(No Model.)

E. P. HOLLY.

WATER RETURN SYSTEM FOR STEAM GENERATORS.

No. 587,291. Patented July 27, 1897.

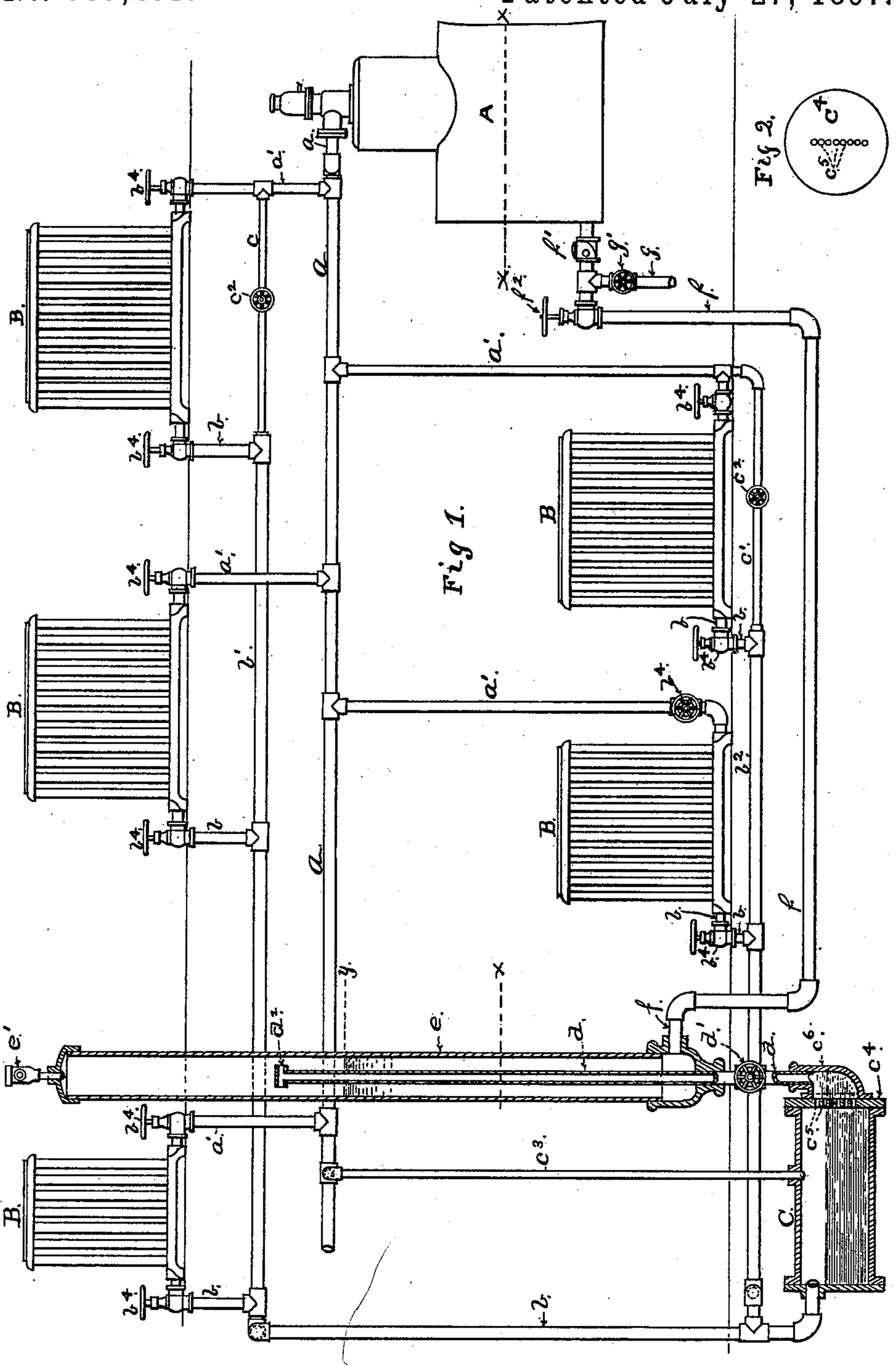

Fig 1.

Fig 2.

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WATER-RETURN SYSTEM FOR STEAM-GENERATORS.

SPECIFICATION forming part of Letters Patent No. 587,291, dated July 27, 1897.

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To all whom it may concern:

Be it known that I, EDGAR P. HOLLY, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Water-Return Systems for Steam-Generators; and I do hereby declare the following specification, taken in connection with the accompanying drawings, forming a part of the same, to be a full, clear, and exact description thereof.

In another application of even date herewith I have shown and described certain improvements in water-return systems for steam-generators whereby the water of entrainment or condensation may be returned from a point below the water-level in the generator back into the generator and against the pressure therein without the employment of a pump or similar device. In said application means are shown and described for thus returning the water of condensation from a single steam-using device.

The object of the present invention is to provide means for thus returning the water of entrainment or condensation from a series of steam-using devices, and incidentally to improve the circulation through said devices.

Referring to the drawings, Figure 1 is an elevation showing the invention applied for returning the water of entrainment and condensation from a series of steam-radiators for heating purposes, and Fig. 2 is an end view of the discharging-head of the receiver.

A represents a steam-generator, which may be of any desired form or type, from the steam-dome of which extends the steam-pipe a, from which extend the branch pipes a' to supply steam to the series of radiators B, three of which are shown in the drawings as located upon the floor above the generator and two of which are shown as located on the floor below and below the water-level in the generator.

b are the exhaust-pipes from the radiators, the exhaust-pipes from the radiators upon the upper floor leading into the pipe b' and the exhaust-pipes from the radiators upon the lower floor leading into the pipe b^2. Both of the pipes b' b^2 lead into the pipe b^3, through which pipe b^3 the exhaust from all the radiators is delivered into the common receiver C.

b^4 are the usual valves for controlling the flow of steam through the radiators. An equalizing-pipe c connects one end of the exhaust-pipe b' with one of the branch steam-pipes a', and a similar equalizing-pipe c' connects one end of the exhaust-pipe b^2 with another of the branch steam-pipes a', each of said equalizing-pipes being provided with a controlling-valve c^2. Another equalizing-pipe c^3 connects the steam-pipe a with the receiver C, all as shown in Fig. 1.

The receiver C may be of any suitable shape, but is preferably constructed in the form of a cylinder with detachable heads. The exhaust-pipe b^3 enters the receiver at one end and preferably near the top thereof. The head c^4 at the other or discharging end of the receiver is provided with a series of holes or discharge-orifices c^5, preferably arranged in a central vertical line and forming in effect an elongated vertically-arranged opening, as shown at Fig. 2. Instead of such a series of separate discharge-orifices a single orifice in the form of a narrow elongated slot may be employed, arranged in the same position in the head. To the outside of the head c^4 is secured a neck c^6, the mouth of which is arranged to cover the orifices c^5 in the head and so that the steam and water discharged through said orifices will be delivered into said neck. Communicating with the opposite end of said neck and leading upward therefrom is a pipe d, which may be termed a "riser," said riser being provided with a controlling-valve d' and terminating, preferably, in the T-piece d^2. Surrounding the riser d is a pipe e of considerably larger diameter, which may be termed a "stand-pipe." This stand-pipe e is closed at top and bottom, and is preferably provided at the top with an automatic air-vent e'. Leading from the bottom of the stand-pipe e is a return-pipe f, which extends to and enters the generator. The return-pipe f is provided with a check-valve f', preferably located at or near the generator, and, if desired, said return-pipe may also be provided with a hand-valve f^2, as shown. A short branch pipe g, communicating with the return-pipe f and provided with a controlling-valve g', is also preferably employed for permitting the escape of air from the system in starting the apparatus.

The operation of the parts above described

is as follows: As the mingled steam and water from the series of radiators B enters the receiver C through the pipe b^3 the water falls and accumulates in the bottom of the receiver, establishing a water-level therein, which water-level ordinarily rises to about the position shown in the drawings, but never to so great a height as to close all of the discharge-orifices c^5. By the employment of the equalizing-pipes $c\,c'\,c^3$ the initial steam-pressure is secured in the upper portion of the receiver and above the water-level therein. By means of this steam-pressure the water is forced out of the lower orifices c^5, while the steam itself flows out of the upper orifices, and flowing through the neck c^6 and into the riser takes up the water which has been discharged into the neck and carries it in the form of detached particles intermingled with the steam up into and through the riser d, the mingled water and steam issuing from the open ends of the T-piece d^2. The particles of water thus carried up with the steam as they issue from the ends of the T-piece will fall and accumulate in the stand-pipe e, while the steam will flow upward into the upper end of the stand-pipe, which extends for a considerable distance above the end of the riser d, where it will be condensed, this extension of the stand-pipe constituting a condensing-chamber. This condensation which takes place in the upper end of the stand-pipe serves the double purpose of inducing and maintaining the necessary circulation through the riser and also of adding to the column of water in the lower end of the stand-pipe. The column of water as it rises in the stand-pipe will sooner or later reach a height where the head produced thereby, added to the steam-pressure in the stand-pipe acting upon the top of the water column, will cause the pressure upon the check-valve f' to become equalized. If there were no loss of pressure in the system, the pressure upon the check-valve would be equalized when the water column in the stand-pipe reached the level of the water-line in the generator, (indicated by the line x in the drawings,) but as there is necessarily in practice a certain loss of pressure in the system due to transmission, radiation, &c., the pressure upon the check-valve is not in fact equalized until the water column in the stand-pipe has risen to a sufficient height above the water-level in the generator to counterbalance such loss of pressure. When the column has been raised to a sufficient height to equalize the pressure upon the check-valve, then any further rise of the column will tend to open the check-valve, until finally as the column continues to rise the requisite head is obtained to open the check-valve and cause the water to be forced through the return-pipe and into the generator against the pressure therein. The line y in the drawings indicates the effective operating height of the column of water in the stand-pipe.

Neither of the equalizing-pipes above referred to are necessary for the operation of the apparatus, and any one or all of them may, if desired, be omitted. Their use, however, is attended with important advantages. Thus by the employment of such equalizing-pipes a more effective steam-pressure is secured for raising the water in detached particles through the riser, whereby the water is more certain to be carried up in the necessary condition of detached particles and the accumulation of a column of water in the riser is prevented, resulting in a better and more certain circulation. Again, by the employment of the equalizing-pipes a greater steam-pressure upon the top of the water column in the stand-pipe is secured, and consequently such column of water does not require to be raised to so great a height to secure the necessary head. Thus the column of water in the stand-pipe will be raised to an effective feeding head more quickly than would otherwise be the case, and the stand-pipe itself does not require to be of so great a height.

If the equalizing-pipes were omitted with the necessarily attendant loss of steam-pressure upon the water column, said column would require to be raised to a greater height to secure the additional head necessary to counterbalance such loss of pressure. Again, by the use of one or more of the equalizing-pipes the water of entrainment and condensation will be taken from the steam-pipe, even when all the radiators are shut off. It will be understood that one or more of the equalizing-pipes may be employed without using the others. Thus the equalizing-pipe c^3 might be omitted and the pipes c' and c^2 be employed, or, on the other hand, the pipes c' and c^2 might be omitted and the pipe c^3 only employed; or, in fact, stated generally, any one of said equalizing-pipes may be employed without the others, or, as above stated, all of said pipes may be omitted. So, on the other hand, still other equalizing-pipes might be employed, if desired, in addition to those shown in the drawings, the object of such equalizing-pipes being simply to keep up the pressure in the system and to secure a sufficient and effective pressure in the receiver to insure the water being taken up in detached particles intermingled with the steam, and thus facilitate the circulation and also to enable the water column and the stand-pipe to be of less height than would be necessary if no such equalizing-pipes were employed. The use of such equalizing-pipes and the number thereof will depend a good deal upon the character and extent of each particular system. If the system be a large one, embodying a large number of radiators and extending to great distances from the generator, the employment of one or more equalizing-pipes is more desirable and advantageous than in the case of a smaller and more compact system. So also it is not necessary for the operation of the apparatus above described that the discharge-

orifices in the receiver should be of the character or arranged as shown and described. In many cases other forms and arrangements of discharge-openings from the receiver may be employed. It is always desirable, however, that the discharge opening or openings should not become sealed or closed by the accumulation of water in the receiver, as in such case the steam would not have a free escape from the receiver and the proper action of taking up the water in the form of detached particles intermingled with the steam would be interfered with. In a large system including a large number of radiators there is liable to be a considerable variation in the position of the water-line in the receiver, and in such a system the employment of a discharge orifice or orifices, such as described, is of great advantage to guard against the danger of sealing up the discharge-opening by the accumulated water and the resulting interference with the proper action of the apparatus and the maintenance of the desired circulation.

By the employment of a series of discharge-orifices arranged one above the other in a vertical line or, what amounts to the same thing, by the employment of a narrow elongated vertical slot variations in the position of the water-line in the receiver will have no prejudicial effect, as there will always be an opening above the water-line through which the steam can escape and operate to take up the water issuing from the lower orifices or the lower portion of the slot and carry it in detached particles intermingled with the steam up into and through the riser. It is desirable that the total area of the discharge opening or openings from the receiver should be equal to the area of the riser.

While I have shown an apparatus in which the communication between the riser and receiver is by means of an elongated vertically-arranged opening formed in a part of the receiver, it will be understood that the exact form of this opening and its location in any particular part of the apparatus are immaterial, it being only necessary for the proper action of the apparatus that the communication between the riser and receiver shall be of such a character that the steam as it is caused to flow through the riser shall carry the water with it. I have also shown a condensing-chamber as the means for inducing the flow of steam through the riser; but any other means for effecting this result may be substituted for such condensing-chamber without departing from my invention.

With the combination and arrangement of parts above described, in which the return-pipe may be located in any desired position and below the generator or even underground, if desired, the generator may be in one building and the radiators in another, and so, also, a number of separate buildings may be heated from one and the same generator.

While it is not necessary that the exhaust from those radiators of a system which are located a sufficient distance above the generator should be taken to a receiver located below the generator and the water of condensation be thence raised to be returned into the generator, as from such generators the water might be returned by gravity, it is advantageous to connect all the radiators in the system, even including those which are thus elevated, with a common receiver and to return the water to the generator in the manner described, and for the reason that thereby the circulation through the radiators is facilitated and increased and the circulation through all the radiators rendered uniform.

It will be understood that the apparatus above described is not limited to use in connection with a series of radiators or in a system of steam-heating, as the same may be likewise employed with the same resulting advantages in any system of steam distribution where it is desired to collect the water of entrainment or condensation from a number of pipes or steam-using devices and return it to the generator.

It will be further understood that the broad feature of the present invention is not dependent upon the employment of the particular construction of apparatus shown and described for returning the water of condensation from the receiver to the generator, but instead consists in a water-return system in which, in connection with a series of steam-pipes or steam-using devices, a receiver located below and adapted to receive the water of condensation from all of said devices is employed, from which receiver the water is returned to the generator by means of a return-passage and a condensing-chamber in communication therewith. Consequently while I prefer to make use of the construction and arrangement of parts herein described for the return of the water from the receiver to the generator this is not necessary for the employment of the broad feature of my invention, but instead any other suitable construction and arrangement of return-passage and condensing-chamber may be employed—as, for instance, a construction in which the condensing-chamber is located in and forms a part of the return-passage instead of being located outside of or at one side of said return-passage.

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

1. The combination, with a steam-generator and a steam-pipe leading therefrom, of a series of branch pipes leading from said steam-pipe, a receiver in communication with all of said branch pipes to receive the water of entrainment or condensation therefrom, a riser communicating with said receiver and terminating in an open end, a stand-pipe communicating with said riser, a condensing-chamber communicating with said stand-pipe, and a return-pipe leading from said stand-pipe to said generator and provided with a check-valve, substantially as described.

2. The combination, with a steam-generator and a series of radiators or other steam-using devices, of a steam-pipe leading from said generator to supply steam to said steam-using devices, an exhaust-pipe to receive the exhaust from said steam-using devices, a receiver in communication with said exhaust-pipe, a riser communicating with said receiver and terminating in an open end, a stand-pipe communicating with said riser, a condensing-chamber communicating with said stand-pipe, and a return-pipe leading from said stand-pipe to said generator and provided with a check-valve, substantially as described.

3. The combination, with a steam-generator and a series of steam-using devices, of a steam-pipe leading from said generator to supply steam to said steam-using devices, an exhaust-pipe to receive the exhaust from said steam-using devices, an equalizing-pipe connecting said steam and exhaust pipes, a receiver in communication with said exhaust-pipe, a riser communicating with said receiver and terminating in an open end, a stand-pipe communicating with said riser, a condensing-chamber communicating with the upper end of said stand-pipe, and a return-pipe leading from said stand-pipe to said generator and provided with a check-valve, substantially as described.

4. The combination, with a steam-generator and a series of steam-using devices, of a steam-pipe leading from said generator to supply steam to said steam-using devices, an exhaust-pipe to receive the exhaust from said steam-using devices, a receiver in communication with said exhaust-pipe and adapted to receive the water of condensation from all of said steam-using devices, an equalizing-pipe connecting said steam-pipe with said receiver, a riser communicating with said receiver and terminating in an open end, a stand-pipe communicating with said riser, a condensing-chamber communicating with the upper end of said stand-pipe, and a return-pipe leading from said stand-pipe to said generator and provided with a check-valve, substantially as described.

5. The combination, with a generator and series of steam-using devices, of a steam-pipe leading from said generator to supply steam to said steam-using devices, a receiver adapted to receive the water of condensation from said steam-using devices, and an equalizing-pipe connecting said receiver with said steam-pipe, substantially as described.

6. The combination of a receiver adapted to receive the water of condensation from a series of steam-using devices, a riser leading from said receiver and terminating in an open end, a stand-pipe communicating with said riser, and a condensing-chamber in communication with said stand-pipe, whereby the water of condensation from all of said steam-using devices will be first collected in said receiver, and will then be lifted up out of said receiver and into and through said riser, and accumulated in said stand-pipe to form a water column therein, substantially as described.

7. A steam and water receiver adapted to be connected to a steam-distributing system and provided at one end with an elongated vertically-arranged discharge-outlet whereby the water accumulating in the bottom of said receiver may be discharged through the lower end of said discharge-outlet while the steam may be discharged through the upper end of said outlet, and whereby the water-line in said receiver may be varied without entirely closing or sealing said outlet.

8. A steam and water receiver adapted to be connected to a steam-distributing system and provided at one end with an elongated vertically-arranged discharge-outlet, and with a neck arranged to cover said discharge-outlet, said neck being provided with an opening for the passage of steam and water therefrom, substantially as described.

9. The combination, with a generator and a series of steam-using devices, of a steam-pipe leading from said generator to supply steam to all of said steam-using devices, a receiver located below and adapted to receive the water of condensation from all of said steam-using devices, a return-passage leading from said receiver to said generator and embodying a riser, and a condensing-chamber located above the water-line of the generator and in communication with said return-riser, substantially as described.

10. The combination, with a generator and a series of steam-using devices, of a steam-pipe leading from said generator to supply steam to all of said steam-using devices, a receiver located below and adapted to receive the water of condensation from all of said steam-using devices, a return-passage leading from said receiver to said generator and embodying a riser, and means for inducing a flow of steam through the riser, substantially as described.

11. The combination, with a generator and a series of steam-using devices, of a steam-pipe leading from said generator to supply steam to all of said steam-using devices, a receiver located below and adapted to receive the water of condensation from all of said steam-using devices, a return-passage leading from said receiver to said generator and embodying a riser, said riser communicating with the receiver through an elongated vertically-arranged opening, and means for inducing a flow of steam through the riser, substantially as described.

12. The combination, with a steam-generator and a steam-pipe leading therefrom, of a series of branch pipes leading from said steam-pipe, a receiver in communication with all of said branch pipes to receive the water of entrainment or condensation therefrom, a riser communicating with said receiver and terminating in an open end, a stand-pipe communicating with said riser, a return-pipe leading from said stand-pipe to said genera-

tor, and means for inducing a flow of steam through the riser, substantially as described.

13. The combination, with a steam-generator and a steam-pipe leading therefrom, of a series of branch pipes leading from said steam-pipe, a receiver communicating with all said branch pipes to receive the water of condensation or entrainment therefrom, a riser terminating in an open end and communicating with said receiver through an elongated vertically-arranged opening, a stand-pipe communicating with said riser, a return-pipe leading from said stand-pipe to said generator, and means for inducing a flow of steam through said riser, substantially as described.

14. The combination, with a steam-generator and a series of steam-pipes communicating therewith, of a receiver in communication with all of said steam-pipes to receive the water of entrainment or condensation therefrom, a riser terminating in an open end and communicating with the receiver through an elongated vertically-arranged opening, a stand-pipe communicating with said riser, a condensing-chamber communicating with said stand-pipe, and a return-pipe leading from said stand-pipe to said generator, substantially as described.

15. The combination of a receiver, means for supplying steam to said receiver a riser leading from said receiver and communicating therewith through an elongated vertically-arranged opening, and means for inducing a flow of steam through the riser, whereby the water in the receiver is carried up in the riser with the steam, substantially as described.

16. The combination of a receiver, means for supplying steam to said receiver a riser leading from said receiver and communicating therewith through an elongated vertically-arranged opening, a condensing-chamber communicating with said riser, whereby steam is caused to flow through the riser and carry the water therewith, substantially as described.

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