F. G. Smith,

Steam-Boiler Condenser.

No. 11,274. Patented July 11, 1854.

Fig: 1.

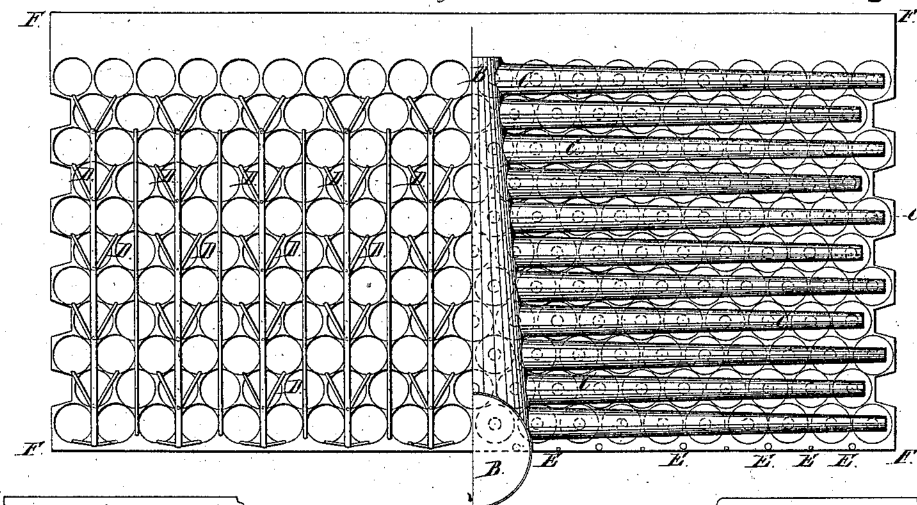


Fig: 2

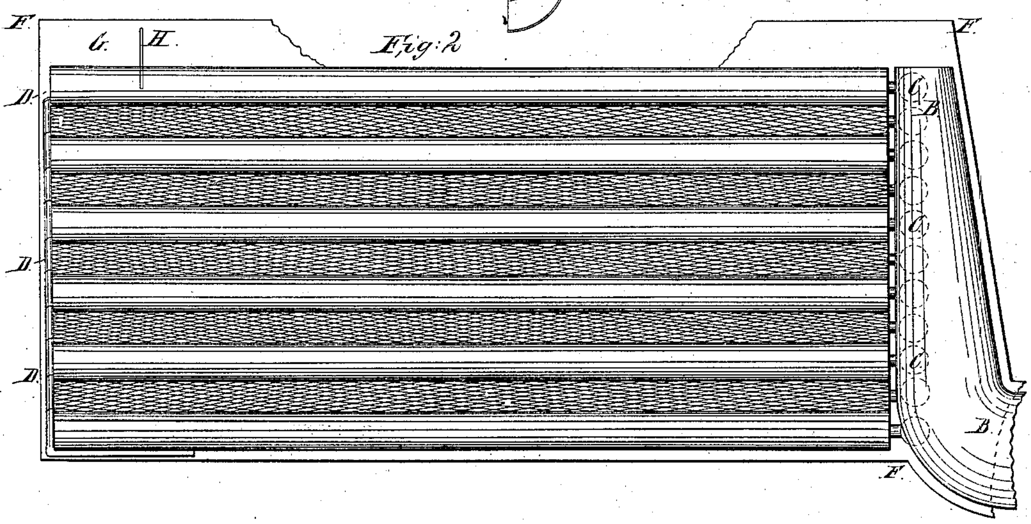


Fig: 3.

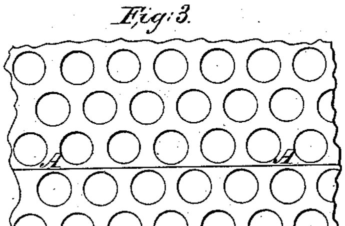


Fig: 4.

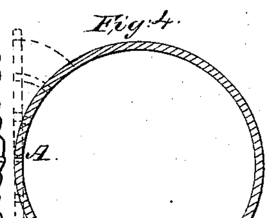
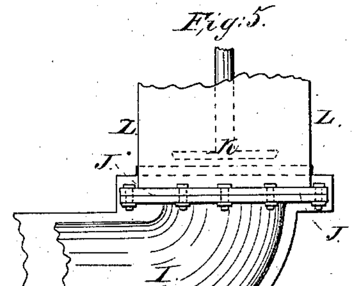


Fig: 5.



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UNITED STATES PATENT OFFICE.

F. G. SMITH, OF COLUMBIA, TENNESSEE.

CONDENSER FOR STEAM-ENGINES.

Specification of Letters Patent No. 11,274, dated July 11, 1854.

To all whom it may concern:

Be it known that I, FRANKLIN G. SMITH, of Columbia, in the county of Maury and State of Tennessee, have invented a new and useful Improvement in the Construction of Tubular Condensers for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, which are made a part of this specification.

Figures 1 and 2, which are on a scale of one inch to one foot, represent a large number of my condenser tubes arranged side by side, ten feet long and six inches scant in diameter. Figs. 3 and 4, which show the construction of the tubes more accurately, are on a scale of one inch to two inches.

For making my condenser tubes, I take boiler-plate iron, somewhat less than a quarter of an inch in thickness, (as shown in the vertical section, Fig. 4,) and punch innumerable holes in it, as seen in Fig. 3; the holes being so arranged as to leave the largest spaces of uncut iron between them, that the sheet, (on being bent into a cylinder,) may have a due degree of strength for resisting the atmospheric pressure. The edges of the sheet, shown at A, Figs. 3 and 4, are brought together without riveting, as the only force acting upon the tube, is that which tends to crush or collapse it.

The ends of the condenser tubes may be cast-iron disks, six inches in diameter; the disk for the rear end of the tubes, (see Fig. 1,) having a small hole in the lower side, through which the water of condensation may flow into its water-pipe, D; and the disk for the front end having a projecting tube (cast in one piece with the disk,) forming the connection between the tubes and the arms C, C, C &c. of the education pipe B.

The plate-iron, Fig. 3, after being bent into a cylinder, as in Fig. 4, is to be covered with very thin sheet copper, or other suitable metal. The design of the numerous holes punched through the plate-iron, is to bring the steam as near as possible to the cold water. The size of the holes must have reference to the strength of the sheet copper for resisting the pressure caused by the vacuum within the tubes. The tubes should not lie in actual contact with one another; a small space must be allowed for the passage water.

Figs. 1 and 2 show the position and connections of the condenser tubes, so that all of them may act at same instant upon the steam issuing from the engine cylinder. The large eduction pipe, B, Fig. 2, receives the steam from the cylinder and sends it the arms C, C, &c., (only those on the right hand half of the condenser are shown in Fig. 1), toward the front end of the condenser tubes.

Figs. 1 and 2, examined in connection, show distinctly how the neck cast with the disk of the front end of the condenser tubes, connects with the arms, C, C. The right hand half of Fig. 1 shows the connection between the tubes and the arms, while the left hand half shows a view of the condenser from behind, and represents the water-pipes, D, D, &c., for receiving the water of condensation. These pipes are attached to that end of the condenser, rather than to the front end, because the blast of the entering steam will drive any drops of water it may encounter, in that direction. E, E, &c., are continuations of those pipes, carrying the water of condensation off to the air pump. This condenser should act so promptly upon the steam, as to require no injection water to assist it in maintaining a good vacuum.

To allow an easier flow of the water of condensation out of the condenser tubes, the farther end of those tubes should be a little lower than the front ends, into which the steam rushes from the pipe B and its branching arms C, C, &c.

All the pipes, D, D, &c., and E, E, &c., are represented in the drawings as returning to the front end of the condenser, surrounded by the cold water which acts upon the condenser tubes; and they should be kept thus surrounded by cold water until they enter the air pump.

The letters, F, F, F, F, Figs. 1 and 2, show the sheet iron box or case, made water-tight, within which the condenser tubes are placed, in order to be surrounded by cold water. In Fig. 2, the case is seen to be extended so as to embrace the large steam pipe B, together with its arms, C, C, &c., and all the joinings of the condenser tubes and the arms. The cold water is to be poured into the space G, Fig. 2, at the rear end of the condenser; a partition, H, causing it to descend along that end of the condenser tubes, and to flow toward the front end of the condenser through the triangular interstices

between the condenser tubes, shown very distinctly in the end view of those tubes presented in both halves of Fig. 1, but most clearly in that to the left hand. The water passes out of the case F, F, &c., at the front end, near the top, the effect of which arrangement is, that the water has a tendency to rise, from one triangular opening to those next above it, while flowing lengthwise; and no portion of the water can become stagnant, or be too much heated by the steam.

The point of outlet for the cold water being nearly as high as that at which it is poured in, the condenser tubes remain covered with water when the engine stops, and all the pipes and branching arms connected with the condenser, are constantly so immersed in water that it is impossible for air to work its way into any of these parts.

With the view of holding a good vacuum while the engine stands still, I propose the following arrangement for the eduction pipe, and its connection with the steam cylinder. Let I represent that part of the eduction pipe B which is nearest to the steam cylinder, and let the extension of the sheet iron case, F, F, which embraces B, and keeps it surrounded with cold water, be continued the whole length of the pipe I. The water should rise a little above and embrace the flanges, J, with which the steam pipe I is attached to the chest L, L, near the lower eduction valve of the cylinder. If the guard-valve K, at the bottom of that chest, be shut down as soon as the engine stops, and waste oil from the cylinder be allowed to flow upon the valve and its seat, (while the air pump is kept surrounded by, and immersed in, water,) whatever perfection of vacuum has been gained within the condenser tubes, can be held for any length of time.

Fig. 1 shows how the sides of the sheet-iron case, F, F, may be strengthened and stiffened by "corrugation."

Whereas, in the operation of tubular condensers, especially if the attempt be made to work without the injection of cold water, there is much difficulty found in effecting the instantaneous transmission of the caloric of the steam through the metal forming the tubes of the condenser, on account of the thickness of the metal, necessarily used, on the plans heretofore adopted, to secure the requisite strength for resisting the force of the atmospheric pressure, I claim—

The mode of constructing such tubes by which the two offices of resisting the atmospheric pressure and transmitting the caloric of the steam to the surrounding cold water through the intervening metal of the tubes, are separated, the pressure-resisting strength being gained from an interior tube of stiff metal, having innumerable holes punched through it, and this being surrounded by a water-tight covering of thin sheet copper, or other similar material, against the internal face of which the steam impinges by passing through the perforations in the strong inner tube, and is thus brought into the nearest possible contact with the surrounding cold water.

FRANKLIN G. SMITH.

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