

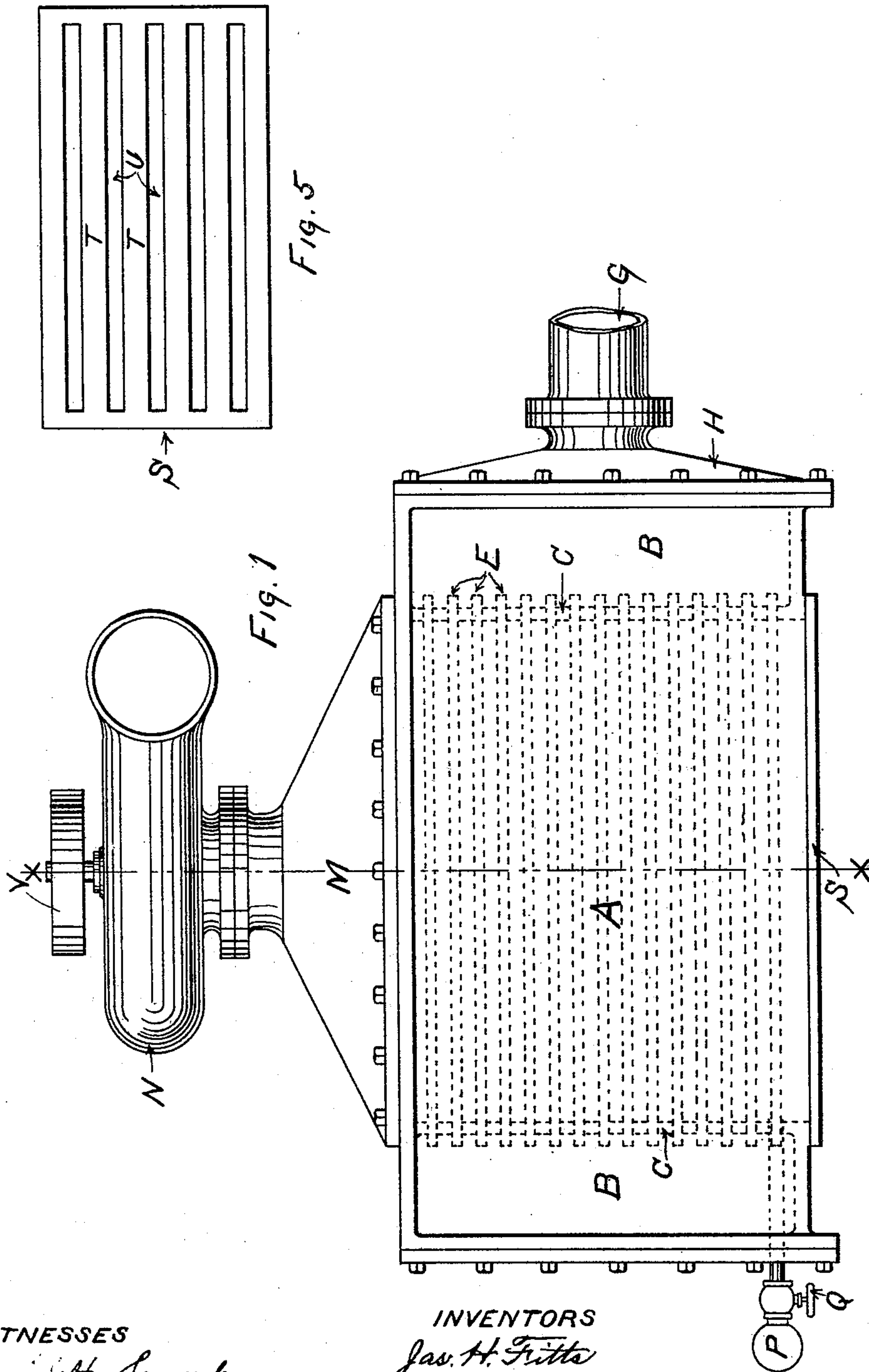
(No Model.)

3 Sheets—Sheet 1..

J. H. FITTS & W. E. ANDERSON.  
CONDENSER.

No. 500,196.

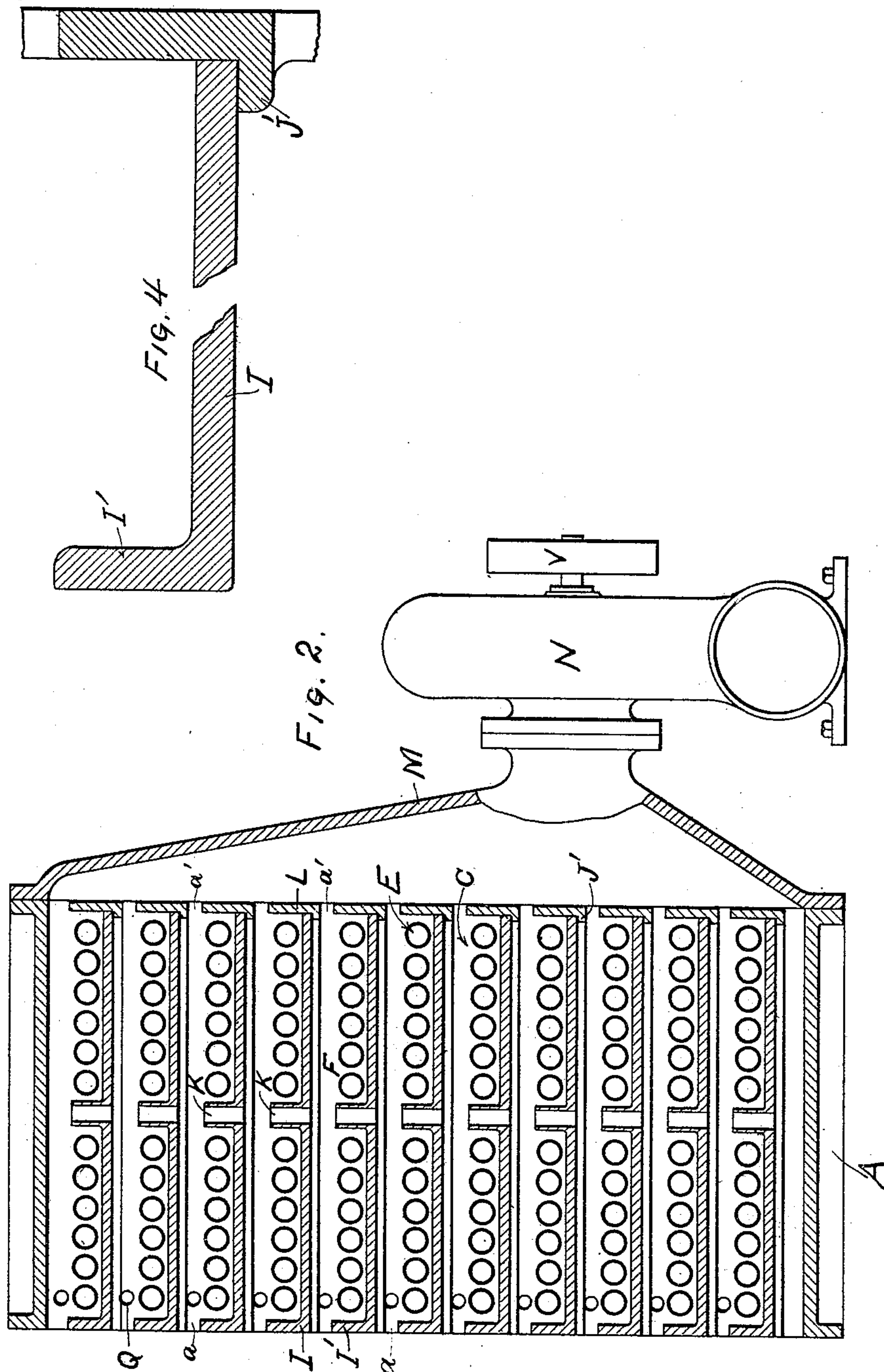
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WITNESSES

Henry W. Lowerby,  
Arch<sup>d</sup>. McLean.

INVENTORS

Jas. H. Fitts.  
 Wm. E. Anderson.  
 PER Geo. R. Ferguson,  
 ATTORNEY

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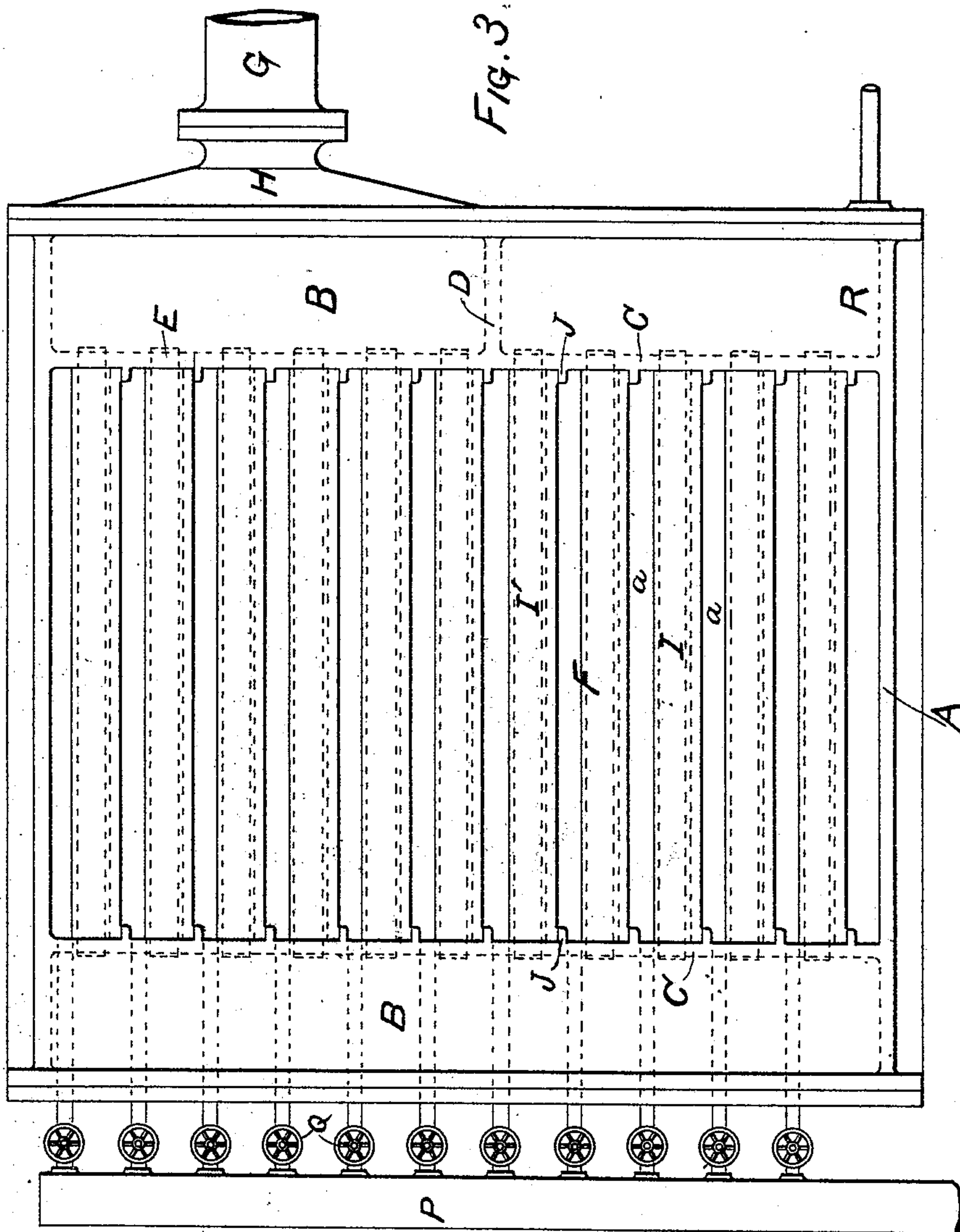
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# UNITED STATES PATENT OFFICE.

JAMES H. FITTS AND WILLIAM E. ANDERSON, OF BLACKSBURG, VIRGINIA.

## CONDENSER.

SPECIFICATION forming part of Letters Patent No. 500,196, dated June 27, 1893.

Application filed October 25, 1892. Serial No. 449,956. (No model.)

*To all whom it may concern:*

Be it known that we, JAMES H. FITTS and WILLIAM E. ANDERSON, citizens of the United States, residing at Blacksburg, in the county of Montgomery and State of Virginia, have invented certain new and useful Improvements in Condensers; and we hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to condensers for condensing the exhaust steam from engines and particularly for those which are to be used in situations where the water supply is limited.

The object of our invention is to construct a condenser in which the cooling effect of water surrounding the condenser tubes is heightened by means of the rapid evaporation of the cooling water effected by the employment of a draft of air over the surface of the water; and our invention consists principally of the convenient form of apparatus by means of which the above principle may be carried out.

An apparatus of the preferred form is disclosed in this specification and in the accompanying drawings, forming a part thereof, and in which—

Figure 1 is a plan of the condenser and its adjuncts. Fig. 2 is a vertical section on the line  $xx$  of Fig. 1. Fig. 3 is a front elevation, and Fig. 4 is a detail view of one of the cooling trays or pans in which the condenser tubes are immersed. Fig. 5 is a detail of a modification.

The condenser consists of a metallic box A, preferably rectangular in shape, having chambers B at the opposite ends formed by means of vertical partitions C. One of the chambers B is preferably subdivided into two chambers by a horizontal partition D. The two partitions C constitute the tube sheets into which are let the condenser tubes E by means of the usual steam tight packing joints. The tubes E traverse the space F between the tube sheets C, and the space F constitutes the cooling chamber.

G is the exhaust pipe leading the exhaust steam from an engine, and H is the connecting cap between the exhaust pipe and one of the chambers B. Between each horizontal

nest of tubes there are arranged horizontal trays or pans I in the space F. These trays extend completely across the space F and subdivide it in practically closed chambers or compartments. Each tray rests upon two side ledges J and a rear ledge J'. Each tray is provided with an upwardly turned flange I'; so that the trays resemble an ordinary drawer with only a bottom and front piece, the remaining three sides being absent. These trays may be made of metal, but we prefer to make them of a porous substance, such as sheet asbestos or burned porous earth for a reason which will appear hereinafter. These trays may be further braced or supported by means of longitudinal braces lying between the tubes, if desired, or found necessary to support them. The trays may be packed at their joints with the ledges; but, as absolute water tightness is not necessary, packing may be dispensed with. Each front piece I' of the trays is made of a height somewhat less than that of the opening which it partially covers in the front of the condenser so as to leave an opening or air space  $a$  above it. Each tray is provided with a suitable overflow outlet K to regulate the height of water in the trays.

The rear wall L of the condenser is provided with openings  $a'$  opposite the openings  $a$  and in the same planes therewith.

M constitutes a cap or conduit extending from the rear wall of the condenser to the suction or delivery side of an air pump N, which is preferably a rotary pump, operated by a belt pulley, V.

P is a water supply pipe or tank, and Q are valved pipes leading therefrom to each of the trays to supply them with water.

R is a hot well into which the condensed steam falls and from which it is removed by the ordinary air and feed pump, to be returned to the boiler.

The operation of our condenser is as follows: The steam coming into the exhaust pipe G, enters one chamber B and is distributed through the tubes E. Water from the supply P comes by pipes Q and fills the trays so as to cover the tubes; its height being regulated by means of the overflow pipes K. The steam passes through the upper rows of tubes, which are above the partition D and is par-



tially condensed and then enters the other chamber B and passes back through the tubes which are below the partition D, and the condensed steam falls into the hot well to be removed by the usual vacuum and feed pumps and passed to the boiler. The tubes E may be vertically inclined, if desired, to favor the flow of the condensed steam. While the steam is passing through the tubes and is being condensed by the surrounding water in the trays, this cooling water is itself cooled by the partial evaporation thereof produced by a blast of air passing in through the openings *a*, across the surface of the water in the trays, and out at the openings *a'* into the pump; or in a reverse direction, if a blower be used. When the trays are made of porous material, the water oozes through the bottoms thereof and the lower sides are therefore also wetted surfaces exposed to the air draft, and the temperature thereof is also decreased, thus adding to the efficiency and extent of the cooling surfaces for the cooling water and the steam tubes immersed therein. The supply of water to each of the trays can be regulated by properly adjusting the valves in the supply pipes Q. If desired, the front pieces I' of the trays I may be dispensed with, and in place thereof may be fitted a gridiron cap or plate S; as shown in Fig. 5, in which the bars T serve to take the place of the front pieces I', and the spaces U, between the bars, constitute openings corresponding to the openings *a*. This cap piece is bolted to the front of the condenser and may be removed when it is desired to remove the trays for cleaning them or replacing them by new ones.

While our invention is intended primarily to be used as a condenser for steam engines, it may also be used as a condenser in all kinds of distillation and sugar refining.

Having thus fully described our invention, what we claim as new, and desire to cover by Letters Patent, is—

1. In a condenser, a chamber containing tubes for the passage of a vapor to be condensed, with trays or receptacles for containing a cooling fluid in which said tubes are submerged, and means for producing an air current over the surface of the liquid, substantially as described.

2. In a condenser, the combination of a chamber containing a series of tubes for the passage of the vapor to be condensed, horizontal partitions between the several layers of tubes, constituting receptacles for a cooling liquid, in which said tubes are immersed; openings at one side of the condenser for admitting air to the surface of the water covering said tubes; openings in the opposite side of the condenser, opposite the first named openings; and means for causing a current of air to pass from the one set of openings through the other over the surfaces of the water to induce rapid evaporation and cooling thereof, substantially as described.

3. In a condenser, the combination of a condensing receptacle immersed in a cooling liquid, with means for producing an evaporating air current over the surface of the cooling medium to lower its temperature, substantially as described.

4. In a condenser, the combination of a chamber containing tubes for the passage of the vapor to be condensed, with removable trays in said chamber for containing a cooling liquid in which the tubes are immersed; and means for producing an evaporating air current over said liquid, substantially as described.

5. A condenser consisting of a receptacle for the condensation of a vapor, in combination with a receptacle containing a cooling liquid, in which the condensing receptacle is immersed; said cooling receptacle being made of a porous material so that the cooling liquid will percolate through, and means for producing an air current over the surface of the cooling liquid and over the moist lower surface of its receptacle, substantially as described.

6. In a condenser, the combination of a chamber, condensing tubes extending across the same, removable trays of a porous material containing a cooling liquid, in which said tubes are immersed, with means for producing an air current over the surface of the cooling liquid and over the bottom of the said trays, substantially as described.

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Witnesses:

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