No. 729,070. PATENTED MAY 26, 1903.

R. H. HORNBROOK.

STEAM CONDENSER.

APPLICATION FILED JULY 24, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

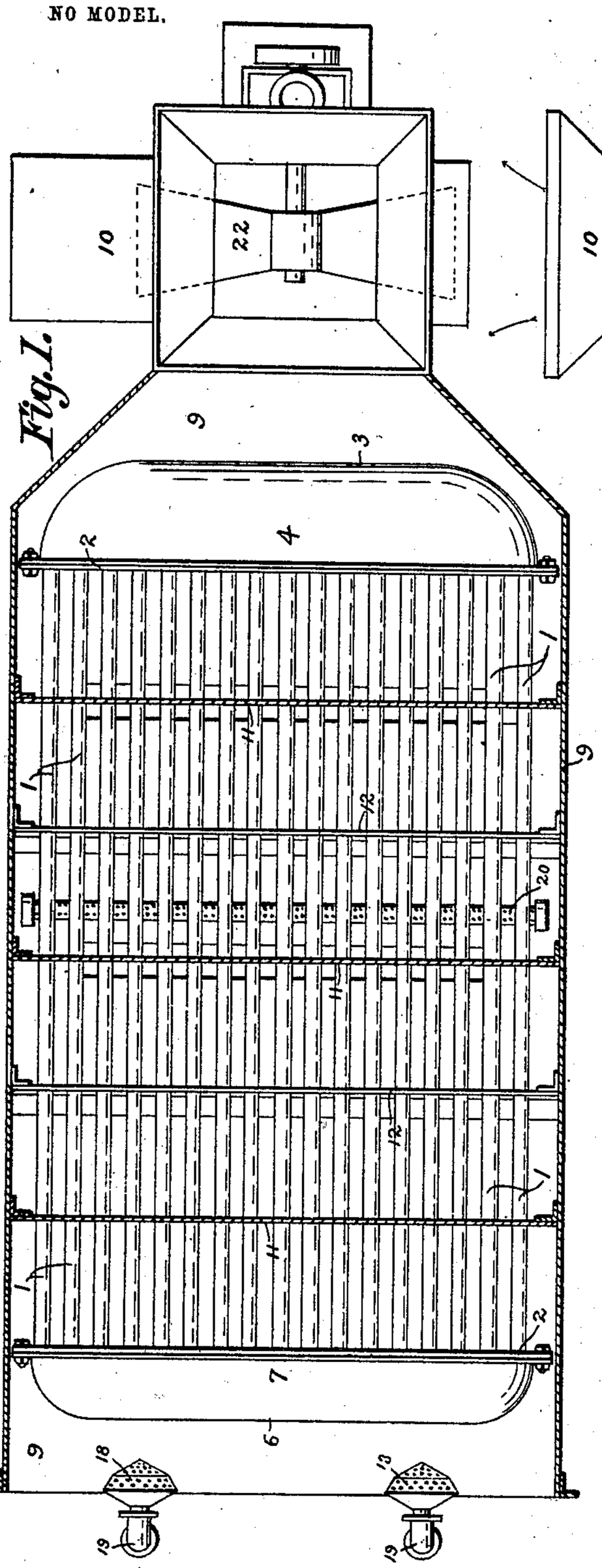
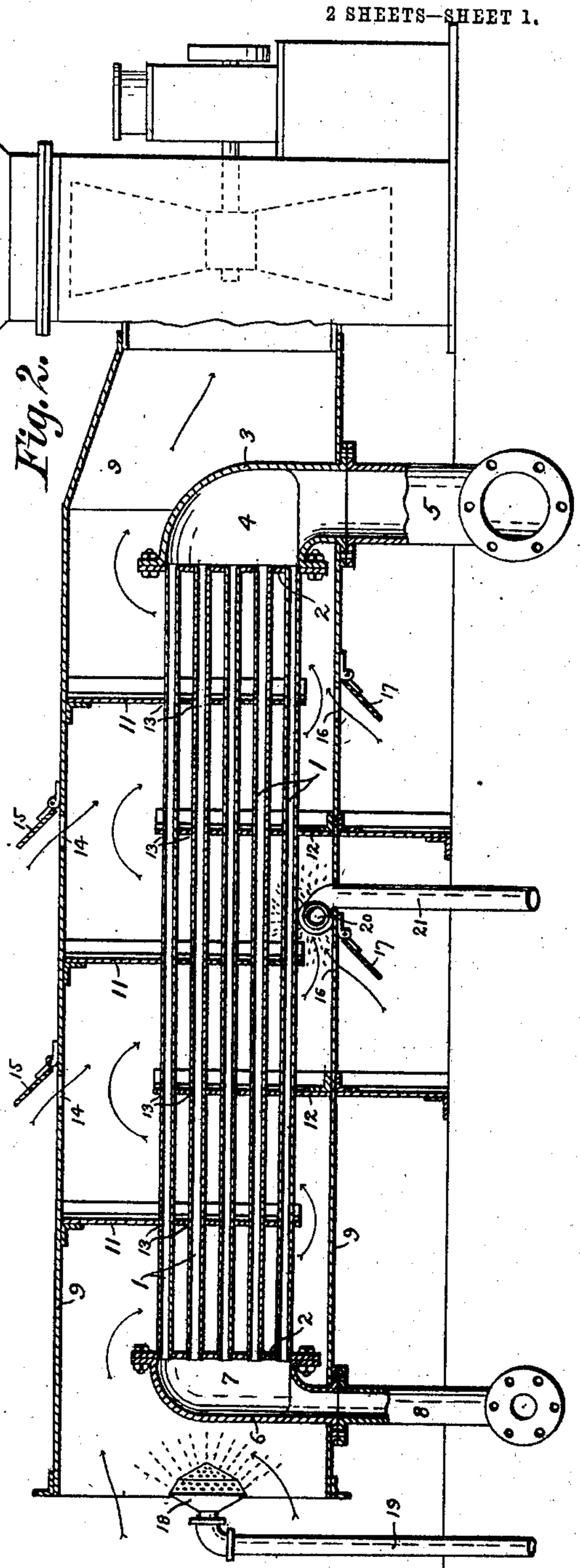


Fig. 2.



Witnesses;
Edward Uhlin
Joseph Frease.

Inventor;
Raymond H. Hornbrook,
By Harry Frease. Attorney.

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NO MODEL. 2 SHEETS—SHEET 2.

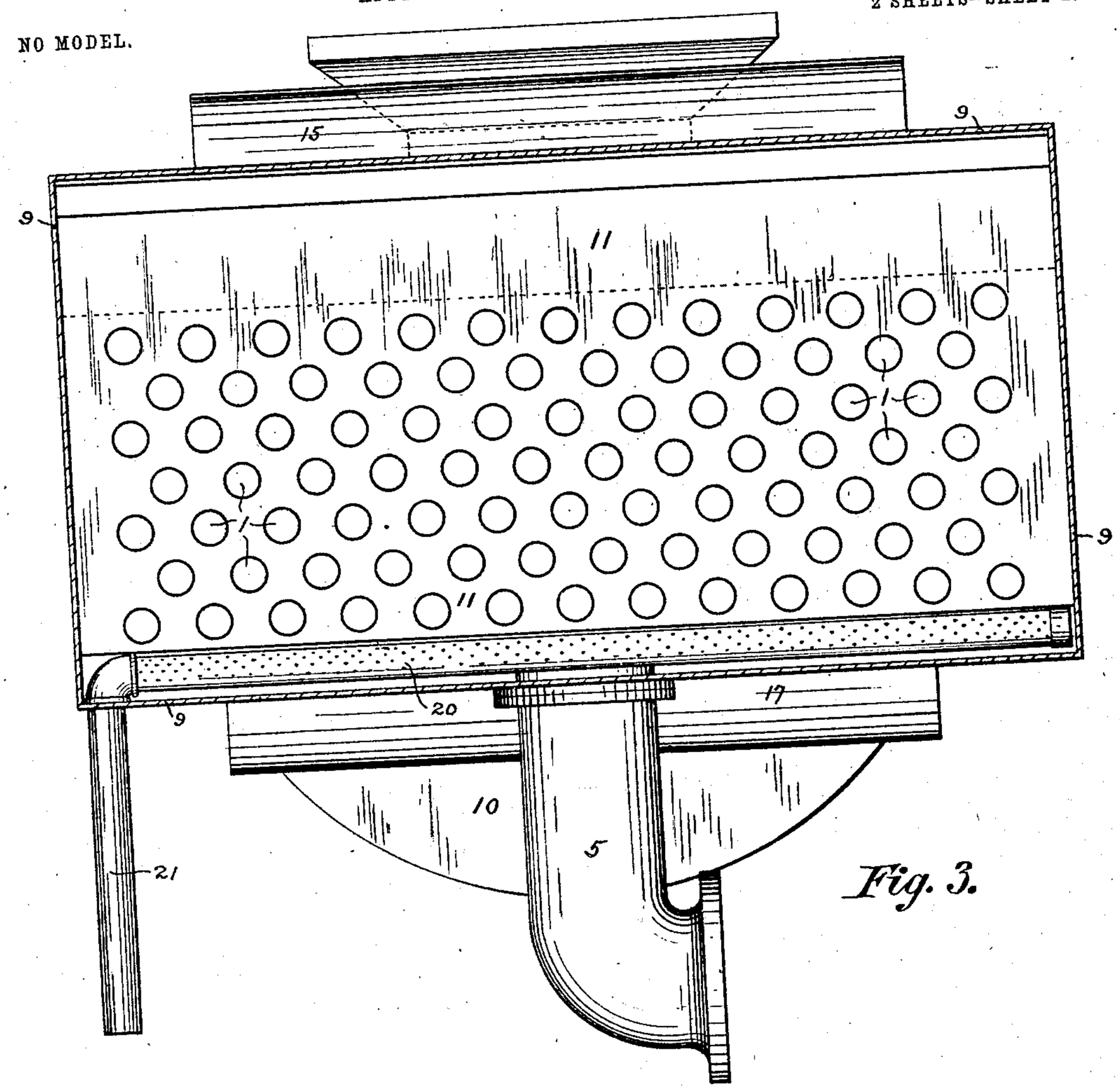

Fig. 3.

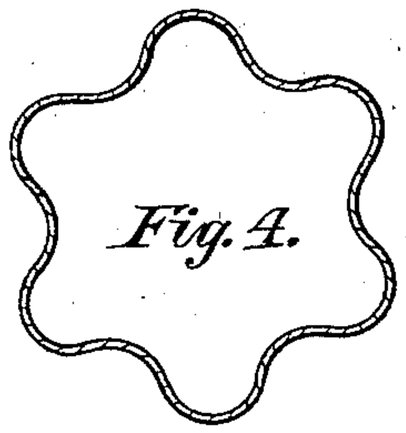

Fig. 4.

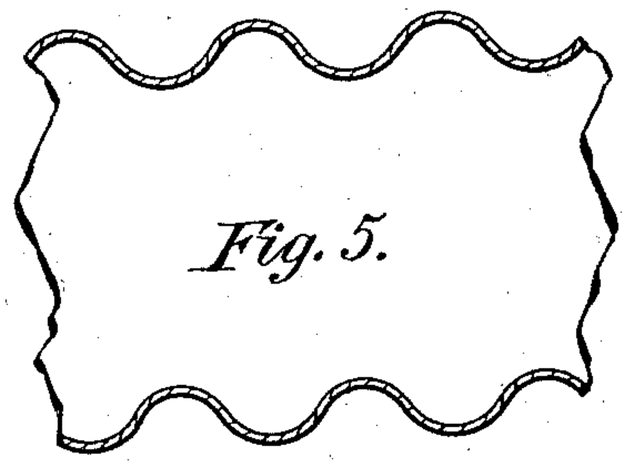

Fig. 5.

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UNITED STATES PATENT OFFICE.

RAYMOND H. HORNBROOK, OF CANTON, OHIO.

STEAM-CONDENSER.

SPECIFICATION forming part of Letters Patent No. 729,070, dated May 26, 1903.

Application filed July 24, 1902. Serial No. 116,761. (No model.)

To all whom it may concern:

Be it known that I, RAYMOND H. HORNBROOK, a subject of the King of Great Britain, residing at Canton, county of Stark, and State of Ohio, have invented a new and useful Steam-Condenser, of which the following is a specification.

My invention relates to an apparatus for condensing steam by passing it through relatively small tubes and cooling the same by currents of air, either dry or moistened, which process is made the subject of another application for patent; and the object of this invention is to accomplish the condensation by an induced draft around and among the tubes. I attain this object by the apparatus and mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of the condenser with the top of the case removed; Fig. 2, a vertical longitudinal section on the median line of the same; Fig. 3, a cross-section of an apparatus in which the tubes are staggered in reference to each other; Fig. 4, a cross-section of a corrugated tube; Fig. 5, a longitudinal section of a crimped tube.

The tubes 1 are preferably made quite thin and of a metal which conducts heat readily, and at either end of the tubes are the plates 2, into which the tubes are securely fastened, so there is no leakage of any sort. To the tube-plate at one end is securely joined, by bolts or otherwise, the head 3, forming the steam-chamber 4, to which is connected the steam-pipe 5, and to the tube-plates at the other end is similarly joined the head 6, forming the receiving-chamber 7, to which is connected the drain-pipe 8.

Steam-exhaust from an engine, a feed-water heater, or other source passes into the steam-chamber through the steam-pipe, from which chamber it is distributed through the respective tubes wherein it is condensed, whence the water or vapor accumulates in the receiving-chamber and passes off through the drain-pipe to an air-pump, a vacuum-pump, or other receptacle. To increase the surface of the tubes, they can be longitudinally corrugated, as shown in Fig. 4, or crimped, as shown in Fig. 5.

The case 9 entirely surrounds the tubes and the chambers at either end thereof, and one end of the case, preferably corresponding to the steam-chamber, is connected with the exhauster 10. The other end of the case, preferably corresponding to the receiving-chamber, is left open. Depending from the top of the case are the respective deflectors or baffle-plates 11, which preferably extend downward to include the lower tubes, but not to the bottom of the case, and projecting from the bottom of the case are the respective deflectors 12, which preferably extend upward to include the upper tubes, but not to the top of the case. Suitable apertures 13 are provided in the several deflectors for the respective tubes, whereby the deflectors serve as suitable supports for the tubes at intervals along the case.

The top and bottom deflectors are located alternately along the case, preferably about equal distances apart. Across the top of the case, preferably opposite the bottom deflectors, are provided the ports 14, which can be opened and closed by doors or dampers, as 15, and across the bottom of the case, preferably opposite the top deflectors, are provided the ports 16, which can be opened or closed by doors or dampers, as 17. Spray-heads 18 are located in the open end of the case, through which heads small jets of water can be distributed from the water-pipes 19, and a spray-pipe 20 is conveniently located in and across the case, preferably about its middle, through which pipe small jets of water can be distributed from the water-pipe 21.

To operate the condenser, the fan 22 of the exhauster is set in motion, and a strong current of air is thus drawn into the case at its open end. This current is conducted, as shown by arrows in Fig. 2, first against the receiving-chamber, thence over the same and diagonally downward around and among and impinging the respective tubes and under the first top deflector, thence diagonally upward around and among and impinging the respective tubes and over the first bottom deflector, and so on to and fro to the end of the tubes and over the steam-chamber, thence passing out through the exhauster. The current of air is reinforced and cooled by subcurrents, which are drawn in the case through the respective ports, as also indicated by arrows in

Fig. 2, so that the induced air-current is kept quite cool in its circulation around and among and impinging the tubes, even to the hot or steam end of the condenser. To further cool the air by evaporation, it is moistened by small jets of water from the spray-heads and the spray-pipe, respectively.

While I have illustrated and described the deflectors in the form of vertical partitions across the case, any other form of deflectors can be used which will guide an air-current through the case to and fro around and among and impinging the respective tubes without affecting the nature of my invention, and the ports in the case can be located wherever it is desired to reinforce the air-current within the case and keep it cool to the end of the tubes, and instead of locating the respective tubes in rows opposite each other, as shown in Figs. 1 and 2, the tubes can be so disposed that each tube in one row is opposite the space between tubes in the adjacent row, as shown in Fig. 3, thus exposing each individual tube more fully to the cooling medium.

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

1. The combination of a steam-chamber connected with a steam-pipe, a receiving-chamber connected with a drain-pipe, and relatively small tubes connecting said chambers; a case surrounding said chambers and tubes, said case being open at one end and connected with an exhauster at the other end; and deflectors alternately depending from the top and projecting from the bottom of said case, said deflectors having apertures for said tubes to support the same.

2. The combination of a steam-chamber connected with a steam-pipe, a receiving-chamber connected with a drain-pipe, and relatively small tubes connecting said chambers; a case surrounding said chambers and tubes, said case being open at one end and connected with an exhauster at the other end; and deflectors arranged to guide an air-current to and fro around and among said tubes to impinge the same.

3. The combination of a steam-chamber connected with a steam-pipe, a receiving-chamber connected with a drain-pipe, and relatively small tubes connecting said chambers; a case surrounding said chambers and tubes, said case being open at one end and connected with an exhauster at the other end; deflectors arranged to guide an air-current to and fro around and among said tubes to impinge the same; and ports in said case intermediate its ends.

4. The combination of a steam-chamber connected with a steam-pipe, a receiving-chamber connected with a drain-pipe, and relatively small tubes connecting said chambers; a case surrounding said chambers and tubes, said case being open at one end and connected with an exhauster at the other end; deflectors arranged to guide an air-current to and fro, around and among said tubes to impinge the same; and means for spraying water in said case.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RAYMOND H. HORNBROOK.

Witnesses:

HARRY FREASE,

JOSEPH FREASE.