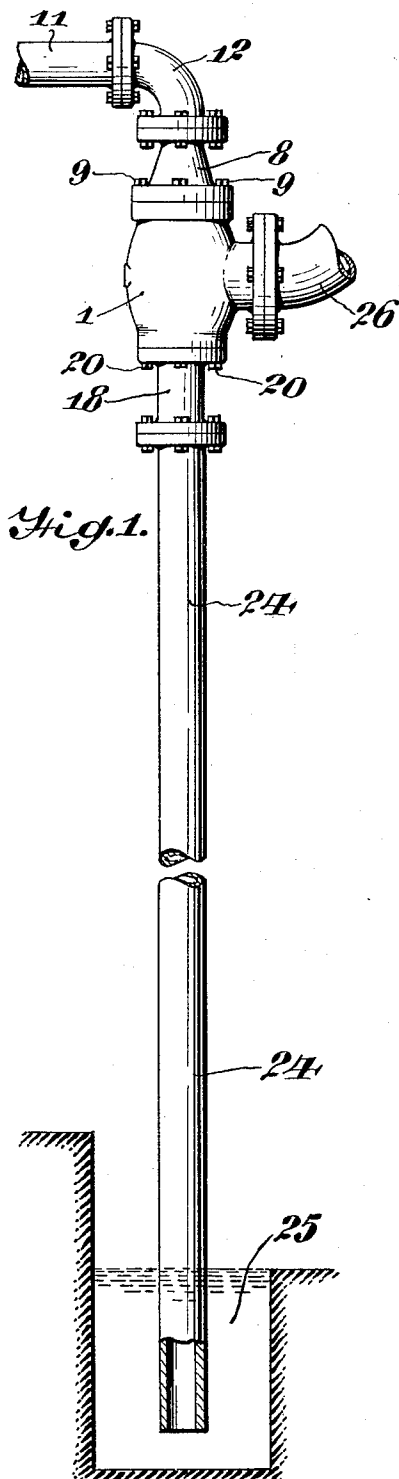
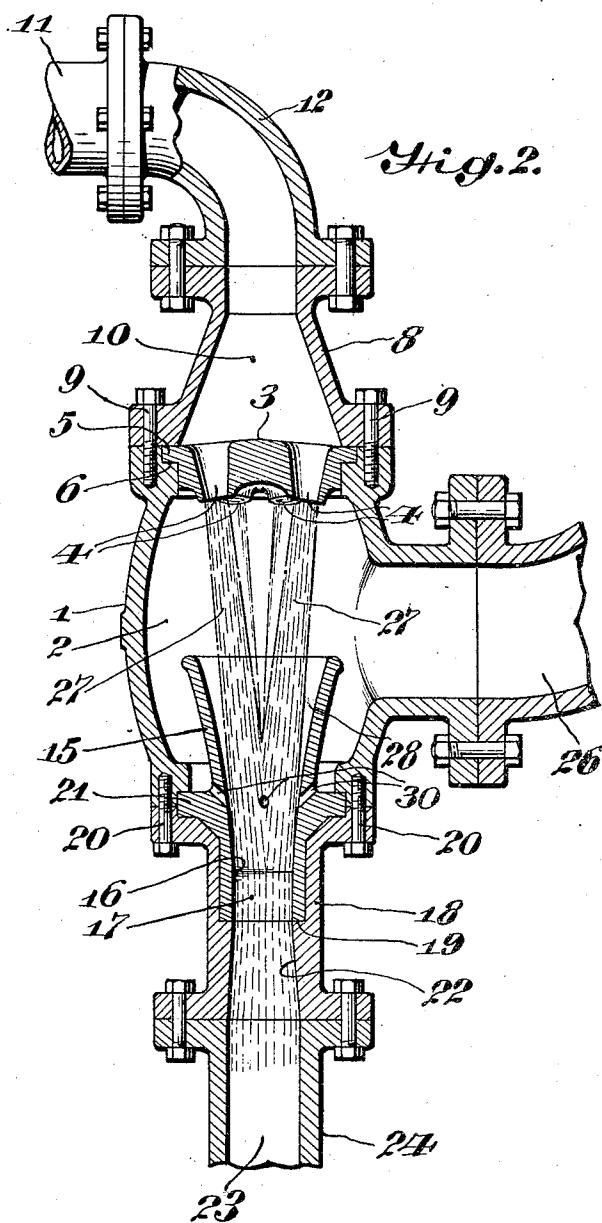


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R. E. HELLMER
BAROMETRIC CONDENSER

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BAROMETRIC CONDENSER

Application filed August 23, 1928. Serial No. 391,521.

This invention relates to barometric condensers of the parallel flow type, and it has for its general object to provide a construction wherein a high vacuum is produced in the condensing chamber without the necessity of employing extraneous means, such as air pumps, for removing air and other gases from such chamber.

It also has for its objects the provision of means for projecting solid jets of water into the condensing chamber for condensing steam and condensable gases, and the utilization of the velocity and kinetic energy of the said solid jets for removing air and other non-condensable gases from the said chamber to produce a high vacuum therein.

I shall not here refer in detail or at greater length to the many objects and advantages incident to my invention but further and additional objects thereof will be referred to in or will become apparent from the detailed description of the invention which follows.

In order that the invention may be more readily understood and its many practical advantages fully appreciated reference should be had to the accompanying drawings wherein I have illustrated a structure showing one form of embodiment thereof. However, it will be understood that the invention is susceptible of embodiment in other forms of construction than that shown and that various changes in the details of construction and in the relative arrangement of parts thereof may be made within the scope of the claim without departing from the said invention or the principle thereof.

In the drawings:

Fig. 1 is a view in elevation of a barometric condenser constructed in accordance with and embodying the invention; and

Fig. 2 is a longitudinal central sectional view of a portion of the structure shown in Fig. 1 taken in a plane parallel with the sheet on which the drawings appear.

In the drawings I have shown a casing 1 for providing a condensing chamber 2. The upper end of the casing 1 is provided with a closure or member 3 having openings 4 extending therethrough. There are a plurality of these openings, the number depend-

ing usually upon the area of the said member, and the area of the latter depending usually upon the cross sectional area of the casing. In the construction as illustrated there are six of these openings 4 of which four only are shown. The openings 4 are convergently related. The closure 3 is provided, in the construction illustrated, upon its outer edge with a laterally extending flange 5 which is located in a groove 6 provided in the inner edge of the upper end of the casing 1 and is retained therein by the lower end of the truncated cone shaped fitting or casing 8 which is secured upon the upper end of the casing 1 by means of screw threaded bolts 9. It will be understood that the member 3 may be otherwise supported and that it may occupy a different position in the casing. The fitting or casing 8 provides a chamber 10 into which water is supplied from a pipe 11 which is connected to the fitting or casing 8 by means of an elbow-coupling 12 of known construction.

The lower end of the casing 1 is provided with an entrainment tube 15 the upper end of which projects into the chamber 2 and is flared as indicated. In other words, the opening in the entrainment tube 15 tapers from its top end downwardly to a point which may be designated as approximately at 16, the diameter of the remaining lower portion of the said entrainment tube being substantially the same as that at 16 and constituting what may be described as a throat or restricted passageway 17. In the construction as illustrated the lower end portion of the entrainment tube 15 projects into the upper end portion of a coupling 18 and fits against a shoulder 19 but if preferred the entrainment tube and coupling may be combined and made as a single member of integral structure. The coupling 18 is provided with a flange at its upper end which is secured to the lower end of the casing 1 by means of fastening bolts 20. The said entrainment tube is provided with a lateral flange at 21 which projects into an annular groove formed partly in the inner side of the upper end of the coupling 18 and the inner side of the lower end of the casing 1 and is clamped and

held between the said coupling and the said casing. The opening through the lower end portion of the coupling 18 is slightly flared or tapered outwardly as indicated at 22 and is in alinement with and a continuation of the opening or passageway 23 through the vertical tail pipe 24 connected in the manner shown or otherwise to the lower end of the said coupling 18. The tail pipe 24 should be of a length not less than thirty-four feet. Its lower end terminates in a "hot well" 25.

The steam and other gases may be delivered into the condensing chamber 2 through a pipe 26.

In the construction as illustrated it will be noted that the water is supplied through the top of the casing 1 while the steam, vapors and gases are delivered into the chamber of the casing through an opening in the side thereof, but it will be understood that the arrangement may be reversed if desired.

Reference has been made previously to the convergent relation of the openings 4 through the member 3 and upon examination of Fig. 2 of the drawings it will be seen that the jets which are discharged from the said openings 4 converge toward a point in the axis of the entrainment tube 15. The convergent flow of these jets is indicated by the dash and dot lines shown at 27. It will be noted that the flaring of the portion of the entrainment tube 15 which projects into the chamber 2 of the casing 1 is such as to provide an angle, as indicated at 28, between the inner surface of the said flaring portion and the outer surface of the combined column of water produced by the jets of water discharged through and from the openings 4. The angle 28 extends entirely around the portion of the column or stream of water within the flared portion of the entrainment tube and may be described as annular. The size of the angle between the inner surface of the flared portion of the entrainment tube and the adjoining surface of the column or stream of water may be varied within rather wide limits but must be of a size to efficiently cause entrainment of the non-condensable gases and vapors by the flow of the jets of water into and through the entrainment tube. In other words, the flared portion of the entrainment tube should taper from the inlet end to the lower end thereof to such extent and in such a manner that maximum air or gas entrainment will be effected by the high velocity water jets discharged from the openings 4.

For successful operation it is necessary that the transverse area of the restricted or throat portion 17 of the passageway of the entrainment tube 15 shall be not less than twice as great as that of the combined areas of the discharge ends of the openings 4, and preferably the transverse area of the said restricted or throat portion should be some-

what greater than twice that of the combined areas of the discharge ends of the said openings 4. It also is preferable that the diameter of the passageway or opening through the tail tube 24 shall be relatively small in order that the velocity of the flow of water therethrough shall be maintained. This is desirable in order that the flow of water through the apparatus shall be of a speed sufficient not only to entrain the non-condensable gases and vapors but to cause a thorough intermingling or emulsification thereof with the water so that the said non-condensable gases and vapors will be discharged into the water of the "hot well" 25 from which they will escape because volume for volume they are very much lighter than the water.

Preferably the diameter of the opening through the tail pipe should be slightly greater than that of the throat or restricted opening at 17, but if the two openings should be of the same diameter the condenser could still be operated efficiently.

It will be understood that the steam and other condensable vapors are condensed in the condensing chamber 2 by the contact thereof with the jets of water which are discharged from the openings 4.

Any water or other liquid which may be formed in the chamber 2 outside of the projecting upper end of the entrainment tube 15 escapes therefrom through openings 30 provided in the side of the said entrainment tube.

By the construction as described, wherein solid jets of water are discharged from the openings 4 in converging relation to each other into the entrainment tube and with relation to the latter as illustrated and described and wherein the water is conveyed through the tail pipe at relatively high velocity, I have provided means whereby a high vacuum is produced within the chamber 2; also by the provision of means whereby the vacuum extends a distance below the throat or restricted portion 17 of the passageway leading from the condensing chamber the flow of water through the openings 4 in the form of solid water jets as described may be effected with but a small difference of pressure between the chamber 10 and the top of the tail pipe 24. That is, the water will flow through the condenser even though it may have but very small head without the necessity of employing pumps other means for causing such flow.

When the water is discharged into the condensing chamber 2 in the form of solid high velocity jets it is found that practically none of the air which normally is present in water by absorption or which may be mechanically entrained therein is released, as would be the case if the water were discharged into the condensing chamber in the form of a spray or in small streams of greater or less fineness. Because of the fact that the water enters the

condensing chamber in the form of high velocity solid jets, the air and other gases which may be absorbed or mechanically held therein are not released but carried thereby into and through the entrainment tube and from the latter into the tail pipe and thence into the hot well 25.

It will be seen that by my invention I have provided a structure which is extremely simple but at the same time highly efficient for the purposes for which it has been designed.

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

A parallel flow barometric condenser comprising in combination a condensing chamber having a steam inlet, a barometric tail pipe, a flaring entrainment tube spaced from the wall of the condenser chamber and constituting the sole outlet for air therefrom, a coupling tube discharging into the tail pipe and of which the entrainment tube is the inlet and which entrainment tube is provided with inlet openings arranged through its wall, and solid water jet nozzles adapted to inject solid jets of water through the entrainment tube and into the throat of the coupling tube whereby their velocity and kinetic energy operate to remove air and non-condensable gases as well as condensate water.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 22nd day of August, 1928.

RALPH E. HELLMER.