

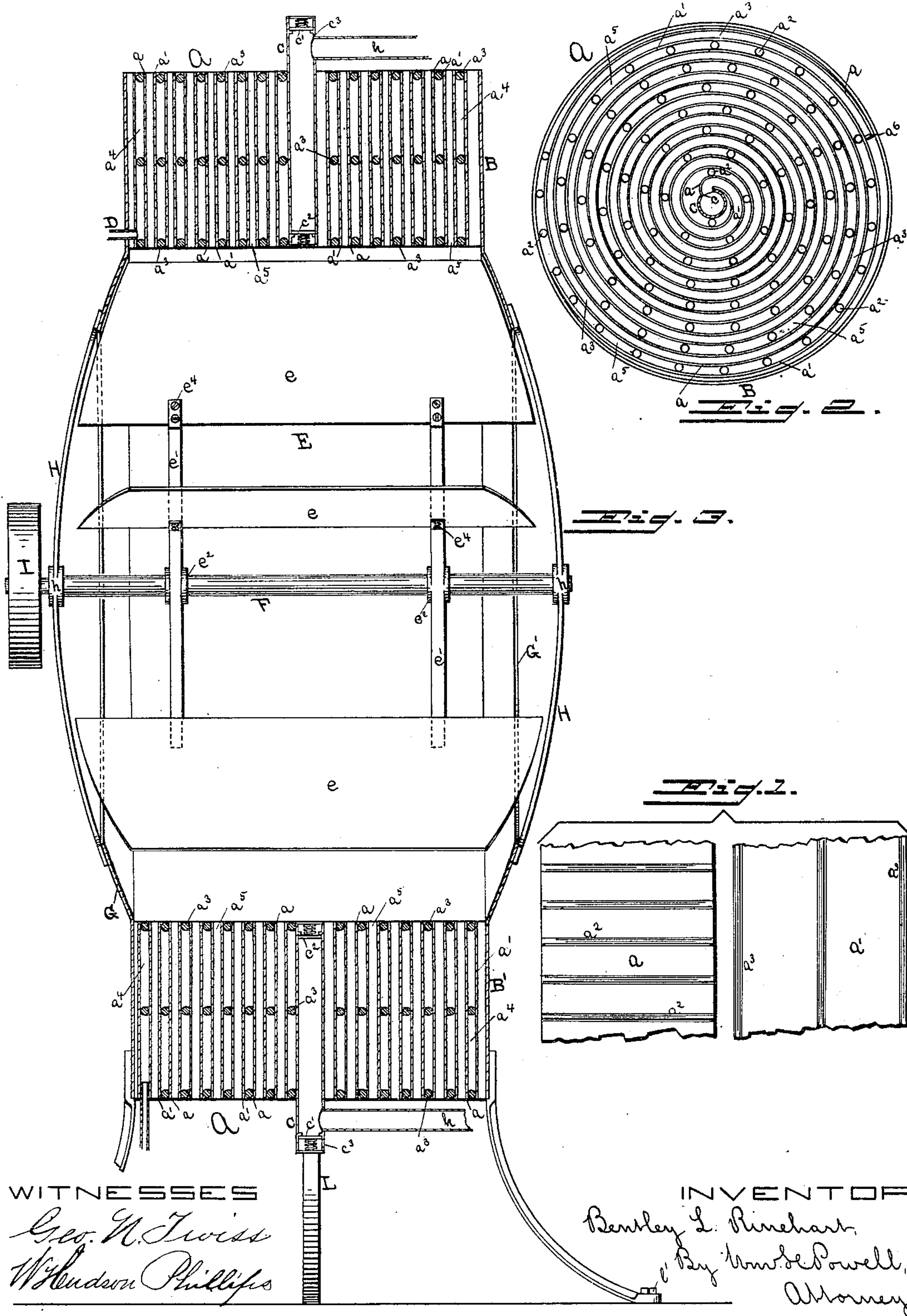
(Model.)

2 Sheets—Sheet 1.

B. L. RINEHART.
CONDENSER FOR EXHAUST STEAM.

No. 405,849.

Patented June 25, 1889.



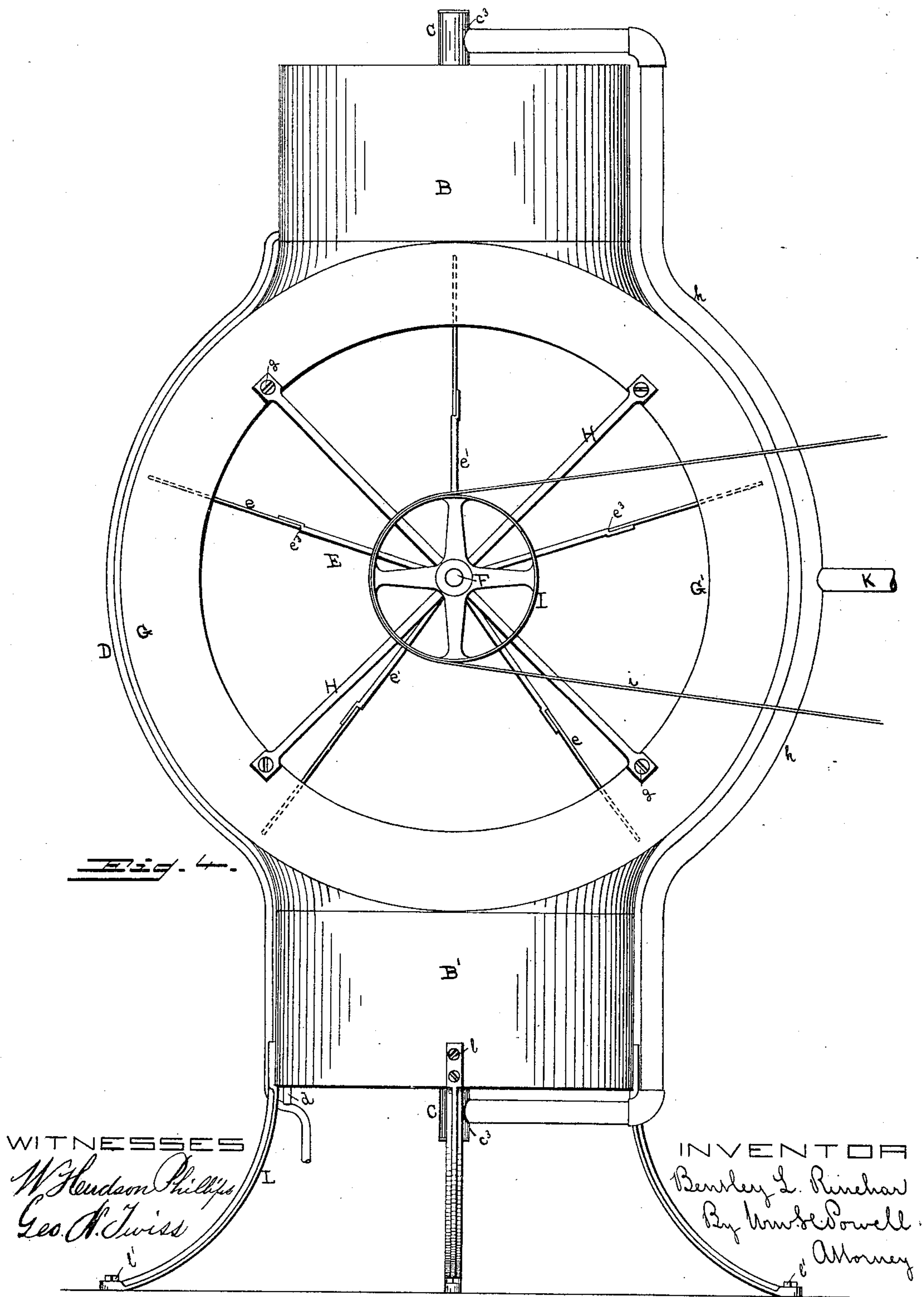
(Model.)

2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

BENTLEY L. RINEHART, OF CAMDEN, NEW JERSEY.

CONDENSER FOR EXHAUST-STEAM.

SPECIFICATION forming part of Letters Patent No. 405,849, dated June 25, 1889.

Application filed January 16, 1889. Serial No. 296,548. (Model.)

To all whom it may concern:

Be it known that I, BENTLEY L. RINEHART, a citizen of the United States, residing at Camden, in the county of Camden and State of New Jersey, have invented certain new and useful Improvements in Condensers for Exhaust-Steam; and I do hereby declare that the following is a full, clear, and exact description of the invention, reference being had to the accompanying drawings.

My invention has relation to apparatus for condensing the exhaust-steam of steam-engines, and has for its object to increase the efficiency and simplify the construction of such apparatus.

My invention consists in the provision of a pair of drum-casings having each on their insides two coils of thin metal, between the convolutions of which are secured alternating longitudinal and transverse partitions, the longitudinal partitions forming passages for the steam, which is led into said passages at the center of the coils, and the transverse partitions forming passages for cold air blown through said transverse passages by a rotary fan, this fan being arranged within a suitable casing secured in place between the drum-casings and receiving its motion from the engine or other source of power, the steam-supply to both drums being through a single pipe, as is also the outlet-pipe for the water of condensation, the above construction also having the usual safety-valves therein.

My invention further consists in the peculiar construction and combinations of parts, as hereinafter fully described and claimed.

Referring to the accompanying drawings, Figure 1 is a plan of sections of the strips of metal which form the coils. Fig. 2 is an end view of one of the drums with its contained coil, the steam-inlet being in section. Fig. 3 is a vertical transverse section of the complete apparatus, and Fig. 4 is an elevation of the same.

A A' represent the upper and lower coils contained within the casings B B' and composed of two long strips $a a'$ of sheet metal, preferably brass, one of which strips a has soldered or otherwise secured to it before coiling the short sections a^2 of wire, which are placed transversely thereon and a short distance apart, while the other strip a' is left

bare. These two strips $a a'$ are then coiled around each other. The bare strip a' , being the inner one, has soldered to its outer surface, while in process of coiling, the long sections of wire a^3 , there being one section on each edge and a third section in the middle. As the coiling of the strip a' progresses, the strip a follows said strip a' , and its inner surface, being opposite to that on which are secured the transverse sections a^2 , is soldered to the long sections a^3 . When this operation is completed, the result is the production of a double coil of sheet metal with two long and coiled steam-passages a^4 , and a great many short cold-air flues a^5 in transverse relation with said passages a^4 and on each side of the same between, as shown clearly in Figs. 2 and 3 of the drawings.

The inner ends of the strips $a a'$ are secured in a slit or opening c in the inlet-pipe C, which slit is of substantially the same extent as the width of said strips, and is wide enough to embrace the two strips and permit of the free entrance of steam into the steam-passages a^4 . The outer end of strip a' is left bare for a short distance where the same joins the casing B, and is bent inwardly at a^6 and soldered to the outer surface of strip a , closing up the end of the steam-passage and compelling the exit of the water of condensation through the outlet-pipe D. Pipe C is provided with a steam-valve c' and vacuum-valve c^2 as measures of security against accident, which valves are placed as shown, one at each end of said pipe C.

E is the fan for blowing the cold air through the flues a^5 , and consists of blades e , which are flat and similar to a paddle-wheel blade. These blades are sustained on arms e' , which arms are formed with collars e^2 for encircling the shaft F, and are suitably secured thereon. Blades e rest in offsets e^3 in the outer ends of arms e' , and are secured to said arms by screws e^4 . I have shown the fan as consisting of five blades; but of course any number of blades may be employed; also, any other form of fan may be employed without in any wise deviating from the principle of my invention. Shaft F is journaled in the hollow bosses h at the point of union of the spider-legs H, which legs are secured to the fan-casing G by the screws g . Fan-casing G, as

shown in Fig. 3, is shaped in cross-section like an ellipse with its extremities cut off or flattened. The ends of this casing are circular in form to correspond with the shape of the casings B B', and the casings B, B', and G may be formed of one piece, as shown in the drawings; or casing G may be formed with its outer circular ends of slightly-larger diameter than that of casings B B', in order to encircle the same and secure the casings in their relative positions.

On one end of shaft F is secured a pulley-wheel I, which receives motion from the engine or other motor through the belt *i* and transmits motion to the fan E. For the purpose of admitting a large quantity of air to the fan, there are formed in two sides of the fan-casing G, and concentric with the shaft F, two large openings G'.

As shown in the drawings, the casings B B', with their contained coils, are placed in such relation with casing G that the ends of the cold-air flues a^5 will be exposed to the interior of said fan-casing, and the air from fan E will have free and unimpeded passage through said flues.

K represents the exhaust-pipe leading from the engine and terminates in forked arms *k*, which follow the contour of the casings and connect with the outer ends c^3 of the inlet-pipes C, so that the exhaust-pipe branches and the coils A A' form practically one long exhaust-pipe. The outlet or water pipe D also follows the contour of the casings, a branch pipe *d* leading from the lower coil A' into pipe D, and the water of condensation from both coils passes through a single pipe directly to a suitable pump.

The entire apparatus is supported at some distance from the floor on legs L, secured to the lower casing B' by screws *l*, said legs being fastened to said floor by bolts *l'*. This is done so as to permit of the escape of air from the lower cold-air flues.

The peculiar shape of the fan-casing G permits of a very great swing of the fan-blades, and the shape of said blades, which follow the contour of said casing, and the large openings in the side of said casing permit of a greater quantity of air being drawn into the fan and forced through the air-flues than would be possible were the blades square on their edges and the opening small.

I have shown and described the steam and air passages as formed by the sections of wire, which is the preferred form in small condensers; yet, where the same are to be of large size, for use in connection with engines of great power, the heads of the steam-passages and the partitions therein and in the air-flues will be formed of strips of metal, as it would be impracticable to use bars of metal of sufficient size therefor.

With the above construction there is an unimpeded current of air through the flues and of such velocity as to insure a constant supply of cold air, and the steam passing or

circulating through the long and flat passages, affording a very large steam-surface to the cold air, is quickly converted into water. Each one of the many air-flues receives its supply direct from the fan-blades, thus dispensing with an air-chamber, as heretofore provided where a blower is employed. Neither is a water-tank necessary, as the water is taken direct from the water-pipe by the pump.

I am aware that it is not new to use cold air forced through air-passages for the purpose of cooling steam. Therefore I do not claim this feature, broadly.

While I have shown and described the use of two coils with a single fan, it might be found desirable to have only one coil, or, still further, it might be desirable to use more than two coils with a single fan. For instance, there might be one coil on each side of the fan-casing in addition to those at the top and bottom of said casing. The casings for these additional coils in that case would be secured in the same manner as those shown in the drawings.

What I claim as my invention is—

1. In a steam-condenser, the combination of one or more coiled steam-passages connected with a steam-supply pipe, provided with a water-outlet and encircled by transverse cold-air flues receiving air from a suitable fan, as and for the purpose set forth.

2. In a steam-condenser, the combination of two strips of sheet metal in concentric coils and secured at their inner ends to a steam-supply pipe, having in the alternate spaces between their convolutions transverse and longitudinal partitions forming cold-air flues and steam-passages, the latter being provided with a water-outlet with a suitable fan, as and for the purpose set forth.

3. In a steam-condenser, the combination of two or more steam-coils encircled by transverse cold-air flues and provided with steam-inlets and water-outlets, the casings of said coils being secured to the casing of a single rotary fan, said fan supplying cold air to the flues of all the coils, as and for the purpose set forth.

4. In a steam-condenser, the combination of coils A A', composed of strips *a a'*, and having the longitudinal and transverse steam and air spaces a^4 and a^5 , formed by the wire sections a^3 and a^2 , all contained within the casings B B', said steam-spaces being connected with steam-supply pipe C, valves c' and c^2 , and provided with water-outlet D, as set forth.

5. In a steam-condenser, the combination, with coils A A', composed of strips *a a'*, having longitudinal and transverse steam and air spaces a^4 and a^5 , formed by wire sections a^3 and a^2 , said steam-spaces being provided with steam-inlet pipe C, valves c' and c^2 , and water-outlet D, of a fan G supported on a shaft F, and having the arms *e'* on collars e^3 encircling said shaft, said arms having offsets e^3 , in which rest

the blades *e*, and screws *e*⁴ for securing said
blades thereto, shaft *F* being journaled in
bosses *h* on spider-legs *H*, secured to casing
G by screws *g*, and provided with pulley *I*,
5 receiving motion through belt *i*, fan-casing
G, having openings *G'*, coils *A* and *A'* being
connected to arms *k* of the exhaust-pipe *K*,
and casing *A'* being provided with legs *L*, se-
cured thereto by screws *l*, as and for the pur-
10 pose set forth.

In testimony that I claim the foregoing I
have hereunto set my hand this 14th day of
January, A. D. 1889.

BENTLEY L. RINEHART.

Witnesses:

WILL H. POWELL,
R. DALE SPARHAWK.

It is hereby certified that in Letters Patent No. 405,849, granted June 25, 1889, upon the application of Bentley L. Rinehart, of Camden, New Jersey, for an improvement in "Condensers for Exhaust-Steam," an error appears in the printed specification requiring the following correction, viz: In line 107, page 2, a comma should be inserted after the compound word "water-outlet"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 16th day of July, A. D. 1889.

[SEAL.]

CYRUS BUSSEY,

Assistant Secretary of the Interior.

Countersigned:

C. E. MITCHELL,

Commissioner of Patents.