No. 789,945. PATENTED MAY 16, 1905.

R. D. TOMLINSON.

CONDENSER.

APPLICATION FILED JAN. 16, 1904.

Fig. 1.

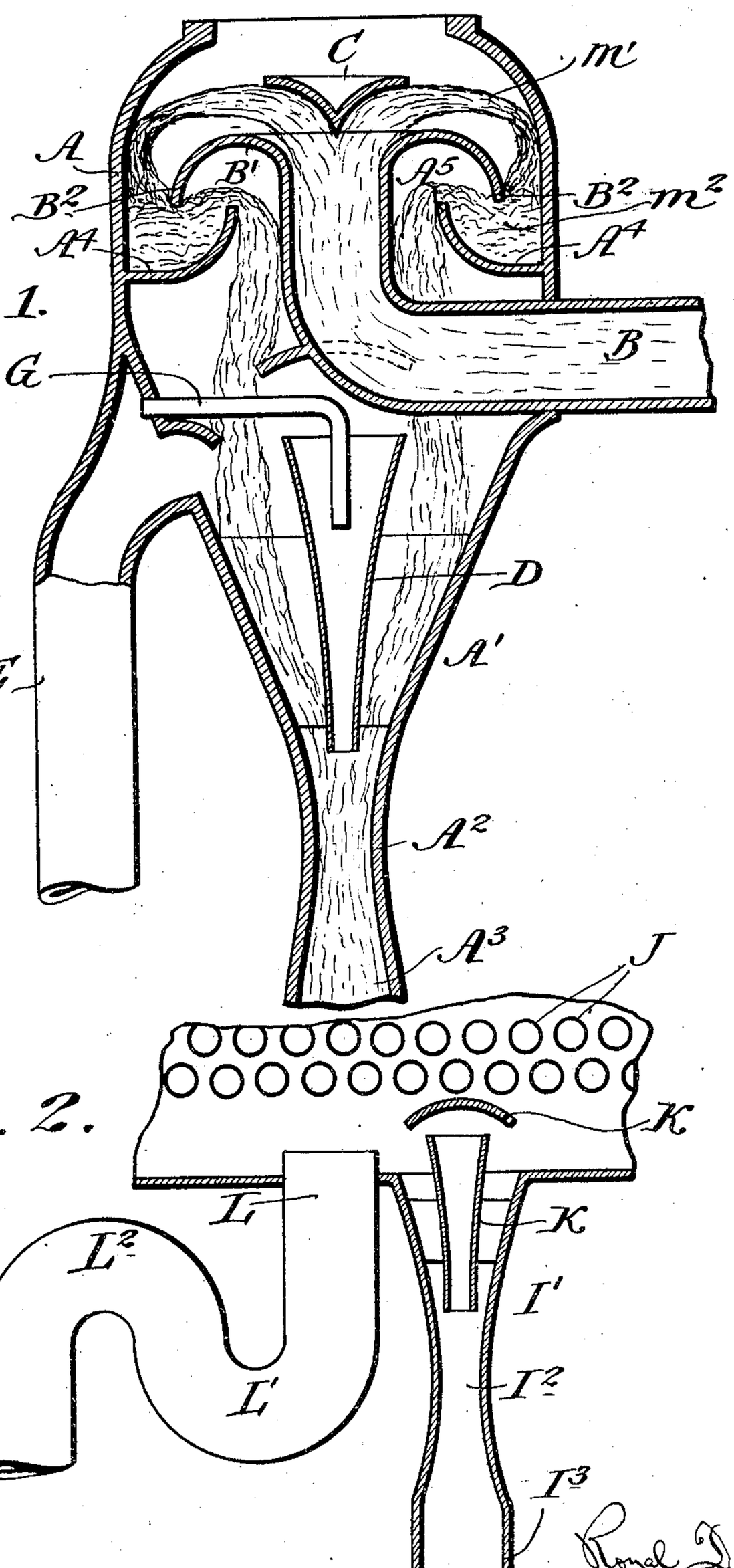

Fig. 2.

WITNESSES:

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No. 789,945. Patented May 16, 1905.

UNITED STATES PATENT OFFICE.

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

CONDENSER.

SPECIFICATION forming part of Letters Patent No. 789,945, dated May 16, 1905.

Application filed January 16, 1904. Serial No. 189,238.

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 Condensers, of which the following is a specification.

The improved condenser may serve with an air-pump of any ordinary or suitable character as a means for removing the water and some of the thin gaseous material. I will describe it as operating in the manner sometimes termed "barometric," the water being allowed to descend by its gravity to such a depth below the condenser that it maintains the vacuum.

The condenser may vary considerably in form; but I prefer an inverted cone with the injection-water entering at a low point and discharging upward a little above the center.

I provide for making a continuous water seal a little below the induction of the injection-water. My condenser is thus divided horizontally into chambers, one above another.

It is essential to remove from the condenser a quantity of thin air which tends to accumulate therein. Its chief source is the air which is naturally contained in the large quantity of water admitted for injection, which tends to escape so soon as it is relieved from the pressure of the atmosphere.

My condenser, in common with many of its class, removes air by drawing it down with the water and provides for condensing the steam before it reaches that low point in the condenser from which the gaseous matter is taken, so that the gaseous material drawn down with the water is nearly all air.

I have discovered that the condensation of the steam on its contact with cold water is more rapid than the liberation and escape of the air contained in the water and that good result is obtained by producing a water seal which prevents the air from rising. I provide a water seal of ample dimensions through which the water descends without permitting the air which is rapidly liberated to rise, but compels it to move at once into the vicinity of the exit.

In common with many condensers of this class some of the water is taken out continuously through a smoothly-contracted portion at the base, ordinarily termed the "throat." It is difficult to proportion the parts so that there shall be always sufficient velocity at this point to draw down the air and also sufficient area of opening of the throat to avoid overflow. I provide a short tapering pipe of thin metal open at each end, extending up and down in and above the throat, which leads the air down to a level where the current of descending water is sufficiently active to seize and drag it down. I make my throat contracted, adapted to serve in the most efficient manner under ordinary conditions and make provision for overflow by a sufficient additional pipe connected to the condenser at an intermediate height. Under some conditions this overflow stands idle. The water in it, having parted with all its air, is quiescent, and much of the water injected, together with the lesser quantity of water resulting from the condensation of the steam and as much of the thin air as can be induced to mingle therewith, descends rapidly through the throat; but at all periods whenever the tumultuous water-level rises sufficiently in the condenser-body a large portion flows quietly away through such additional pipe. Ordinarily the water-surface will be up to or above the connection of the overflow-pipe. The arrangement gives, in effect, an injector action, drawing the air down the tapering pipe, using the head of water as a force to give a high velocity. I provide a bent air-pipe, which insures a free flow of the thin air under all conditions between the upper portion of such pipe and the interior of the mixing-pipe.

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 central vertical section showing the full development of the invention in an injection-condenser. Fig. 2 is a vertical section through a portion of a surface condenser constructed according to this invention.

Similar letters of reference indicate corresponding parts in both the figures.

A is the body of the condenser; A′, the contraction of the lower part; A^2, the smooth throat, and A^3 the barometric pipe, which leads down thirty-four feet or more into a hot-well to draw out the water by gravity against the pressure of the atmosphere.

B is the injection-pipe, bringing water from any source impelled and controlled by ordinary means. (Not shown.)

C is a spreader fitting over the top and raised and lowered by ordinary means. (Not shown.) The injection-water *m* flowing strongly upward and outward through the annular space between the top of the pipe B and the under face of the spreader makes a smooth sheet or canopy of water extending continuously across the whole interior of the condenser.

B′ B^2 is an extended circular top on the end of the injection-pipe, B^2 being a drooping rim forming the periphery thereof.

A^4 A^5 is a shelf extending around the interior of the condenser and reaching inward to an extent considerably within the droop B^2, forming a trap. The inner edge A^5 of this shelf is curled upward to or near the level of the droop, but considerably within it.

D is a short pipe open at each end, shown as tapered and held centrally to the lower portion of the condenser.

E is my overflow-pipe leading down into the same hot-well as the pipe A^3. Under all ordinary conditions this pipe contains quiet water held up by the vacuum obtaining in the condenser.

G is what I will term a "vent-pipe," connecting a pocket in the top of the overflow with the interior of the pipe D.

The water entering through the pipe B, thrown uniformly in all directions in a nearly horizontal sheet *m′* from the top of the injection-pipe B, descends and accumulates in an annular pool m^2 and thence is discharged inward over the inner edge of the shelf A^4 A^5 into the actively-agitated water below and escapes through the throat A^2 and discharge-pipe A^3. So much of the space between the canopy of water *m′* at the top and the annular pool m^2 on the shelf as is unfilled with water receives a large proportion or the whole of the air which comes in with the injection-water. So much of the interior of the condenser within and below this annular pool on the shelf as is unfilled with water by reason of the further condensation which is continued by the water and the cool metallic surface is entirely air. Such air is by the double seal due to the water on the annular shelf or trap and the canopy at the higher level prevented from rising to mingle with the steam above.

The air confined to the bottom of the condenser mingles with the agitated water being discharged downward and is borne away. The presence of the tapering tube D, having its upper open end in the air-space and its lower open end in the current, which is actively moving downward, presents favorable conditions for exhausting the air to a very low pressure and causing it to be drawn down through the throat and expelled through the discharge-pipe A^3.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. Portions may be omitted. The condenser will serve well without the pipe G.

Fig. 2 shows important portions of the invention applied to a surface condenser. In this figure, I is the lower portion of the body of the condenser, and J denotes the tubes therein. I′ is a contracting discharge corresponding to the lower portion A′ of the condenser A, before described; but for a given quantity of steam this portion should be small, because there is no injection-water to be discharged, the only water delivered from a surface condenser being that produced by the condensation of the steam and the water, under good conditions very slight, which is entrained from the boiler with the steam or which leaks through joints. The size of this tapering portion I′ should be carefully determined. I^2 is the throat, corresponding in its functions to the throat A^2 in the principal form, and I^3 is the beginning of the pipe which extends down. In this form of the invention an open-ended pipe K is arranged, corresponding to the open-ended pipe D in the principal form. K′ is a hood which covers the upper end of this pipe and prevents water from falling into it. L is the overflow-pipe, formed with bends L′ L^2, which serve as a trap. In this form the overflow-pipe extends upward a little above the bottom of the condenser, so that water condensed on the tubes and falling into the bottom of the condenser flows to the escape-passage I′ and is discharged. The overflow-pipe in this form of the invention, as in the other, becomes automatically available whenever the water rises sufficiently.

I claim as my invention—

1. In a condenser having a provision for receiving the steam in the top, and a provision for receiving injection-water at a lower point and for taking out water and air at the bottom, means substantially as specified for producing a double seal with water, one by the injection-water in the act of forcibly entering and another by the action of such water in subsequently descending within the condenser, all substantially as herein specified.

2. In a condenser, a steam-inlet at the top, a water-inlet at a lower point, means for exhausting water and air at the bottom, and an overflow-pipe connecting at an intermediate height and structurally independent of air-exhaust means.

3. In a condenser, a steam-inlet at the top,

a water-inlet at a lower point, means for exhausting water and air at the bottom, and a tapered air-pipe with its large end presented upward and opening directly into the air-space of the condenser.

4. In a condenser, a steam-inlet at the top, a water-inlet at a lower point, means for exhausting water and air at the bottom, an overflow-pipe connecting at an intermediate height, an air-pipe within the condenser, and a vent-pipe connecting the overflow-pipe and the air-pipe.

5. In a condenser, a steam-inlet at the top, a water-inlet at a lower point, means for exhausting water and air at the bottom, and a trap at an intermediate point.

6. In a condenser, a steam-inlet at the top, a water-inlet at a lower point, means for exhausting water and air at the bottom, and a trap between the water-inlet and the means for exhausting water and air.

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,

M. F. BOYLE.