

(No Model.)

2 Sheets—Sheet 1.

B. S. BENSON.  
SURFACE CONDENSER.

No. 346,348.

Patented July 27, 1886.

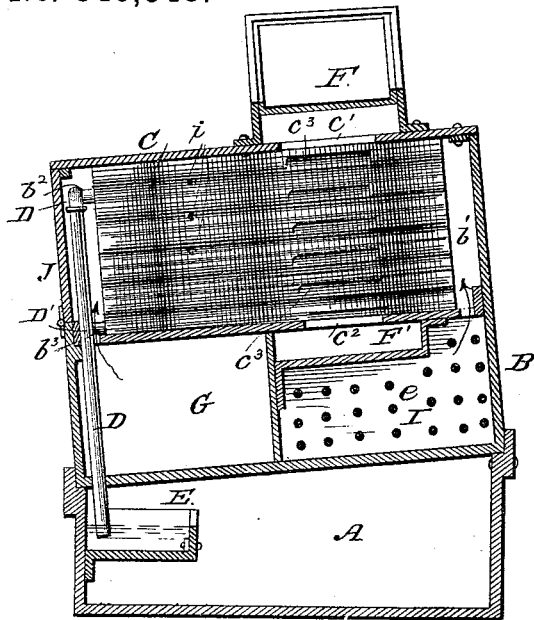


Fig. 1.

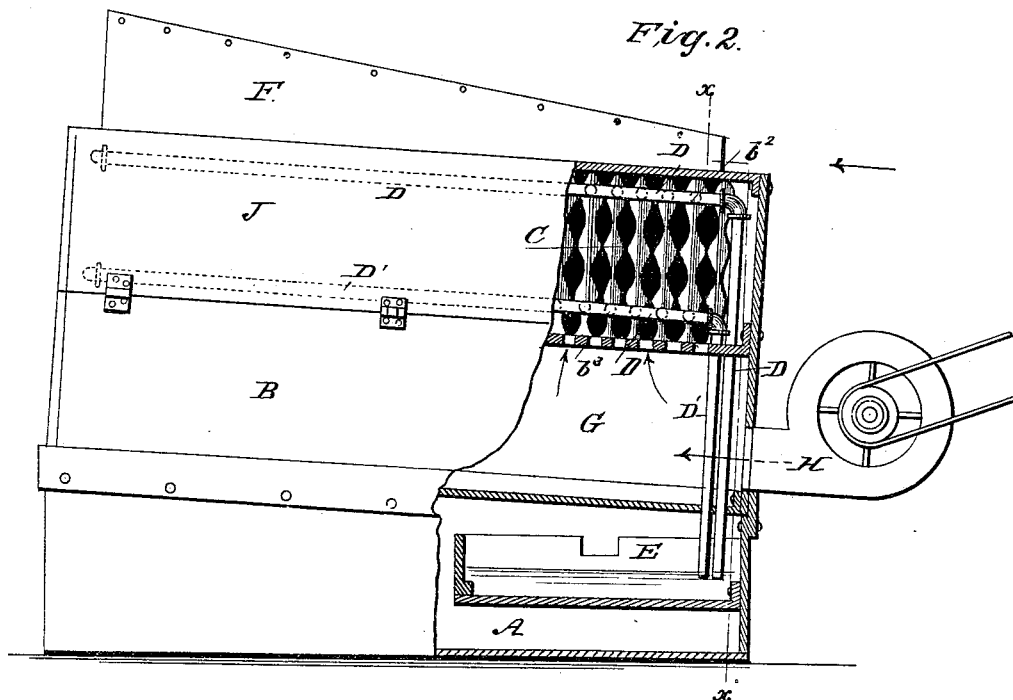


Fig. 2.

WITNESSES:  
*Fred G. Dieterich*  
*Edw. W. Byrnes*

INVENTOR:  
*B. S. Benson*  
BY *Munn & Co*  
ATTORNEYS.

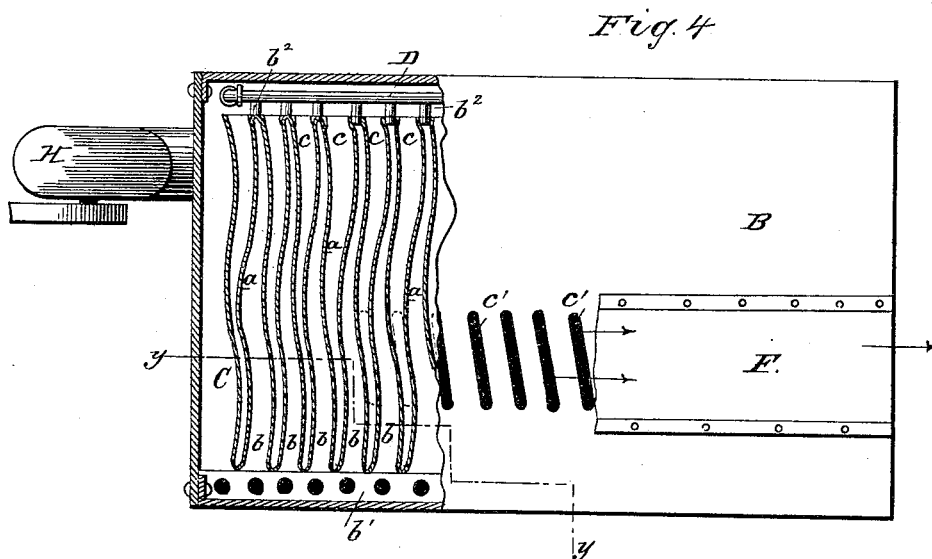
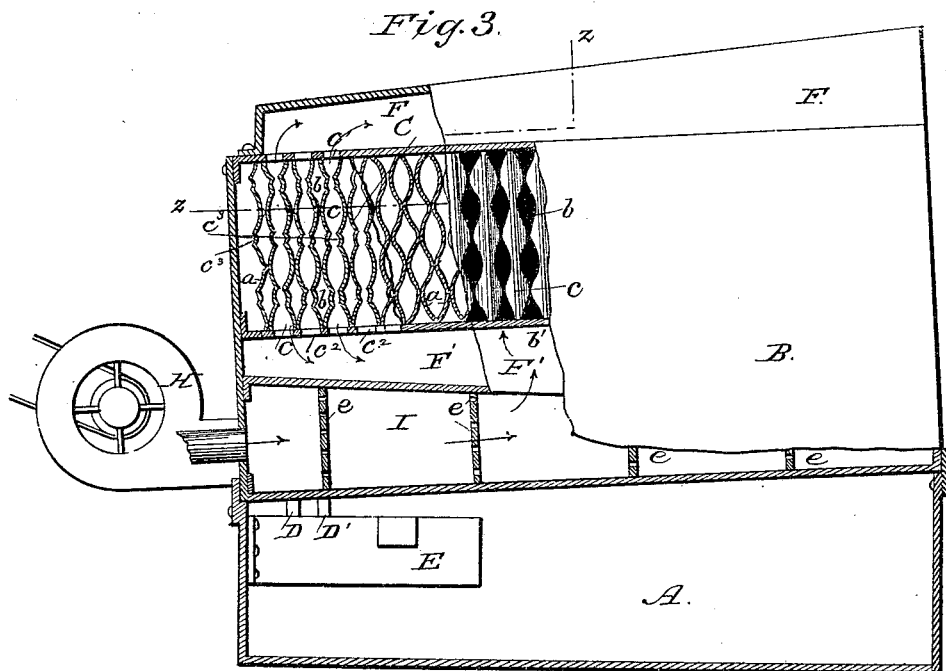
(No Model.)

2 Sheets—Sheet 2.

B. S. BENSON.  
SURFACE CONDENSER.

No. 346,348.

Patented July 27, 1886.



WITNESSES:

Fred G. Dieterich  
Edw. W. Byrnes.

INVENTOR:

B. S. Benson  
BY *Manna L*

BY *Mann & Co*  
ATTORNEYS.

# UNITED STATES PATENT OFFICE.

BENJAMIN S. BENSON, OF BALTIMORE, MARYLAND.

## SURFACE-CONDENSER.

SPECIFICATION forming part of Letters Patent No. 346,348, dated July 27, 1886.

Application filed March 29, 1886. Serial No. 197,067. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN S. BENSON, of Baltimore city and State of Maryland, have invented a new and useful Improvement in Surface-Condensers, of which the following is a specification.

Figure 1 is a vertical cross section through the line *xx* of Fig. 2. Fig. 2 is a side elevation with one end of the case in section. Fig. 3 is a side elevation from the opposite side with the lower part and left-hand side broken away through the plane shown by broken line *yy* of Fig. 4. Fig. 4 is a plan view with the left-hand portion in section through the broken line *zz* of Fig. 3.

The object of my invention is to provide a surface-condenser for condensing the steam of steam-engines, and which is especially designed for steam traction-engines, such as are designed for plowing the western prairie, where the scarcity of water makes the saving of the water by condensing the steam a consideration of great importance.

My invention adapts the principle of condensing the steam between thin plates or laminae, forming alternating steam and air chambers, into which air-chambers air is forced to cool the steam; and it consists in the peculiar construction and arrangement of parts, which I will now proceed to describe.

In the drawings, A represents the base of the condenser, which is in the nature of a case or tank, which forms a reservoir for the condensed water, and from which the water is taken by pumps and fed again to the boiler. This base is lower on one side and end (see Figs. 1 and 3) than on the other, and has around its upper edge a flange that forms a seat, into which fits the main case B of the condenser, which by the construction of the base is thus held in an inclined position to facilitate the drainage of the condenser-cells, hereinafter described.

C is the condenser proper, which is composed of a great number of thin parallel plates of brass or other metal, which rest in a vertical plane, and which plates run transversely to the case B, leaving, however, space at both ends between the condenser and its case for the admission of the steam and discharge of water, as hereinafter described. The plates *a*

of the condenser are corrugated horizontally, and are fastened together, by solder or otherwise, in such relation that the hollows of the corrugations of one plate face the hollows of the next adjacent plate, thus approximating the form of a vertical series of horizontal tubes. These plates, furthermore, instead of being fastened together in pairs, are connected so that while two plates may be connected together at one end said two plates at the other end are not connected to each other, but are joined to the next adjacent plates, thus forming a series of cells, which open alternately at opposite ends of the plates. Of these cells those marked *b* (see Fig. 4) are for steam, and those marked *c* are for air, the air serving to cool the plates, and thus condense the steam. The air therefore goes into these cells at one end of the plates or one side of the condenser, and the steam at the other. The steam-cells *b* open into a space, *b'*, at one side of the case B, and at the other side the said steam-cells have nipples *b<sup>2</sup> b<sup>3</sup>*, that open into horizontal pipes D D', that lead the condensed water down into a trap-chamber, E, in the base. The object of the upper pipe, D, is to permit any air that may get into the steam to also pass out, instead of collecting in the cells and choking the same. The pipes D D' are arranged horizontally in case B, but at the end turn down into vertical position and have their lower ends immersed in the water in the trap-chamber E. The air-cells *c* open at one end into a space around the pipes D D' to receive the air, which, after passing through said cells, escapes at openings *c' c<sup>2</sup>* at top and bottom into the hollow trunks F F' of the case B. To permit the air to pass through these holes *c' c<sup>2</sup>* from all the horizontal tubular spaces in the corrugated plates the corrugations have opposite these holes countersunk dents *c<sup>3</sup>*, which at this point form by corrugations of smaller size a vertical communicating passage between the cells, that allows the air to pass out from all of the flutes or hollows of the corrugated plates. The corrugations of the plates *a* are as so far described horizontal; but I prefer also to wave or corrugate the plates in their length, as in Fig. 4, as well as in their width, so that there will be a certain amount of spring or elasticity in the length of the plates to take

up expansion and contraction without buckling.

In making the corrugations which form the horizontal tubes it will be seen that these corrugations greatly stiffen the plates, and when they move endwise from expansion and contraction they are liable to buckle or strip their end connection; hence I wave the plates, so that a sufficient elasticity is allowed in endwise movement to overcome the difficulties mentioned, even though the plates be stiffened by the corrugations first named. At the side of the condenser where the pipes D D' are located the space about said pipes, it will be seen, is in communication with the air-cells of the condenser, and said space is also in communication with the horizontal conduit G in the bottom of case B, into which conduit a blast of air is forced by a blower, H, at the end, which blast of air circulates through the air-cells of the condenser, and after abstracting the heat from the steam escapes through the upper and lower trunks, F F'.

On the opposite side of case B from the air-conduit G is the steam-chest I, which receives the exhaust-steam, and which is divided into a number of compartments by perforated partitions *e*, which break the force of the exhaust-steam and prevent too great shock on the tender metal plates *a* of the condenser. This steam-chest communicates along the side of the case B with the steam-space *b'* at the open ends of the steam-cells *b* of the condenser, and through said cells the steam passes in opposite direction to the movement of the alternate currents of air.

On the side of the condenser-case B is constructed a hinged door, J, which may be let

down to give access to the pipes D and D'. The plates *a* are also formed with indentations *i*, to cause the flutes or hollows to remain in proper relation to each other without slipping.

Having thus described my invention, what I claim as new is—

1. The condenser C, composed of thin corrugated plates *a*, having their hollows fitted together to form tubular cells, opening alternately at opposite ends for air and steam, the alternate or air cells having openings *c'* *c''* and dented or countersunk corrugations *c''*, forming a communicating channel for all the tubes of the cells, substantially as shown and described.

2. The combination of the condenser C, with alternating air and steam cells opening at opposite ends, the inclosing-case B, leaving a space upon each side of the condenser, the pipes D D', air-conduit G, steam-chest I, and the air-trunks F F', substantially as and for the purpose described.

3. A condenser composed of corrugated plates placed together to form tubular chambers, said plates also being waved or corrugated at right angles to the longitudinal corrugations, substantially as and for the purpose described.

4. The combination, with the condenser and its case B, with drain-pipes, of the subjacent base A, having an inclined seat for the case made lowest at the end having the drain-pipes, and a seal or trap chamber for said pipes, substantially as shown and described.

BENJAMIN S. BENSON.

Witnesses:

MURRAY HANSON,  
WILLIAM H. BERRY.