

(No Model.)

2 Sheets—Sheet 1.

A. A. HUNTING.
PAPER DRIER.

No. 577,034.

Patented Feb. 16, 1897.

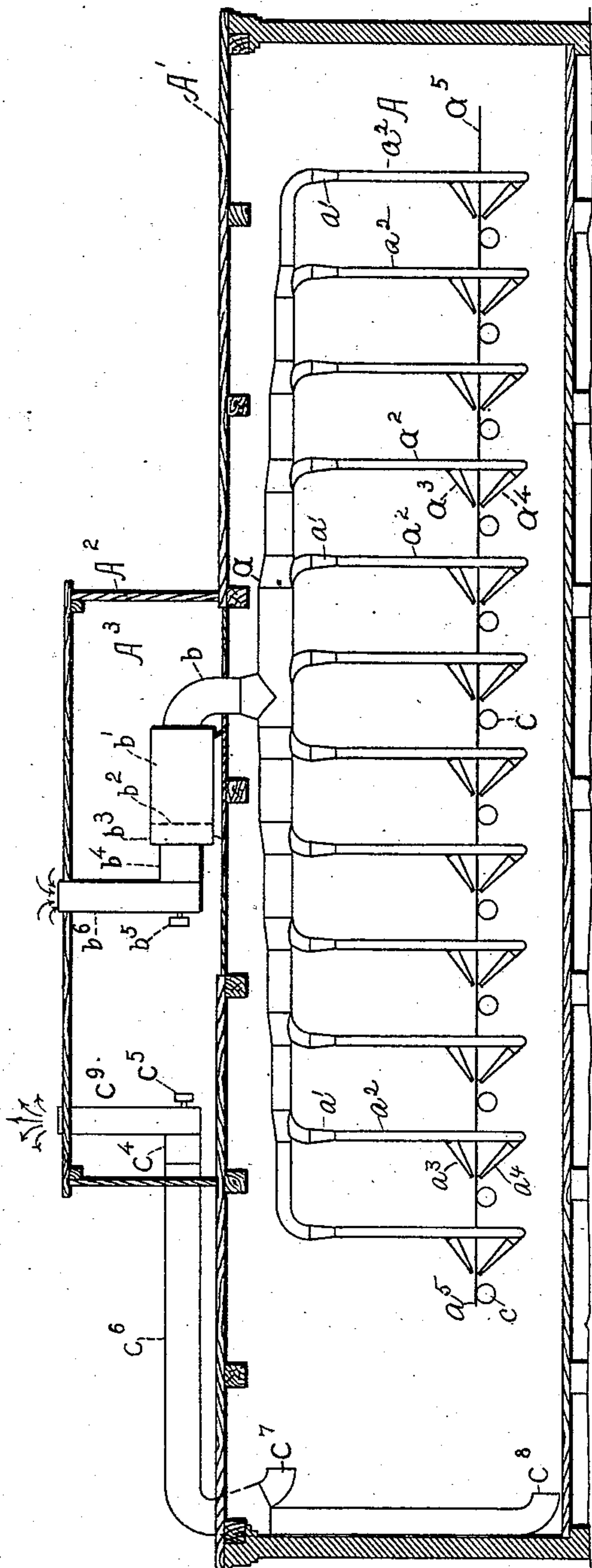


FIG-1

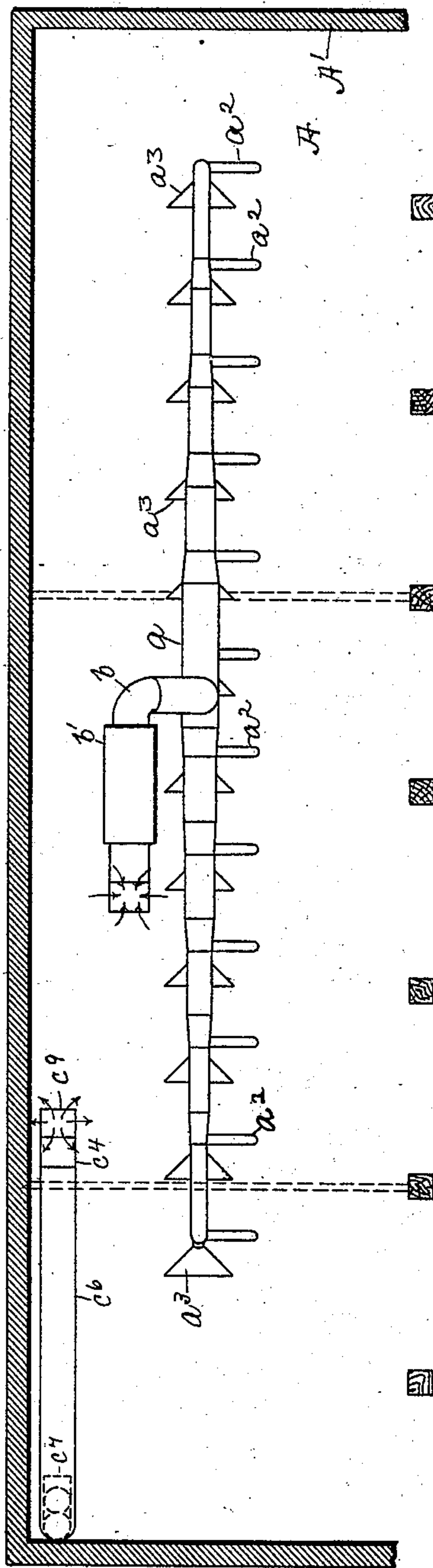


FIG-2

WITNESSES:

Walter L. Perry
J. Murphy

INVENTOR:

Alfred A. Hunting

BY

Jas. H. Churchill

ATTORNEY

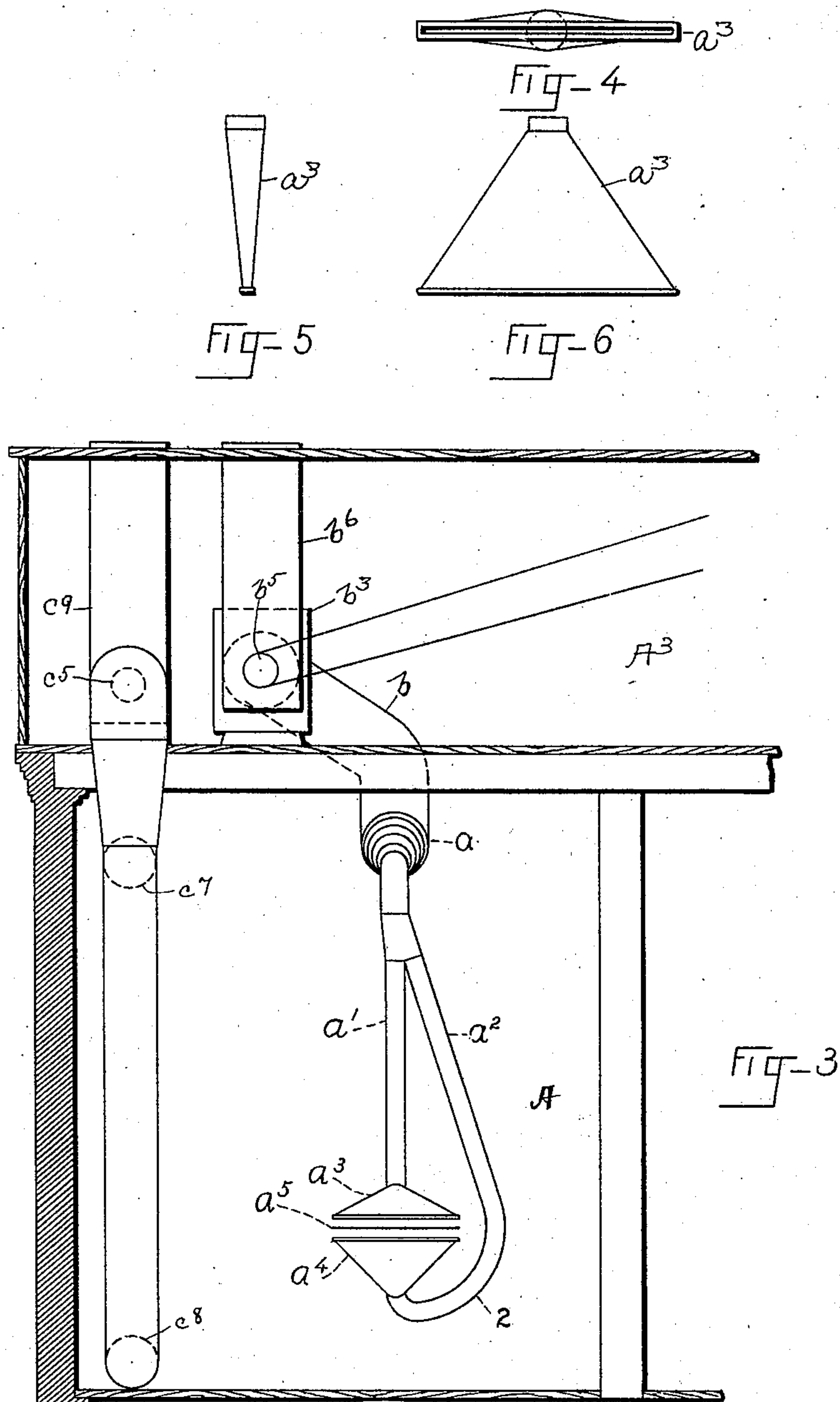
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UNITED STATES PATENT OFFICE.

ALFRED A. HUNTING, OF SALEM, MASSACHUSETTS, ASSIGNOR OF ONE-HALF
TO THE SMITH & ANTHONY COMPANY, OF BOSTON, MASSACHUSETTS.

PAPER-DRIER.

SPECIFICATION forming part of Letters Patent No. 577,034, dated February 16, 1897.

Application filed August 28, 1893. Serial No. 484,161. (No model.)

To all whom it may concern:

Be it known that I, ALFRED A. HUNTING, residing in Salem, in the county of Essex and State of Massachusetts, have invented an Improvement in Methods of and Apparatus for Drying Paper, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention relates to a novel method of and apparatus for drying paper or like fibrous stock. As now commonly practiced, paper-stock in the form of a sheet or web of varying thickness is exposed to heat in a chamber, usually a room of considerable size, into which air is admitted by natural draft, and which is commonly heated by steam-pipes arranged about the said room. This method of drying the paper, which depends upon heat alone, is defective, owing to the fact that the air in the chamber or room soon becomes saturated with moisture absorbed from the paper, which requires that the paper be left for a long time in the chamber or until the saturated air has been changed by natural draft or by a very high temperature in the room. This long exposure of the partially-dried paper web causes the latter to twist or curl, so that when the paper is thoroughly dried it is twisted out of shape and is cracked, split, or torn off, thereby occasioning a considerable waste, which in large mills is a very important item. This defective condition of the paper is due to the imperfect method of drying the paper; and it is the object of this present invention to obviate these defects, so that the paper may be thoroughly and evenly dried on both surfaces in a substantially short space of time and before it has a chance to twist or curl.

In accordance with this invention the wet paper-stock, which for the purpose of this invention may be supposed to be in the form of a web, is subjected to the action of air, preferably heated, and which is also preferably partially freed from moisture normally contained therein under atmospheric conditions, and in which freed condition the capacity of the air for absorbing moisture is greatly increased, the said air being admitted into the drying chamber or room at a sub-

stantially high velocity and distributed in a continuous transverse stream over both surfaces of the paper web at a plurality of points or stations and then exhausted from the said room at substantially the same rate and preferably at a greater rate than the said air is being admitted, whereby air at a substantially low temperature but at a substantially high velocity may be used. By this method the paper web is exposed to a current of non-saturated air, which is in the best condition to effect a thorough drying of the paper-stock.

The method just referred to may and preferably will be carried out with an apparatus substantially such as will be hereinafter specifically described.

Figure 1 represents in partial section and side elevation a drying chamber or room containing a paper-drying apparatus embodying this invention; Fig. 2, a top or plan view of the apparatus shown in Fig. 1, the chamber or room in which the apparatus is located being shown in section; Fig. 3, a side elevation of the apparatus shown in Fig. 1, the building or structure being shown in section; Fig. 4, an edge view of one of the air-delivery nozzles; Fig. 5, a side or end elevation of the nozzle shown in Fig. 4, and Fig. 6 a front elevation of the nozzle shown in Fig. 4.

Referring to Fig. 1, A represents the drying-room of a building or structure A' of any suitable or desired construction, the said building, as herein shown, supporting the walls A² of an auxiliary chamber A³. The room or chamber A has located within it the main portion of my improved drying apparatus, which consists, essentially, of a main distributing-pipe a, preferably extended in the direction of the length of the room A and having connected to it at suitable intervals apart branch distributing-pipes a' a², respectively provided with discharge-nozzles a³ a⁴, each having a continuous discharge slot or orifice. (See Fig. 4.) The branch distributing-pipe a² is extended downward below the nozzle a³ of the pipe a', so that its attached nozzle a⁴ is located below the nozzle a³ a suitable distance to afford a passage for the web or sheet a⁵ of paper or other fibrous stock to be dried, and the said pipe a² is, for the best results, of slightly-larger area than the pipe a'.

In the present instance the branch pipe a^2 is shown in Fig. 3 as curved at its lower end, as at 2, and is located at one side of the branch pipe a' .

5 The main distributing-pipe a has connected to it a plurality of the branch pipes a' a^2 , and the said main distributing-pipe is so proportioned as to deliver substantially the same amount of air at substantially the same velocity from the nozzles a^3 a^4 of all the branch pipes connected to it. The main distributing-pipe a has connected to it an air-supply pipe b , which in the present instance is extended up into the chamber A^3 and forms an outlet for a heater-chamber b' , within which may be located one or more coils of pipes connected to a suitable source of heat, and not herein shown. The heater-chamber b' may have secured to or forming part of it, but separated therefrom in suitable manner, herein represented by a dotted line b^2 , a chamber b^3 , within which may be located a condenser of any usual or suitable form, such, for instance, as a coil of pipes through which water is circulated, the said pipes being not herein shown. The condenser-chamber b^3 communicates with the discharge-outlet of a blower or air-forcing apparatus b^4 , which also may be of any usual or suitable construction, containing within it a rotary fan, which may be driven in any suitable manner, it being represented in the present instance as driven by a pulley b^5 on a shaft extended through the air-inlet pipe b^6 , the latter communicating with the atmosphere, it being herein represented as extended up through the roof of the auxiliary chamber A^3 . The main distributing-pipe a is made of decreasing area in cross-section from the point of its connection with the air-supply pipe b toward its opposite ends, as clearly shown in Fig. 1, so that substantially the same quantity of air will be discharged through the nozzles of the branch pipes connected to the main distributing-pipe near its center as will be discharged from the nozzles of the branch pipes connected to the main distributing-pipe near its ends, and as a result the web a^5 is subjected on both its upper and lower surfaces to the action of air-blasts uniformly and equally distributed against the surfaces of the paper throughout its passage through the drying apparatus.

The nozzles a^3 a^4 are preferably made of substantially the form shown in Figs. 4, 5, and 6, and are of substantially the width of the web or sheet to be acted upon, each nozzle having a continuous discharge slot or orifice extended across the paper web, so that the entire width of the paper on both surfaces may be subjected to a continuous stream of air, and as a result both surfaces of the paper are evenly dried.

The paper web or sheet a^5 , while the air-blasts are in operation, will be practically supported by the current of air on its under side, but I prefer to employ between each set of branch pipes a support shown as a roller

c , which may be rotated or driven by any suitable mechanism, and upon which the paper may rest in case of accidents or stoppage to the apparatus, as, for instance, in the case of the breaking of the paper sheet or web.

In operation the heated air issuing from the nozzles a^3 a^4 rapidly absorbs the moisture in the paper sheet or web, and in order to successfully dry the paper it is necessary that this air should be taken away from the presence of the paper before it is completely saturated. This fact is of vital importance to the successful accomplishment of a perfect drying of the paper in a substantially short space of time, and in order that the saturated air may be taken away from the sheet or web as fast as formed an air-exhausting apparatus is employed having a capacity equal to and preferably even greater than the air-forcing apparatus.

The air-exhausting apparatus may be an exhaust-fan of any usual or suitable construction, and is herein represented as a box or chamber c^4 , located in the chamber A^3 and containing a suitable fan driven, as herein represented, by a pulley c^5 , the containing case or chamber c^4 of the exhaust apparatus having its inlet port or opening connected by a pipe c^6 to branch pipes c^7 c^8 , communicating with the drying room or chamber A , preferably at both its top and bottom, the branch pipe c^8 being herein represented as communicating with the chamber at its bottom, and the branch pipe c^7 communicating with the said chamber at its top.

As represented in Fig. 1, the branch pipes c^7 c^8 are located within the chamber A , but it is evident that they may be located without the walls of the said chamber and communicate therewith through suitable openings.

The air-exhausting chamber c^4 has its outlet opening or port communicating with the atmosphere, it being herein represented as connected by a pipe c^9 , extended through the roof of the auxiliary chamber A^3 .

I prefer to employ a condensing apparatus in connection with the heater, as at certain seasons of the year the atmospheric air is heavily charged with moisture, which by means of a condenser can be reduced before being admitted into the drying-chamber; but I do not desire to limit my invention in this respect, as the use of the condenser may be dispensed with on days in which the atmospheric air is substantially dry.

I prefer to construct the apparatus as herein shown and to locate the heater b' and the condenser outside of the drying-chamber A , but I do not desire to limit my invention to any particular location of the said parts. Furthermore, I do not desire to limit my invention to the drying of the paper-stock in the form of a sheet or web, as it is evident the said stock may be loose and supported upon a suitable screen made to travel between the series of nozzles.

The discharge-slots of the nozzles a^3 a^4 are

made narrow, so that the air is projected from the said nozzles in thin streams or sheets which impinge on both sides of the paper at substantially diametrically opposite points with a twofold beneficial result, namely, first, the thin streams of air strike the paper web on opposite sides with substantially great force, thereby driving the sizing toward the center of the paper web and penetrating the pores of the paper web to such extent as to insure a rapid and complete drying of the paper; second, the thin sheet of air is projected with such velocity that it is not broken up or disturbed by the currents of air created by the exhaust apparatus, and as a result the thin sheet of air does its work efficiently and is influenced or acted upon by the exhauster only after it has performed its work on the paper.

I claim—

1. In an apparatus for drying fibrous stock in the form of a sheet or web, the combination of the following instrumentalities, viz: an air-forcing apparatus, a main distributing-pipe connected with the air-forcing apparatus and of varying areas in cross-section decreasing from the connection of the distributing-pipe with the air-forcing apparatus, a series of branch pipes connected to the main distributing-pipe at the junctions of sections of smaller area with sections of larger area, a series of discharge-nozzles connected to the said branch pipes in pairs located above and below the plane in which the paper web is moved, and each nozzle having a continuous slot or orifice extended transversely of the paper web and of a length substantially equal to the

width of the paper web, substantially as and for the purpose specified.

2. In an apparatus for drying fibrous stock in the form of a sheet or web, the combination of the following instrumentalities, viz: an air-forcing apparatus, a main distributing-pipe connected with the air-forcing apparatus and of varying areas in cross-section decreasing from the connection of the distributing-pipe with the air-forcing apparatus in opposite directions, a series of depending upper and lower branch pipes connected to the main distributing-pipe at the junctions of sections of smaller area with sections of larger area, and of substantially the same length, discharge-nozzles for each branch pipe arranged in pairs with the discharge-nozzles of the upper branch pipes in substantially the same plane and the discharge-nozzles of the lower branch pipes in substantially the same plane, with the discharge-mouths of the upper and lower nozzles of each pair in substantially the same vertical plane and of a length substantially equal to the width of the paper web, whereby the said web may be simultaneously acted upon at a number of points by a plurality of continuous streams of air striking the upper and lower surfaces in substantially the same vertical plane, substantially as described.

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

ALFRED A. HUNTING.

Witnesses:

JAS. H. CHURCHILL,
J. MURPHY.