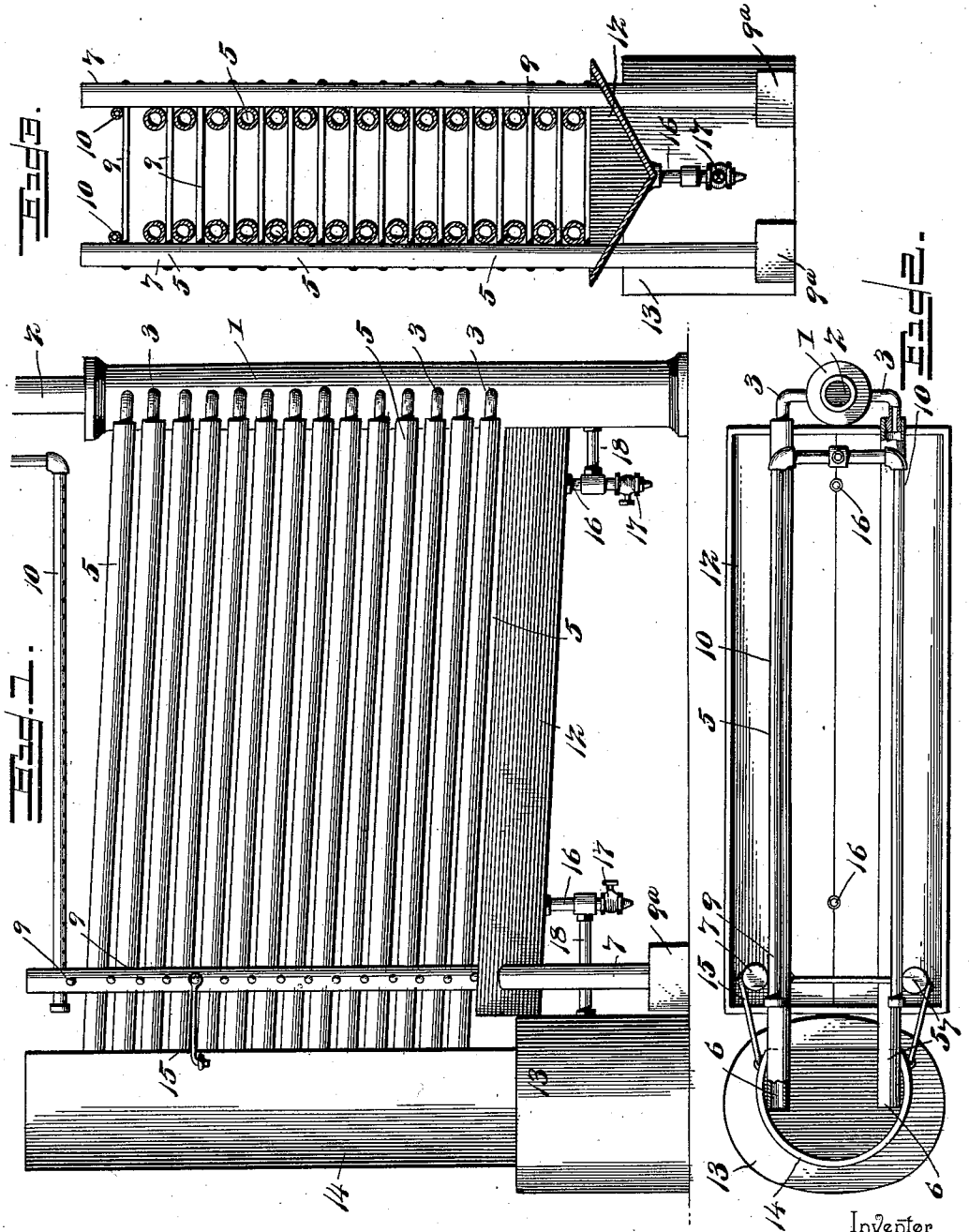
(No Model.)

C. A. JOHNSON.

CONDENSER FOR EXHAUST STEAM.

No. 590,740. Patented Sept. 28, 1897.



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CONDENSER FOR EXHAUST-STEAM.

SPECIFICATION forming part of Letters Patent No. 590,740, dated September 28, 1897.

Application filed May 11, 1897. Serial No. 636,054. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. JOHNSON, a citizen of the United States, residing at Alexandria, in the county of Douglas and State of Minnesota, have invented a new and useful Condenser for Exhaust-Steam, of which the following is a specification.

This invention relates to condensers especially designed to condense the exhaust-steam from steam-engines; and the object of the invention is to provide a simple and efficient apparatus for this purpose in which all or practically all of the exhaust-steam conveyed into it will be condensed and the water of condensation be discharged into a suitable receptacle, from which it may be pumped or otherwise returned to the boiler.

With this and other objects in view the invention consists in the several details of construction and combination of parts, as will be fully described, and particularly pointed out in the claims.

In the drawings, Figure 1 is a side elevation of the condenser. Fig. 2 is a plan view. Fig. 3 is a vertical transverse section.

Similar reference-numerals indicate similar parts in the several figures.

1 indicates a stand-pipe into which the exhaust-steam is conveyed through a pipe 2, which is connected to the stand-pipe at its upper end. A vertical series of short curved pipe-sections 3 are tapped into the stand-pipe on opposite sides thereof in such manner that their outer ends may have limited vertical movement, and these pipe-sections are each provided with a collar or reducer, which is firmly connected to it at its outer end. These collars or reducers fit into the ends of the vertical series of tubes, to which they are secured in any suitable manner. These tubes 5 are arranged in two vertical series parallel to each other, and their outer ends 6 are open in order that the water of condensation may be discharged from them at their outer ends when required.

7 indicates vertical standards, which may be either pipes or solid bars, as preferred, and each of these standards is provided with a series of equidistant perforations extending nearly its entire length.

9 indicates transverse connecting-rods secured at each end in the perforations in the respective standards 7, and these rods serve to support and space apart the outer free ends of the tubes 5. The vertical standards and cross-rods may be so arranged that when the standards rest on the floor the tubes 5 will incline downwardly at their outer ends, and the water of condensation will be, therefore, discharged from the outer ends. Should it, however, be desired to discharge the water of condensation into the stand-pipe, the standards will be elevated in order to change the inclination of the tubes so that the water of condensation will flow through the pipe-sections 3 into the stand-pipe 1. The elevation of the standards and the outer ends of the pipes may be effected in any suitable manner, as will be readily understood. As illustrated in the drawings, removable blocks 9^a are inserted between the lower ends of the standards and the floor, and the tubes are inclined to discharge the water of condensation into the stand-pipe. I do not, however, limit myself to this means of adjustment, as it may be effected in many other ways.

10 indicates a pair of water-pipes which are designed to be connected to a source of supply in any suitable manner, and these pipes are arranged, respectively, over the two series of vertical tubes 5 and are perforated on their lower sides in order to spray water over the said tubes to cool them and thereby effect the condensation of the steam which will be delivered into them.

12 indicates a trough supported below the series of tubes 5 to receive the water which is discharged by the pipes 10 onto the tubes. The trough will preferably be supported at one end by the standards 7 in order that its inclination may be changed to correspond with the inclination of the tubes 5, but this is not essential, as the trough may be supported by other means in such manner that its inclination may be changed at the pleasure of the user.

13 indicates a vessel to receive the water of condensation and also the water which is collected in the trough 12. A portable casing 14 is arranged in front of the open ends of the tubes 5 to confine the steam and water discharged from the tubes and to direct the water into the vessel 13. The lower end of this casing will preferably be supported in or

by the vessel 13, and it may be held in its vertical position by any suitable means, such as a hook-and-eye connection between it and the standards 7, as indicated at 15.

16 indicates pipes leading downwardly from each end of the trough, and each of these pipes is provided at its lower end with a valve 17. Between the valve and the trough each pipe is provided with a branch pipe 18, which leads, respectively, to the vessel 13 and the stand-pipe 1. If the valves 17 be closed, the water which collects in the trough 12 will be conveyed into either the vessel 13 or the stand-pipe 1, this depending upon which way the trough is inclined.

In operation the exhaust-steam will be conveyed through the pipe 2 into the stand-pipe 1, from which it will be distributed into the several tubes 5, and cold water will be constantly discharged from the pipes 10 and drip down over the tubes 5, thereby keeping them comparatively cool and consequently condensing the steam within the tubes 5. The water of condensation will be discharged into the vessel 13 or the stand-pipe 1, as the operator may elect, as has been already described, and the water discharged from the pipes 10, after passing over the tubes 5, will be collected in the trough 12 and may be discharged into either the vessel 13 or the stand-pipe 1 to mix with the water of condensation, or the valve 17 may be opened and the water from the trough conveyed to any other point, as desired. As the water from the pipes 10 trickles over the tubes 5 the heat from the latter will cause the water to deposit its mineral impurities on the pipes, and when the water reaches the trough 12 it will be practically free from such impurities and may be used in the boiler without liability of scaling the latter. The tubes 5 will become scaled, but owing to the expansion and contraction of these tubes caused by their heating and cooling the scale will be cracked and may be easily removed therefrom by tapping them with a light hammer.

In an actual test of this device with an engine capable of developing from twenty-five to seventy-five horse power the exhaust-steam was condensed and yielded from two to four gallons of pure soft water per minute, the amount varying according to the amount of steam being used, and it required only about one gallon of cold water per minute to be discharged over the condensing-tubes. In a four weeks' run about a bushel of scale was removed from the condensing-tubes, and in washing out the boiler after two weeks' use with the water supplied from the condensing apparatus I found only about a handful of scale, whereas previously after using the boiler for the same length of time at least a bushel of scale would be removed from the boiler when washed out. It is therefore obvious that by the use of this invention the scaling of a boiler is practically prevented and its efficiency greatly increased. If the water of condensation is discharged into the stand-pipe, it will be in a heated condition and be, therefore, in better shape for use in the boiler. If, however, it is discharged into the receptacle 13, it will be much colder and may require the use of a separate heater before it will be in condition to be returned to the boiler.

It will be understood that changes in the form, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

What I claim is—

1. In a condenser for exhaust-steam, the combination of a vertical stand-pipe into which the exhaust-steam is delivered, a series of horizontal tubes flexibly connected at one end to the stand-pipe and free at their other ends, means to elevate the free ends to vary the inclination of the tubes, means to spray cold water over the tubes, and a suitable receiver for the water of condensation, substantially as described.

2. In a condenser for exhaust-steam, the combination of a vertical stand-pipe into which the exhaust-steam is delivered, a series of curved pipe-sections tapped into the stand-pipe on opposite sides, a collar or reducer on the end of each pipe-section, two vertical series of horizontal tubes connected respectively to the collars or reducers on the opposite sides of the stand-pipe, means to adjustably support the outer free ends of the tubes, perforated pipes above the tubes to spray cold water upon them, a trough arranged below the tubes to receive the water sprayed over them, and a receiver for the water of condensation and the water collected in the trough, substantially as described.

3. In a condenser for exhaust-steam, the combination of a vertical stand-pipe into which the exhaust-steam is delivered, two vertical series of horizontal tubes connected at one end to the stand-pipe and arranged parallel to each other, a pair of standards between which the outer ends of the tubes extend, cross-bars connecting the standards and serving to support and space apart the tubes in the series, means to adjust the standards vertically, means to spray cold water on the tubes, and a receiver for the water of condensation, substantially as described.

4. In a condenser for exhaust-steam, the combination of a vertical stand-pipe into which the exhaust-steam is delivered, a series of horizontal tubes flexibly connected at one end to the stand-pipe and their outer ends being free and open, a vessel arranged below the outer ends of said tubes to receive the water of condensation, a vertical casing arranged in front of the open ends of the tubes, means to vertically adjust the free ends of the tubes, and means to spray cold water on the tubes, substantially as described.

5. In a condenser for exhaust-steam, the combination of a vertical stand-pipe into

which the exhaust-steam is delivered, a series of horizontal tubes connected at one end to the stand-pipe and their other ends being open, means to adjustably support the open ends of the tubes, a vessel to receive the water of condensation from the open ends of the tubes, means to spray cold water on the tubes, a trough supported below the tubes to receive the water sprayed on them, means to adjust the inclination of the trough, and a pipe at each end of the trough connecting, respectively, with the said vessel and the stand-pipe, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CHARLES A. JOHNSON.

Witnesses:

C. J. GUNDERSON,

C. F. WHITCOMB.