2 Sheets Sheet 1.

F. Ransom,

Steam Boiler Condenser,

No. 83,092. Patented Oct. 13, 1868.

Fig. 2.

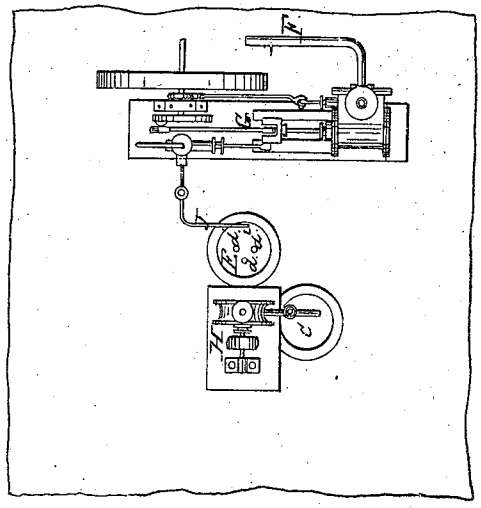
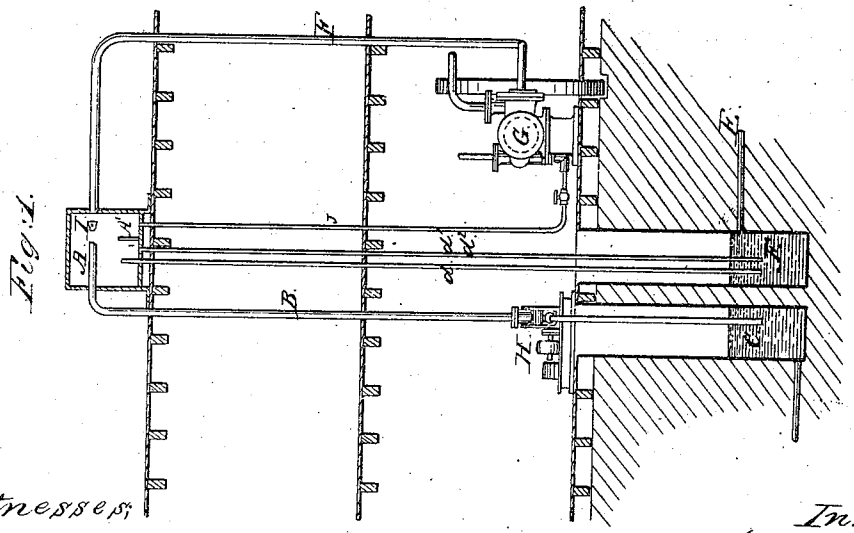


Fig. 1.



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2 Sheets. Sheet 2.

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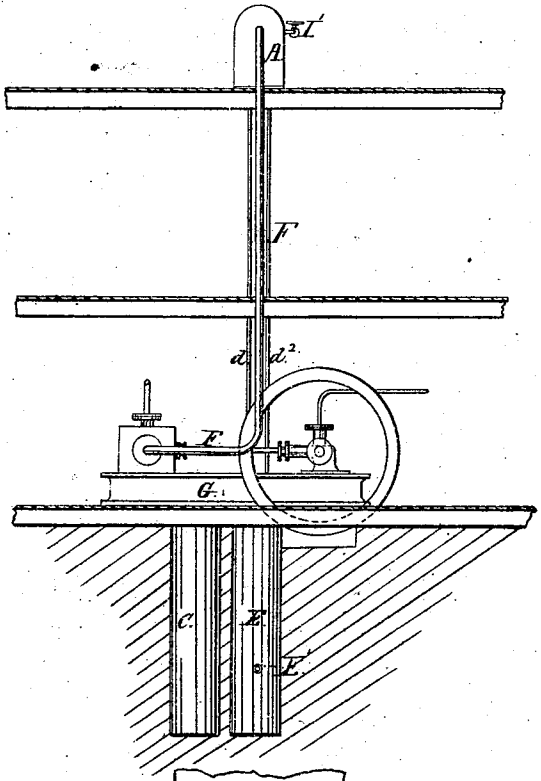
Fig: 3.



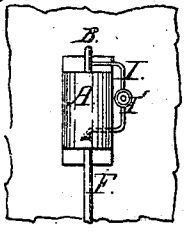


Fig: 4.

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United States Patent Office.

FRANKLIN RANSOM, OF BUFFALO, NEW YORK.

Letters Patent No. 83,092, *dated October* 13, 1868.

IMPROVEMENT IN CONDENSERS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, FRANKLIN RANSOM, of the city of Buffalo, in the county of Erie, and State of New York, have invented a certain new and improved Condensing-Apparatus for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation thereof, reference being had to the accompanying drawings, making a part of this specification.

The economy in the working of the steam-engine resulting from the use of the condenser, with its attendant air-pump, to produce and maintain a vacuum, into which the exhaust steam may escape, is well understood; but the greatly-increased first cost of such condensing-engines, and their greater liability to derangement, and the higher order of skill required to manage them, have heretofore greatly restricted their use.

Two classes of condensers are in common use, viz, the injection-condenser, and the surface-condenser, and it is to the first-named class that my improvements relate.

In the common construction of injection-condenser, the injection-water, by contact with which the exhaust steam is condensed, is necessarily admitted into the vacuous condensing-chamber, and the air-pump, which performs the duty of carrying off such injection-water, is therefore obliged to work against an atmospheric pressure upon its piston corresponding to the vacuum obtained in said chamber, which amounts in common practice to from ten to twelve pounds to the square inch, and is a very serious detraction from the increased pressure on the engine-piston obtained by said vacuum.

It is a well-known fact in hydraulics that atmospheric pressure will raise and sustain a column of water in a pipe exhausted of air, thirty-three feet high, and no more; and my invention takes advantage of this law by a construction, which will be hereinafter described, to dispense with the use of the air-pump, and thereby cheapen and simplify the apparatus, and reduce, to a great extent, the power required to operate the same, in obtaining and maintaining a vacuum.

My invention relates to a condensing-apparatus, in which the condensing-vessel is arranged at the crown of a siphon, the length of the longer leg of which is in excess of that of a column of water which would be sustained by the vacuum obtained in the condensing-vessel, so that said long leg will constitute a waste-pipe which will carry off the injection-water by its own gravity, as against the pressure of the atmosphere, while the shorter leg will constitute the injection-pipe in which atmospheric pressure will raise the water to a height corresponding to the degree of vacuum obtained; from which it follows that the power required to supply the condensing-water will be measured by the excess in the length of said leg over the height to which the water will rise therein, as above stated.

My invention consists—

First, in the arrangement of several waste-pipes, of small bore, the aggregate capacity of which shall not exceed that of the injection-pipe, the object being to cause the waste water to effectually carry off all air which may enter the condenser with the injection-water, or from small leakages of the joints.

Second, in the arrangement of a secondary injection-pipe in connection with a partitioned condenser, by which a portion of the injection-water, by being first brought in contact with the steam, may be heated to the highest possible temperature, for the purpose of feeding the boiler.

In the accompanying drawings—

Figure I is a sectional elevation of my improved apparatus.

Figure II is a ground-plan of same.

Figure III is a side elevation, taken at right angles to Fig. I.

Figure IV is a plan view of condensing-vessel.

Like letters refer to like parts in each of the figures.

A represents the condensing-vessel, which may be constructed according to the common rules for injection-condensers, as to form, size, and material, although a form which makes a horizontal section of equal or greater length and breadth than a vertical one is preferable.

B represents the main injection-pipe rising from the supply-well C, and entering the condenser A at one end, near the top, passes horizontally about two-thirds of the distance across the same, the pipe within the condenser being perforated with small holes, to shower the water therein.

d d^1 d^2 represent the waste-pipes connecting with the condenser at the bottom, and leading downward to the waste-well E and drain E'. The pipe d may be of larger diameter, and project up a few inches into the condenser, to act as an overflow, to prevent the possibility of the condenser being flooded with injection-water.

Presupposing the vacuum obtained in the condenser to be perfect, or nearly so, it must be sufficiently elevated above the level of the waste-well to allow the waste-pipes a vertical length of at least thirty-three feet.

F represents the exhaust-pipe leading from the engine G to the condenser, into which it opens on the side opposite the injection-pipe.

H represents a pump of any approved construction, applied to the injection-pipe at any convenient point, in such manner as to raise the injection-water from the supply-well to the condenser.

The operation of my apparatus, so far as the same is above described, is as follows:

The exhaust steam, when the engine is first put in motion, will flow through the exhaust-pipe F into the condenser, when it will come in contact with the injection-water discharged therein, through the injec-

ion-pipe B, by the action of the pump H. This contact of the injection-water and steam will condense the latter, which, together with the injection-water, will fall to the bottom of the condenser, and be carried off by the waste-pipes d d^1 d^2. The descending columns of water in the waste-pipes will take up and carry off a certain percentage of air from the condensing-vessel, until a vacuum more or less perfect is produced therein.

This effect is due to the commingling of air with the showering water, and the consequent formation of air-bubbles, which are carried down by the descending columns, their buoyancy being overcome by the velocity with which said columns move. The expansibility of the air also assists its escape with the water, since the descending columns remove the pressure upon one side of the body of air confined in the condenser, and its expansibility causes it to seek egress at such point with the water.

The pump H will, on the start, require to raise the water the full length of the injection-pipe, but in proportion as the vacuum becomes established in the condenser, atmospheric pressure will assist the pump, and decrease the power required to operate the same.

The length of the injection-pipe will be governed by the elevation of the water-supply above the waste-drain.

Assuming the most unfavorable conditions, viz, the supply and waste being on the same level, the length of the injection-pipe will be equal to that of the waste-pipes plus the height from the bottom of the condenser to the injection-orifice. The length of the waste-pipes will in practice be about thirty-four feet, and the additional length from one to three feet, so that under the most unfavorable circumstances, the length of the injection-pipe will not exceed thirty-seven feet.

Assuming the most perfect vacuum which may be obtained in the condenser to be equal to fourteen pounds, which is in accordance with practice, the pump would have to raise the injection-water only nine feet. This might be still further reduced by shortening the waste-pipes and lowering the condenser, for the reason that the vacuum of fourteen pounds would not sustain a column of over twenty-eight pounds, and the waste-pipes will carry off the injection-water whenever their length is in excess of the column which the obtained vacuum will sustain.

But it is found advisable in practice to give the waste-pipes a few feet of additional length, as the velocity with which the water will discharge is thereby increased, and, in consequence, the percentage of air which it will carry off with it.

It is also found in practice that the smaller the bore of the waste-pipes, (the required capacity being made up by an increase in their number,) the larger the percentage of air which the waste-water will carry off, and as the successful operation of the apparatus depends upon its capacity to carry off the air which enters with the injection-water, and which may leak in at defective joints, the importance of this feature is manifest; and, further, the vacuum is not only maintained but perfected by this means.

It may be here observed, that the relative position of the parts, except as to vertical distances, is of little importance, and may be made to suit the ever-varying circumstances of location.

It is also manifest that the pump may be dispensed with when an equivalent natural head of water is at command.

Several inferior modifications of the apparatus may be made, as the application of a small air-pump to exhaust the air from the condenser in the first instance, and carry off such air as may enter or leak therein during its operation. But this same result is accomplished by the multiplication of waste-pipes, as described. A pump might also be applied to the waste-pipes, and their length and that of the injection-pipe decreased to such an extent as that the injection-water would flow into the condenser from atmospheric pressure alone.

My apparatus may further be used for the purpose of producing a vacuum without acting as a condenser.

I will now describe the fourth feature of my invention.

I represents a small pipe, branching from the main injection-pipe, and, entering the condensing-chamber at one side, presents its end to the mouth of the exhaust-pipe.

A portion of the condensing-water entering by this pipe is thrown directly in contact with the steam as it first enters the condenser, and its volume being comparatively small, it will receive all the heat from the steam it is capable of holding in the form of water, and as it falls upon the bottom of the condenser, it is prevented from mingling with the main portion of the injection-water by the partition A'. This portion of the condensing-water being raised to the highest possible temperature, is employed to feed the boiler, and is conducted thereto by the pipe J, leading from the condenser to the feed-pump K.

The higher the temperature of the feed-water, the less the quantity of the fuel which will be required to convert it into steam, so that a very material saving in fuel will be the result of this arrangement.

The pipe I is provided with a valve or cock, I', by which the quantity of water passing through it may be regulated according to the demands of the boiler.

Having thus described my invention,

What I claim, and desire to secure by Letters Patent, is—

1. The arrangement, with the condenser A, and main induction-pipe B, of the overflow-pipe d, and small pipes d^1 d^2, as herein set forth.

2. The arrangement of the secondary injection-pipe I, in relation to the partitioned condenser A, and boiler-feed pipe J, as set forth.

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