No. 724,970. PATENTED APR. 7, 1903.

R. D. TOMLINSON.

CONDENSER.

APPLICATION FILED JULY 21, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

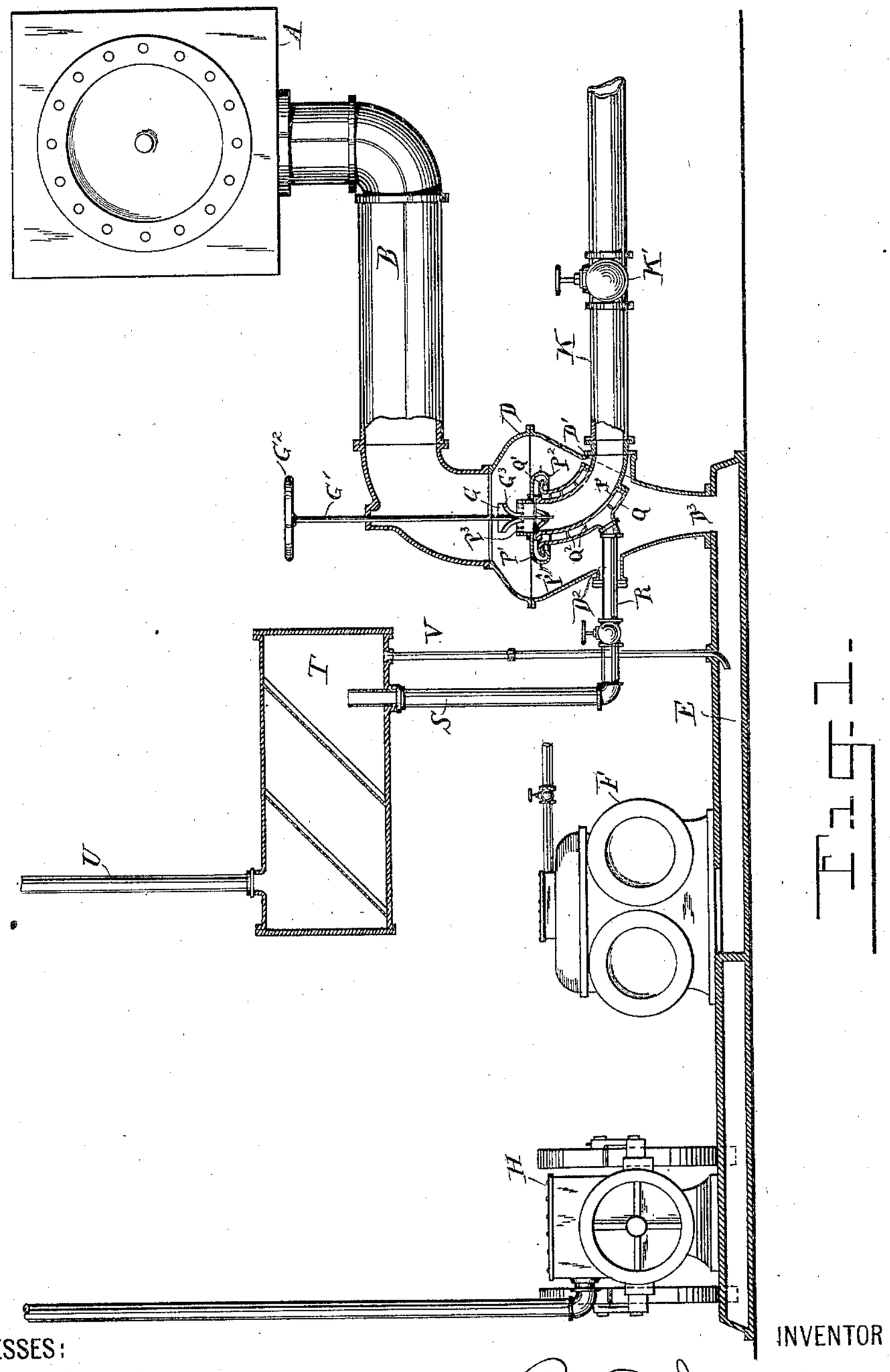

FIG. 1.

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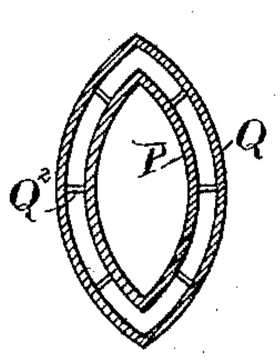

Fig. 3.

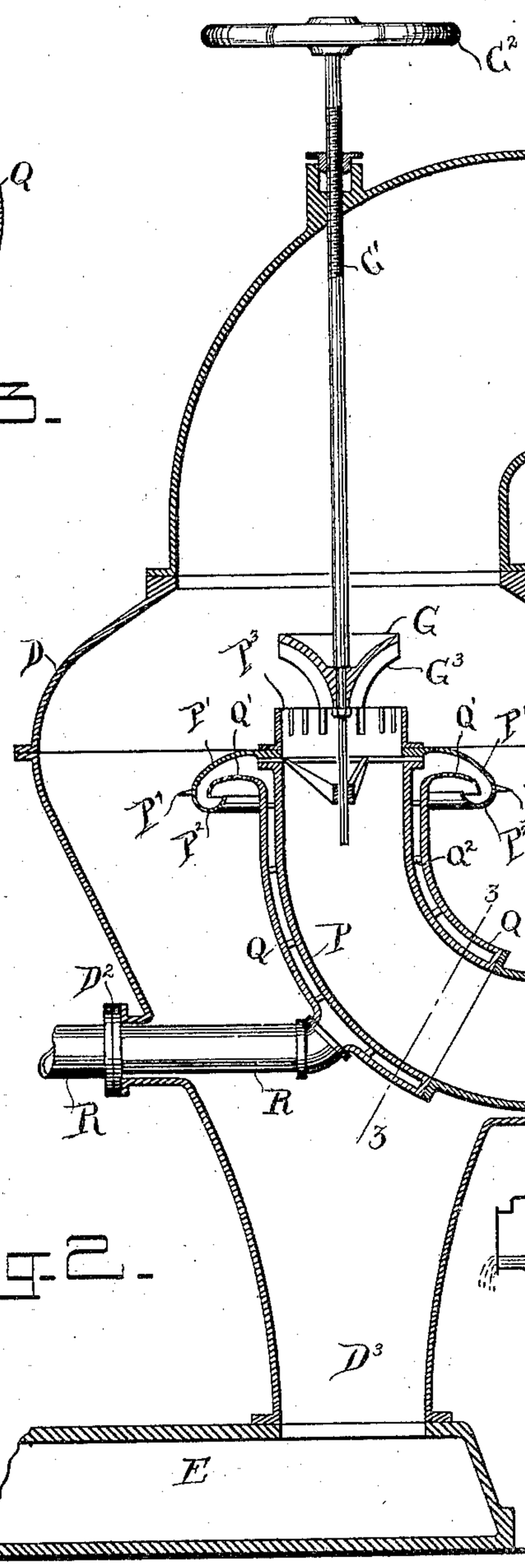

Fig. 2.

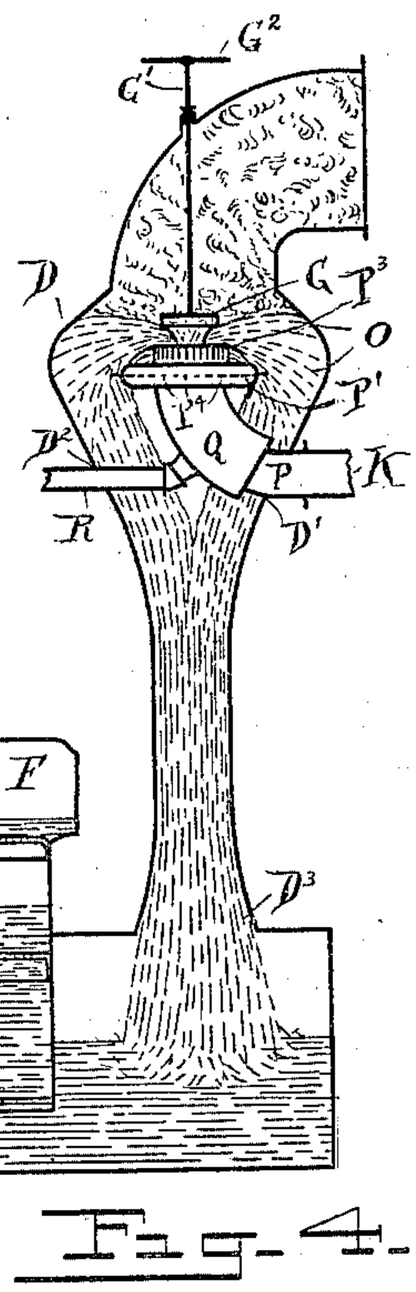

Fig. 4.

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UNITED STATES PATENT OFFICE.

ROYAL D. TOMLINSON, OF NEW YORK, N. Y.

CONDENSER.

SPECIFICATION forming part of Letters Patent No. 724,970, dated April 7, 1903.

Application filed July 21, 1902. Serial No. 116,365. (No model.)

To all whom it may concern:

Be it known that I, ROYAL D. TOMLINSON, a citizen of the United States, residing in the borough of Manhattan, in the city and State of New York, have invented a certain new and useful Improvement in Condensing Apparatus for Use with Steam-Engines, of which the following is a specification.

My improvement applies to that class of condensing apparatus in which the condensing-chamber is kept partially filled with water violently agitated and the condensing is effected in a zone near the surface. Ordinary water contains air, which escapes from it when relieved from pressure in the condenser and vitiates the vacuum. Among the many ways of removing the air is to have a "bell" in the water near the surface and a pipe leading therefrom, which bell and pipe are formed to catch and by what is called a "dry-air pump" may remove a large portion of the air. I adopt such method. It requires less injection-water and gives a superior vacuum. After the air is thus removed the water may be drawn out by gravity if the condenser has been set high or by a large slowly-acting pump, which I will term a "wet-air pump." There are many situations where the gravity method, sometimes termed "barometric," or, more briefly, "siphon," is not practicable, and a wet-air pump must be used. It is important to graduate the speeds so that although the wet-air pump is aided by the gravity of the water in the slight depth obtaining in the condenser-chamber, if not by an additional pipe extending downward sealed with water, the dry-air pump shall maintain a just sufficient vacuum to allow the proper air-space in the upper portion of the water in the condenser, such space tending usually to the form of an inverted cone. I attain this and secure a high vacuum under all variations of temperature of injection-water and other conditions by employing two air-pumps with means for driving them at varying speeds by independent means, so that their rate may be relatively varied. I have also devised important improvements in the details. I prefer the form usually adopted for the condensing-chamber in this class of condensing apparatus—a pear shape, with its small end downward—and will describe the invention as thus carried out.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a general vertical section showing all the novel parts with so much of the ordinary parts as is necessary to indicate their relation thereto. Fig. 2 is a corresponding section of the condensing-chamber on a larger scale. Fig. 3 is a section in the plane indicated by 3 3 in Fig. 2, but showing a modification in the forms. Fig. 4 is a vertical section, on a smaller scale, showing a modification.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A is the cylinder of the engine, which we will assume to be a horizontal Corliss, having the exhaust-valves in the ordinary positions at the bottom.

B is the exhaust-passage, of liberal size, leading horizontally and downwardly into a condenser-chamber D, which latter is an upright vessel of approximately pear shape opening at the small end D^3 into a horizontal passage E, leading to the principal air-pump F, which I term the "wet-air" pump, represented as a horizontal duplex pump. The condenser D is cast with a large nozzle D′, shown on the right hand side, and an upwardly-curved casting P is bolted, extending inward and upward to form a smoothly-curved passage, through which a liberal quantity of injection-water may be received. The other nozzle D^2 on the opposite side may be smaller and receives the air-pipe.

K is a pipe coupled tightly to the nozzle D′, bringing injection-water from any convenient source. K′ is a valve by which the quantity is controlled, and G is an ordinary spreader carried on an adjustable stem G′ and operated by a hand-wheel G^2, the function of which is to expand the stream of water received through the curved passage P and give it the form of an inverted cone presenting the water to the incoming steam. The upper end of the pipe P is formed with a trumpet-lip P′, hav-

ing its outer edge curled downwardly and inwardly, as indicated by P^2. This lip $P' P^2$ forms a shield, under which is a space for receiving air to be withdrawn. The horizontal form and area of this space at the top is defined by the lip P'. It extends downward, contracting more or less rapidly, tapering according to various conditions, one of which is the greater or less perfect vacuum which obtains in it.

My improved condenser induces an unusually complete vacuum; but it is possible to have an appreciable difference between that in the vacuous space in the water and that outside of that space.

When the apparatus is working, the exhaust-steam, flowing with a very low tension through the liberal-exhaust pipe B, contacts with the agitated cone of water O, and the greater portion mingles therewith and flows downward and out through the lower end, whence it flows through the pipe E to be taken away by the wet-air pump F in the usual manner.

The spread portions P' and Q' of the double pipe P Q inclose between them an annular space, which receives at its large and well-shielded upper end only gaseous matter, air, and some uncondensed steam. Practice establishes that it will be mainly air. The outer pipe Q is held accurately in position by studs Q^2. The upper end P' of the inner pipe P is spread and of smoothly-curved section, its extreme edge P^2 extending inward under the edge of the upper and outer end Q' of the outer pipe Q. From the lower portion of Q a pipe R extends outward through the nozzle D^2 into a pipe S, leading upward, and the contents are delivered into a separating-chamber T, from whence the air flows through the elevated pipe U up to a sufficient height and then smoothly turning descends to the dry-air pump H. The latter is a pump which may be worked more rapidly than would be permissible with the main pump F. By means of my provision P Q and the connecting-pipe S nearly all the air is taken out of the condenser from the annular rim of P^2 Q', surrounding the admission of the condensing water. This air is drawn out and discharged into the atmosphere. An advantage by cooling it has been realized in the reduced volume to be pumped. Such thin steam as shall be drawn along with it is condensed by the coldness of the inner pipe P. The water thus produced, as also any other water which may by any chance be received by the pipe S, is separated in the vessel T. A pipe V, sufficiently liberal to allow for all ordinary or extraordinary conditions, leads down from the bottom of the separating vessel T and connects with the main bottom passage E.

The upper face of the trumpet-flange P' carries teeth P^3, extending upward. I extend outward other teeth P^4 around the periphery, where the lip P' changes to the inturned lip P^2. The effect is to roughen the inner surface of the thick shell of water descending in the condenser. The underside of the spreader G is equipped with ribs G^3, which induce corresponding deep grooves in the upper surface of the spreading-jet.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. Instead of making the pipe P and Q of the ordinary circular section, as shown, I can narrow them laterally and elongate them upward and downward, making the upper and lower edges sharpened, so as to present the same internal area, and attain substantially the same ends with less resistance to the downward motion of the water in the vessel. Fig. 3 shows such modification. The dry-air pump may be worked slowly, if preferred in any case; but I prefer to make it small and quick-acting. The other pump, working mainly water, should work moderately. I have shown a duplex horizontal and prefer such; but any slow pump may serve. This wet-air pump may sit lower relatively to the condenser, and the lower portion of the condenser may enlarge downward as well as upward. Fig. 4 shows such modification. The perforated screen in the separator may be horizontal instead of inclined, as shown, or it may be omitted altogether, if desired. The projecting lip P^2 at the outer edge of the trumpet-flange P' may be smooth instead of being toothed. What I have termed the "teeth" P^3, extending upward, may be variously formed and arranged. I have shown what I esteem the preferable form, a deeply-slotted or flanged lip formed separately and bolted on. The separator T may be higher or lower than shown. It is only essential that it be sufficiently high to allow the head of the water in the descending pipe V to effect the drainage. There should be several feet of such height, because the vacuum maintained in the connections to the dry-air pump will be often or usually greater than that in the pipe E, leading away from the bottom of the wet-air pump. The height of the summit of the pipe U may be reduced when the apparatus is to be used on high elevations, as in Denver. It is essential only that the pipe U be carried up a little above the highest point to which the water can be ever carried by the pressure of the atmosphere at the point where it is used. It allows the air to flow freely to the dry-air pump H, but forbids any water ever reaching there under any conditions, even in case of the fracture of a pipe, so as to admit the full pressure of the atmosphere on the water. The admission of water to the quick-acting pump H might result in a serious breakdown.

I claim as my invention—

1. In a condensing system a condenser-chamber D having two eduction-passages D^2 D^3 and connecting-pipes leading therefrom, in combination with a slowly-acting air-pump F connected with one of said pipes for taking out the water, and a quicker-acting and sepa-

rately-controllable pump H connected with the other eduction-pipe for taking out the air, and with an injection-pipe P having a trumpet-shaped lip P′ with an inturned edge P^2 and a trumpet-lip Q′ spaced within such edge, with connections for withdrawing air between, all arranged to serve substantially as herein specified.

2. In a condensing system, a tapering chamber D having two eduction-passages D^2 D^3 and connecting-pipes leading therefrom, in combination with a slow air-pump F for taking out the water and another quicker-acting and separately-controllable dry-air pump H for taking out the air, and with an injection-pipe K, P, having a trumpet-shaped lip P′ with an inturned edge P^2 and a trumpet end Q′ spaced within such lip carried on the end of a larger pipe Q surrounding and extending along the exterior of the cold pipe P and spaced to form a thin chamber through which the air is caused to move, all substantially as herein specified.

3. In a condensing system, a chamber D having two eduction-passages D^2 D^3, and connecting-pipes leading therefrom, in combination with a slow air-pump F connected to the passage D^3 for taking out the water, and a quicker-acting dry-air pump H connected through the passage D^2 for taking out the air, and with pipes S, U, for the air extending upward above the level to which water can be raised by the pressure of the atmosphere, and down again between the condenser-chamber and the dry-air pump, all arranged to serve substantially as herein specified.

4. In a condensing system, a condenser-chamber D having two eduction-passages D^2 D^3, and connecting-pipes leading therefrom, in combination with a slow air-pump F for taking out the water and another H which may be quicker-acting and separately controllable for taking out the air, a separator-chamber T adapted to insure that any water present as a product of the condensible vapors therein shall become separated, and a drain-pipe V leading from a low point in such chamber to remove such water, and with pipes S, U, carrying the air extending upward above the level to which water can be raised by the pressure of the atmosphere and down again between the said separating-chamber and the quick air-pump, all substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

ROYAL D. TOMLINSON.

Witnesses:
THOMAS DREW STETSON,
EM. CASTKA.