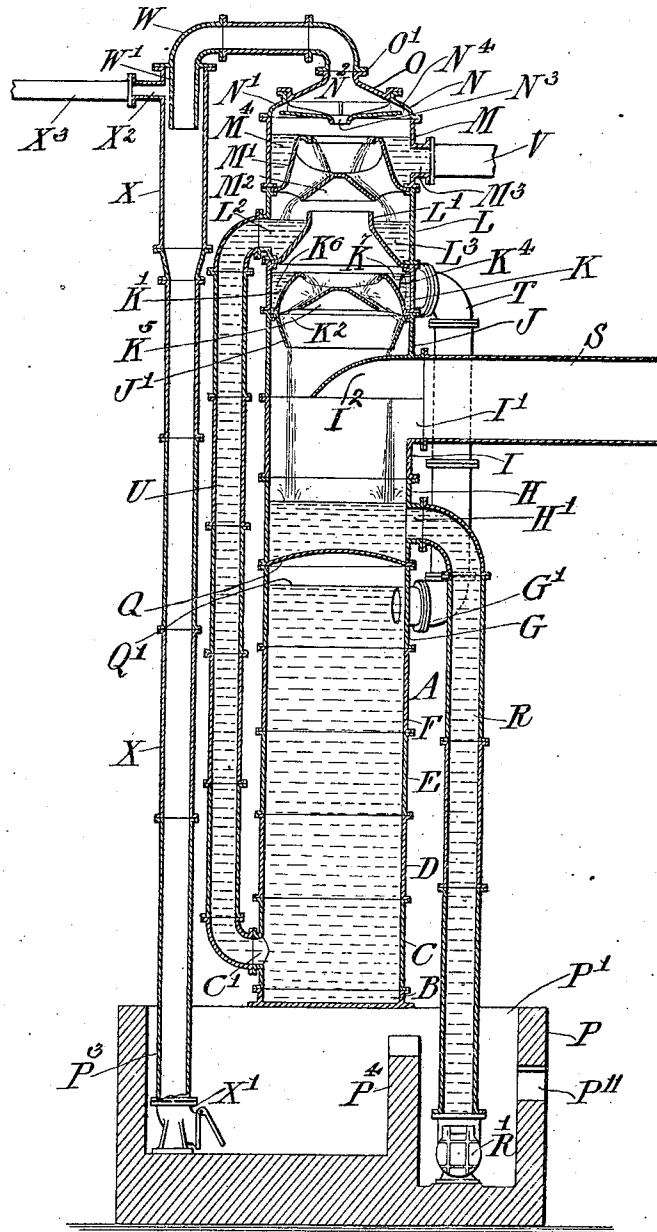


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CONDENSER.

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933,849.

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WITNESSES:

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CONDENSER.

933,849.

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To all whom it may concern:

Be it known that I, GUSTAV BERNHARD PETSCHÉ, a subject of the Emperor of Germany, residing in Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Condensers, of which the following is a true and exact description, reference being had to the accompanying drawing, which forms a part thereof.

My present invention relates to condensers such as are employed for condensing the exhaust steam from steam engines and has for its main objects to improve the operation and simplify and improve the construction of such condensers.

In carrying out my invention I provide one or more reservoirs into which water which has already been passed through a portion of the condenser proper and has been effective in producing condensation is discharged and from which reservoir or reservoirs water is drawn into another portion or portions of the condenser proper to produce more condensation, the condenser being so arranged that in normal operation the major portion of the condensation produced by the condenser occurs in the last mentioned condenser portion, or portions. With this arrangement I insure that when the load on the condenser, *i. e.*, the amount of steam to be condensed, rises above the average, the water drawn from the reservoir or reservoirs, which for this reason I must call equalizing reservoirs, is cooler than that fed into the reservoir and the condenser, therefore, effectively takes care of the steam fed into it when the engine or engines with which it is connected are overloaded, which, of course, is the time when the capacity of the condenser should be at a maximum.

In so far as above described, my improved condenser contains the invention described and claimed in the Weiss patent 771,515. My present invention differs from that of the Weiss patent, however, in the fact that I have arranged for a pure "counter-current" action and have simplified and improved the construction of the condenser as a whole by making the equalizing reservoir and the condenser proper, parts of a single mechanical structure.

The various features of novelty which characterize my invention are pointed out

with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, however, and the advantages possessed by it, reference may be had to the accompanying drawing in which I have illustrated in a single vertical section one of the forms in which my invention may be employed.

In the drawing, A represents the condenser structure proper which is made up of tubular sections B, C, D, E, F, G, H, I, J, K, L, M, N and O, placed one above the other in the order given. The lower section B which has a closed end rests upon the foundation work or base P. The various sections may be formed of any suitable material as wrought or cast iron, the adjacent end of adjacent sections being secured together in any suitable manner. The sections G and H are separated by a diaphragm Q, and the lower sections B, C, D, E, F, and G forming the one equalizing reservoir employed in the condenser shown and the upper sections forming the condenser proper. An outlet port G¹ from the reservoir is formed in the section G and an inlet port C¹ is formed in the section C. The water discharged from the condenser collects above the diaphragm Q and passing through a discharge port H¹ formed in the section H is carried by piping R to a well or chamber P¹ formed in the base P, from which it escapes through a waste port P². A non return valve R¹ located below the waste port P and in normal operation submerged in water, prevents any upward flow through the piping R.

The steam enters the condenser from the steam pipe S through a port I¹ formed partly in the section I and partly in the section J. A hood I² carried by the section J above the port serves to partially deflect the steam downward and against the side wall of the condenser. An annular chamber K⁶ or receptacle is formed in the section K, by a member K¹ in the form of the frustum of a hollow cone, at the base of which is formed an outwardly extending circumferential flange K² which is secured between internal flanges formed on the sections K and J. Water passing into the annular chamber of reservoir K⁶ thus formed, through the inlet port K⁴ from the outlet port G¹ of the equalizing reservoir through the piping T is discharged over the upper

edge of the member K^1 and falls upon a spreader K^5 of conical form, which diverts the water toward the wall of the condenser. A member J^1 in the form of a frustum of an inverted hollow cone serves to deflect the water discharged from the upper surface of the member J^5 and throw it toward the center. The member J^1 is provided with a circumferential flange at its upper end which may bear against the side of the flange formed in the lower end member K and with it be received between the flanges formed on the adjacent ends of the sections K and J . The member K^5 may be supported in any suitable manner from the member K^1 , as by bolts or rivets when the parts are formed of wrought iron, and when the parts are formed of cast iron the members K^1 and K^5 may be integrally connected together by ribs or webs. As these are obvious features of mechanical construction, I have not thought it necessary to illustrate them in detail in the drawing.

Between the lower end of the section L and the upper end of the section K is secured the base of a member L^1 in the general form of a frustum of a hollow cone. The annular chamber or receptacle L^3 formed between the inner wall of the chamber L and the outer wall of the chamber L^1 has a discharge port L^2 connected by piping U with the inlet port C^1 of the reservoir. Between the sections L and M is secured a member M^1 generally similar to the member K^1 and supporting in the same manner a spreader M^2 generally similar to the spreader K^5 .

The member M^1 and section M form an annular chamber M^4 . The cold water supply pipe V feeds water into the condenser through an inlet port M^3 formed in the section M and opening into the chamber M^4 . A spreader or baffle N^1 is secured in the upper end of the condenser in any suitable manner as by means of web like ribs or wings N^2 integrally connecting the spreader N^1 to the section N . The spreader is provided with a central aperture N^3 and is spaced away from the section N to form an annular passage N^4 between its periphery and the adjacent surface of the member N . The steam discharge port O^1 of the condenser formed in the upper section O , is connected by piping W and piping X to a well or chamber P^3 formed in the base of the condenser. Water from the well P^3 escapes into the well P^1 over the wall P^4 , the upper edge of which is above the waste port P . A non-return valve X^1 , which may be similar to the valve R^1 , prevents backward flow through the piping W . As shown, the downwardly turned end W^1 of the piping W projects into the upper end of the piping X below the port X^2 which is connected by a pipe X^3 to any suitable vacuum

producing device such as a vacuum pump (not shown in the drawing).

In operation the steam entering the condenser through the pipe S passes upward in a tortuous manner on account of the arrangement of the members K^5 , K^1 , L^1 , M^2 , M^1 and N . The uncondensed residue of the steam passes out of the condenser through the port O^1 and is carried through the piping W into the piping X , from the enlarged upper end of which it is withdrawn through the port X^2 and piping X^3 . Any water carried through the pipe W passes into the well P^3 through the piping X . The cold water supplied by any suitable means to the condenser through the pipe V escapes from the chamber M^4 by splashing over the upper edge of the member M^1 and, falling upon the spreader M^2 , is diverted into the annular chamber L^3 . From there it passes to the bottom of the equalizing reservoir through the piping U . From the equalizing reservoir the water passes through the piping T to the chamber K^6 formed at the outer side of the member K^1 . The water from this chamber splashes over the upper edge of the member K^1 and is diverted first toward and then away from the wall of the condenser by the members K^5 and J^1 .

It will be observed that the steam admitted to the condenser flows in all cases through or along the various condensing streams of water in a direction generally opposite to that of the streams of water. By the term "condensing streams" I mean to describe the broken stream portions or jets such as pass from the lower edges of the spreaders K^5 and M^2 and also the films of water such as flow down the conical surfaces of the spreaders. This "counter-current" flow of the steam and water has been found to be highly conducive to the best results.

In operating my invention in the preferred manner under normal load, practically all of the steam entering the condenser is condensed by the water discharged from the lower chamber K^6 of the condenser and the condensing water does not rise appreciably in temperature in passing from the pipe V to the equalizing reservoir. As a result, when the amount of steam to be condensed increases above the ordinary amount, the water discharged into the chamber L^3 from the upper chamber M^4 condenses the excess. Moreover, since the temperature of the water drawn from the equalizing reservoir is at first practically unaffected in temperature by an increase in the temperature of the water flowing into it, the condenser can adequately take care of the large temporary increases in the amount of steam supplied to the condenser which occur from time to time. When, after such an increase, steam is again supplied to the condenser at the usual rate the temperature of the water

in the equalizing reservoir, which, of course, has risen during the excess or overload period gradually lowers. It will be understood that more of the steam is condensed during this period by the water passing to the chamber L^3 from the chamber M^4 than is the case when the water in the equalizing reservoir is colder.

By supplying water to the equalizing reservoir at its lower end and withdrawing water from the upper end of the reservoir, instead of supplying water at the upper end and withdrawing water at the lower end of the reservoir, as in the Weiss patent referred to, an important advantage is obtained. This is due to the fact that when the water admitted at the bottom of the reservoir is colder than the water already in the reservoir, the hotter water stays on top and is soon withdrawn. In consequence, the average temperature of the water in the reservoir during light load periods falls more rapidly than would be the case if the relatively cool entering water commingled readily with the hotter water already in the reservoir. On the other hand, during heavy load periods when the water entering the reservoir is hotter than the water in the reservoir there is a thorough commingling of the entering water with the water already in the reservoir due to the difference in their specific gravities, thus obviating the necessity for any other mixing provisions.

By arranging the reservoir beneath the condenser proper and making it a part of the condenser structure, the mechanical construction is simplified, the amount of piping employed is reduced to a minimum, as is also the floor space occupied by the condenser, and the condenser structure as a whole is made more compact than would be the case if the condenser proper and reservoir were separate mechanical structures.

It will be observed that the outlet port G^1 of the reservoir is located a slight distance below the diaphragm. In consequence the water level Q^1 in the equalizing reservoir will be in the same plane with the upper side of the port G^1 , the space above the water level Q^1 being filled with air escaping from the water fed into the reservoir. This layer of air is an advantage in preventing the transfer of heat from the diaphragm Q and water above it to the water in the equalizing reservoir.

While the form of my invention disclosed in the drawing has been found to give excellent results in practice, it will be understood by those skilled in the art that changes may be made in my invention without departing from its spirit.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is,

1. In a vacuum condenser, the combination with an equalizing reservoir, of a condensing chamber located above and supported by said reservoir and forming with the latter a single mechanical structure, a pipe connection by which water is conveyed from one level of the condenser proper to the equalizing reservoir, and a separate connection by which water is returned to a lower level of the condenser proper from the reservoir.

2. A condenser structure formed of tubular sections arranged one above the other and a transverse diaphragm which divides the structure into an upper condenser portion proper and an equalizing reservoir portion, said condenser portion being provided with upper, lower and intermediate chambers, means for supplying water to the upper chamber, means for withdrawing water from the bottom of the condenser portion, a conduit for conveying water from the intermediate chamber to the equalizing reservoir, a conduit for conveying water from the equalizing reservoir to the lower chamber, said condenser being provided with an inlet port for the steam to be condensed located below the lower chamber and an outlet port for the uncondensed residue of the steam located above the upper chamber, said chambers being so arranged that water supplied to the upper reservoir discharges in a condensing stream into the intermediate reservoir and water supplied to the lower reservoir discharges in a condensing stream into the lower end of the condenser.

3. In a vacuum condenser, the combination with an equalizing reservoir of a condenser proper located above and supported by said reservoir, a pipe connection by which water is conveyed from one level of the condenser proper to the lower end of the equalizing reservoir, and a separate connection by which water is returned to a lower level of the condenser proper, said separate connection leading from the reservoir a slight distance below its upper end, whereby an air space between the reservoir and condenser is provided which retards the transfer of heat between the condenser and the reservoir.

4. In a vacuum condenser, the combination with the condensing chamber, of an equalizing reservoir, a pipe connection leading to the lower end of said reservoir by which water is conveyed from an upper level of the condensing chamber to said reservoir, and a separate pipe connection leading from the upper end of said reservoir by which water is returned from said reservoir to a lower level of the condensing chamber.

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Witnesses:

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