

No. 612,944.

Patented Oct. 25, 1898.

F. A. COLBY, Dec'd.

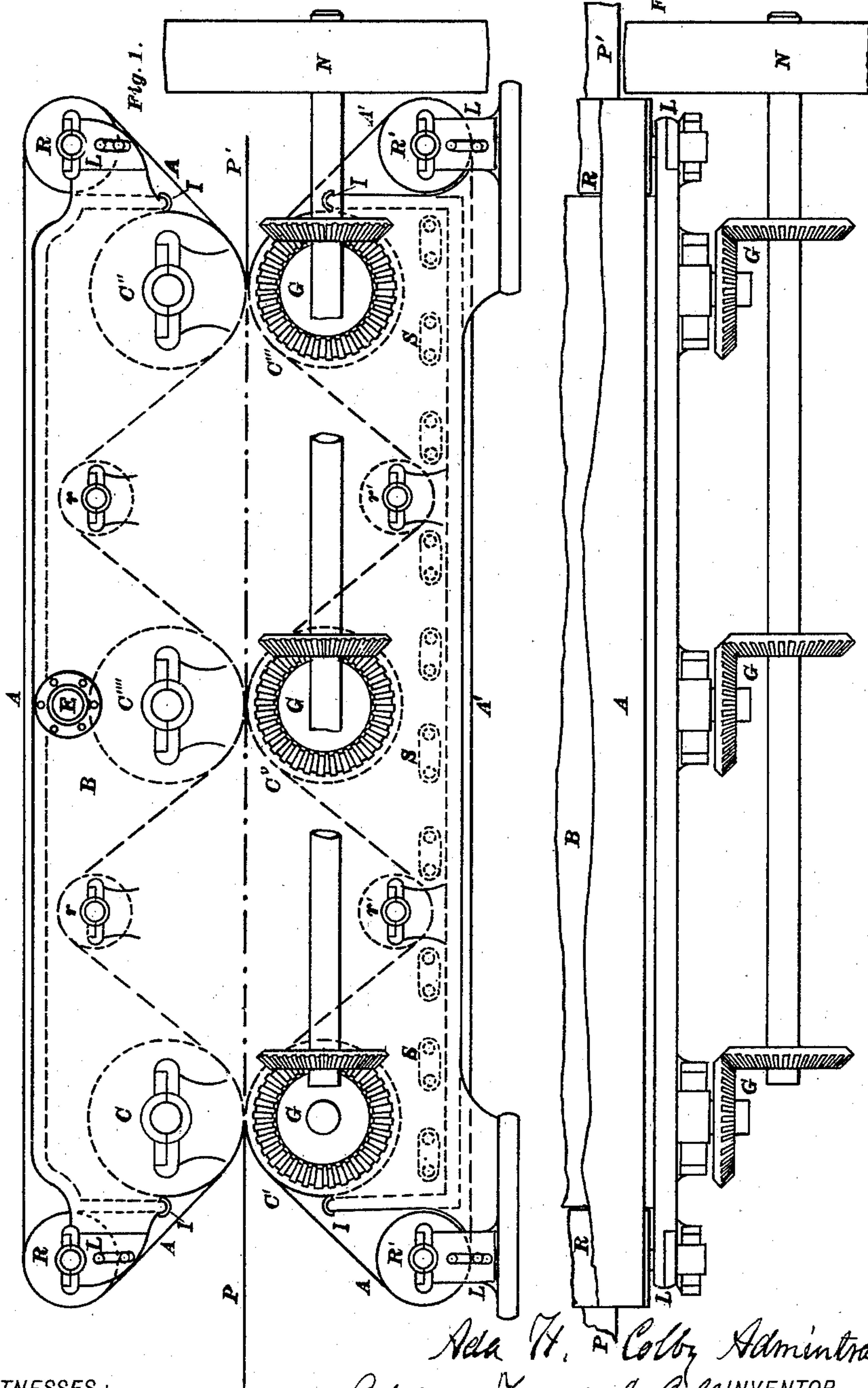
A. H. COLBY, Administratrix.

MACHINE FOR DRYING WEBS OF CLOTH OR PAPER.

(No Model.)

(Application filed Apr. 10, 1897.)

Fig. 2. 2 Sheets—Sheet 1.



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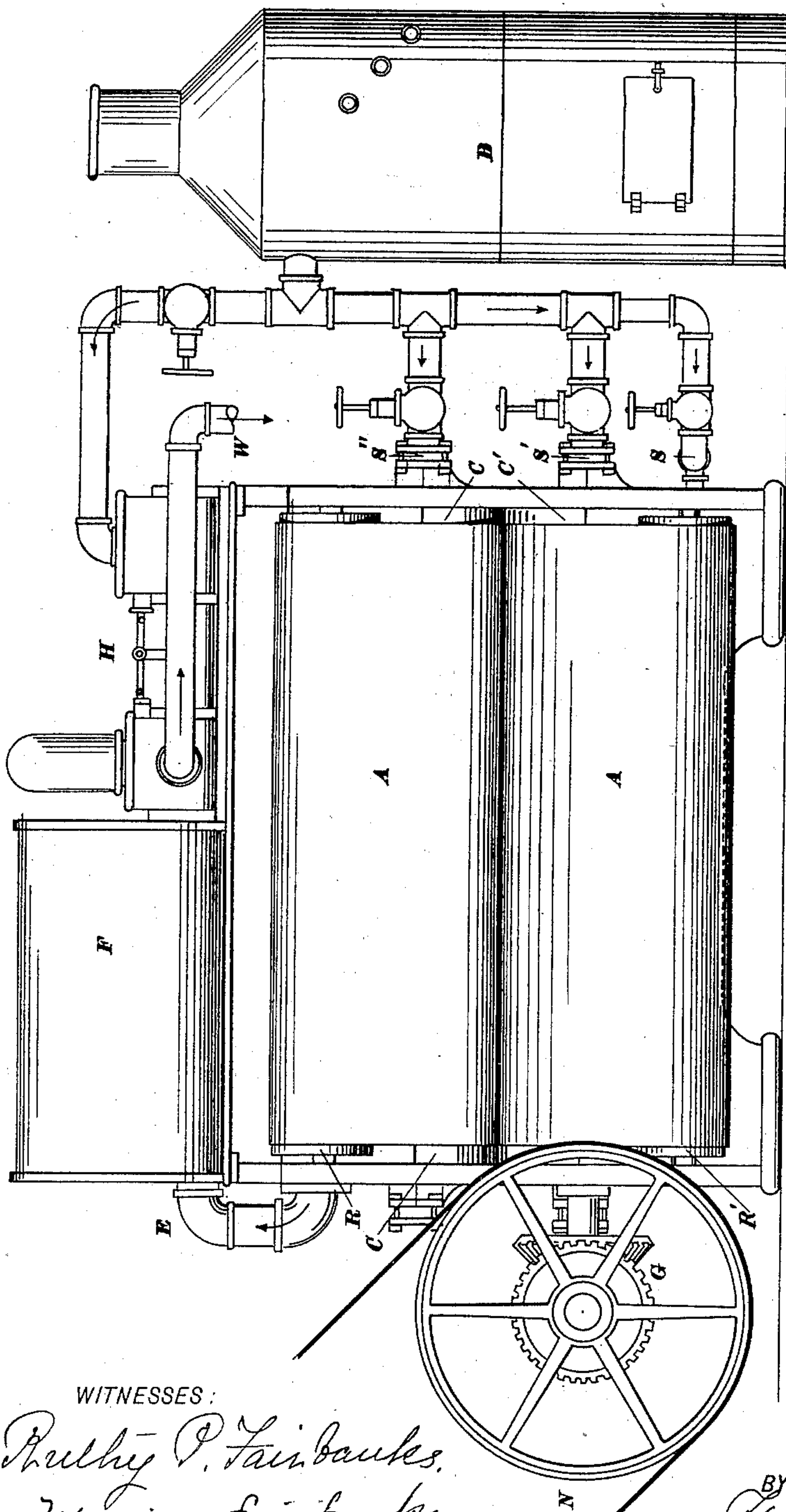


FIG. 3.

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UNITED STATES PATENT OFFICE.

ADA H. COLBY, OF BERLIN, NEW HAMPSHIRE, ADMINISTRATRIX OF FRANK A. COLBY, DECEASED, ASSIGNOR TO THE VACUUM DRIER COMPANY, OF VERMONT.

MACHINE FOR DRYING WEBS OF CLOTH OR PAPER.

SPECIFICATION forming part of Letters Patent No. 612,944, dated October 25, 1898.

Application filed April 10, 1897. Serial No. 631,506. (No model.)

To all whom it may concern:

Be it known that FRANK ARTHUR COLBY, late a resident of Berlin, in the county of Coos and State of New Hampshire, did invent certain new and useful Improvements in Machines for Drying Webs of Cloth or Paper, of which the following, taken in connection with the accompanying drawings, is a specification.

10 This invention relates to a means for drying yarn, cloth in the web, pulp or paper as it runs from the machine, leather-board, straw-board, and similar products. These webs have heretofore been dried in the air by passing them over steam-heated cylinders or drying-cans, and since too much heat would be injurious it has been necessary to provide a large amount of moderately-heated surface, making the machine very clumsy and expensive. The cloth to be dried is in long webs, and paper is run off from a paper-machine continuously, and the application of a vacuum to assist in the evaporation thereof is the problem which has been solved in this invention. In this invention the web is drawn continuously through a heated vacuum-chamber in which the atmospheric pressure is so much reduced that the water is rapidly vaporized and actually boiled out at a temperature that cannot injure the fabric. The vacuum must be maintained sufficient to be effective, and provision must be made for carrying the web in and out continuously without admitting air.

35 The machine devised for carrying out this invention in the most convenient way is understood to be a basic invention and a new article of manufacture. It consists of a closed chamber connected with an exhauster capable of removing at least half of the atmospheric pressure, heated preferably to less than 190° Fahrenheit, and provided with roller-gates through which the web to be dried may pass in and out. The exhauster may be the ordinary air-pump; but since there is more steam than air to be removed a condenser will more than double the efficiency of the exhauster and a comparatively small pump will suffice. The chamber may be heated by steam-coils or in any convenient way, and for some fab-

rics contact with the hot surfaces is not objectionable and cylinders heated from within may be used.

The most important new feature of this drier is the device which allows the web to be dried to pass into and out from the vacuum-chamber without admitting air to spoil the vacuum. At each end of the exhausted chamber is an opening in the wall, rectangular in shape, into which is fitted a pair of cylinders arranged to roll against each other, and with suitable packing to together close this opening practically air-tight. If the web to be dried is cloth, the single thickness will pass between the cylinders that loosely fit each other; but if a web of delicate paper, which when wet has little strength, is to be provided for it will be necessary to provide endless aprons of wire-cloth, duck, or felt to receive this web between them and to guide it through, and in that case the cylinders of the roller-gates must be set a little apart, so that the two thicknesses—namely, the two aprons and the paper between them—will just pass between without admitting air more than the little air-pump will readily remove. These aprons must of course be carried around outside of the chamber by suitable guide-rollers, which can also be used as tighteners, one apron passing above the chamber and the other below and arranged to receive the web between them where they come together and to deliver it at the other end of the chamber, where they separate. These aprons will absorb much of the water from the web squeezed between them by the rollers at the entrance, and the evaporation will take place from them as well as from the paper itself. To allow the steam to pass off freely, the two aprons are separated within the chamber by passing over rollers above and below the center, while the paper web may pass straight through. Preferably the cylinders of the roller-gates are heated from within through their journals, and a third pair so heated also placed in the middle of the chamber, so that the aprons and web are repeatedly squeezed between hot rolls and then separated to allow the steam to pass off, and the chamber is further heated by coils of pipe carrying steam,

or may be heated by these only, the cylinders not being arranged for internal heat.

In the drawings, Figure 1 is a view of the machine in elevation. Fig. 2 is a partial plan view showing one edge of the machine, the rest being represented as broken off; and Fig. 3 is an end view of the machine, showing the condenser, air-pump, boiler, and steam connections.

B represents the box or vacuum-chamber, connected by a pipe E with a condenser F and exhaustor H, driven by steam from the boiler D, the air and condensed water being discharged through the waste-pipe W. At the entrance of the chamber are the two cylinders C C', rolling together, packed against the walls of the chamber at I I, and intended to be heated through the hollow axles S' S'', as shown at the right hand of Fig. 3, the usual steam connections and siphon for removing the water of condensation being applied in the usual manner. At the other end of the chamber is another pair of cylinders C'' C''' and in the middle of the chamber still another pair, or, if needed, more than one pair, as C'''' C''. Over these pass the two aprons A A', meeting at the entrance roller-gates or cylinders C C' and separating at the similar roller-gates or cylinders C'' C''', being carried, the upper one A over guide-rolls R R and above the top of the chamber and the other one A' down over the rolls R' R' and below the bottom of the chamber. The rolls R R R' R' are made adjustable at L L to take up any slight slack in the aprons and to tighten one edge or the other to make them run true. Within the chamber and between the different pairs of cylinders the two aprons are made to separate by carrying them over small rolls r r r' r', so as to allow evaporation from between as well as from above and below them. The cylinders forming the roller-gates and those between are carried with equal velocity by the bevel gear-wheels G G G, connected upon a shaft driven by the pulley N. In addition to or instead of heating the cylinders from within by steam heating-coils S S S may be used. Between the two aprons and straight through the middle of the chamber the paper or other web to be dried is carried, squeezed between the cylinders at the entrance and giving up much of its moisture through capillary attraction to the two aprons, and heated to what in that rarefied air is practically the boiling-point, then having them separate from it, so as to allow free evaporation from all the surfaces, again squeezed between another pair of hot rolls, and again freed from contact with the two aprons, the web and the aprons will pass out through the roller-gates dry. If, however, this web is running too rapidly to be dried in so short a distance, the vacuum-chamber may be made longer and more pairs of hot cylinders be passed in its course.

It will be observed that by this invention the web itself does not touch the heated cyl-

inders, while the advantage of rapid heating is secured by the contact of the aprons and the surface of paper is not calendered, nor its fibers curled and weakened by the heat. It is also to be noted that provision is made for carrying the most delicate webs safely through, since in all close places they are between the moving aprons.

The drawing Fig. 1 shows the interior surfaces of the chamber and the surfaces of the cylinders and separating-rolls by plain dotted lines, the aprons within the chamber by lines of dashes, and the course of the web through the center by lines of dots and dashes.

It will be understood that this invention admits of much variety in the details of construction and that parts of the machine may be omitted or much changed without altogether destroying its efficiency, and it is not intended to limit the claims to a machine constructed precisely as shown. The machine may be used with or without a condenser, the chamber may be heated through the cylinders or by steam-coils below them, and the web and aprons may be carried by a course different from that illustrated; but the feature of the roller-gates cannot be dispensed with, and the machine as shown is believed to be the best form for carrying out the invention.

In case the material of the web shrinks much in drying it will be necessary to make the outlet roller-gate carry the dry web a little slower than the entrance roller-gate takes it in when wet. Since the endless aprons meet outside the vacuum-chamber and go through, the machine is adapted to carry through and dry not only webs and warps, but also short sheets, as of leather-board or strawboard, and also loose substances, as wool, hair, and the like. It is not intended to limit the machine to any single use.

It is of course understood that the journals of the cylinders and all parts that reach through the walls of the vacuum-chamber, as well as the roller-gates, are packed to prevent the entrance of air.

It is known that driers have been invented subjecting moving webs to an artificial blast of warm air, but it is believed to be new to carry them through a vacuum-chamber in which the temperature of the boiling-point of water is so reduced that the water is actually boiled out of the webs when they are heated only to some 180° or 190° Fahrenheit.

What is claimed is—

1. A vacuum web-drier, having a closed chamber, an exhaustor capable of removing at least half of the atmospheric pressure, means to heat said chamber preferably to less than one hundred and ninety degrees Fahrenheit (190° F.) and roller-gates arranged at the entrance and exit of said chamber to close the said chamber against the entrance of external air and to carry the web to be dried into and out of the machine, substantially as described.

2. A vacuum web-drier, consisting of a closed chamber communicating with an exhauster, means for heating the interior of the same, rolls in pairs rolling against each other, and suitably packed against the walls of said chamber, forming roller-gates through which the web may be rolled into and out from the chamber while these rolls with the web between them close the openings against the admission of air, and connecting mechanism, whereby the rolls of the said gates and all the parts in contact with the web to be dried are moved with the same surface velocity, substantially as described.

3. A vacuum web-drier, consisting of a closed chamber, connecting with an exhauster, means for heating the interior of the same, two rolls rolling against each other, suitably packed against the walls of the vacuum-chamber, driven by power, and adapted to carry the web between them into the said chamber without admitting air, and two similar rolls, similarly placed, and adapted to roll the said web out from the said chamber, substantially as described.

4. A vacuum web-drier, consisting of a closed chamber connected with an exhauster, means for heating the interior of the same, two rolls rolling against each other, suitably packed against the walls of the vacuum-chamber, and adapted to carry the web between them into the said chamber, and two similar rolls similarly placed, and adapted to roll the said web out from the said chamber, the said rolls being provided with hollow journals, and means to supply heat to the said rolls through their said journals, substantially as described.

5. In a vacuum web-drier, the combination of the vacuum-chamber, the heating-surfaces within it, the moving rolls in pairs, forming roller-gates, closing the entrance and exit of the said chamber against the pressure of the external air, and an exhauster, arranged for joint action, substantially as specified.

6. In a vacuum web-drier, the combination of the vacuum-chamber, the heating-surfaces within it, the moving rolls in pairs, forming roller-gates, closing the entrance and exit of the said chamber against the pressure of the external air, and a condenser and an exhauster arranged for joint action, substantially as specified.

7. In a vacuum web-drier, a closed chamber connected internally with an exhauster, means for heating the interior of the same, rolls in pairs packed against the walls of the vacuum-chamber, rolling against each other and forming roller-gates by which the web may be rolled into and out from said chamber, an endless apron passing through these gates, and through the said chamber, and adjustable guide or tightening rollers, substantially as described.

8. In a vacuum web-drier, a closed chamber connected with an exhauster, means for heating the interior of the same, rolls in pairs,

packed against the walls of the vacuum-chamber and rolling against each other, and forming roller-gates by which the web may be rolled into and out from the chamber, an endless apron passing through these gates and through the said chamber, and returning outside, and guide or tightening rollers, substantially as described.

9. A vacuum web-drier, comprising a closed chamber connected internally with an exhauster, rolls or cylinders heated through their journals and arranged in pairs, two pairs of such rolls forming the inlet and the outlet for said chamber, in combination with two endless aprons adapted to pass through the said chamber and be pressed between the two rolls or cylinders of each pair, and to receive the wet web between them as they enter the chamber, and to guide such web through this chamber, substantially as described.

10. A vacuum web-drier, comprising a closed chamber connected with an exhauster, rolls or cylinders heated through their journals, and arranged in pairs, two pairs of such rolls forming the inlet and the outlet for said chamber, in combination with two endless aprons arranged about said rollers or cylinders and adapted to pass through the said chamber and to return outside the said chamber, and to receive the wet web between them as they enter the chamber, and to guide such web through the chamber, substantially as specified.

11. In a vacuum web-drier, suitably exhausted and suitably heated, cylinders grouped in pairs and connected to rotate together for joint action, in combination with two endless aprons, arranged to come together where they are pressed between the two cylinders of each pair and being carried over small intermediate rollers to be separated from each other and from the web carried between them, in passing from one pair of cylinders to the next within the vacuum-chamber, substantially as herein set forth.

12. In a vacuum web-drier, a chamber, means to exhaust it, means to heat it, cylinders grouped in pairs and disposed in said exhausted and heated chamber, adapted to rotate together with equal surface velocity, two endless aprons adapted to receive the web to be dried between them, and arranged to come together where they pass between the two cylinders of each pair, and guide-rollers arranged in different planes from the plane of contact of the pairs of cylinders, and between such pairs of cylinders, so as to separate the aprons and their contained web at points between the said pairs of cylinders, substantially as described.

13. In a vacuum web-drier, the closed chamber B, connecting into the exhaust-conduit E, the roller-gates C, C', and C'', C''', packed at I against the walls of the chamber, in a way to exclude the air, while allowing the web which is to be dried to pass between them, the endless aprons A, A', passing together through

these gates, and arranged to carry the web between them through the chamber, and the guide-rollers R, R', R, R', over which these aprons are separately returned, substantially
5 as set forth.

14. In a vacuum web-drier, the closed chamber B, connecting into the exhaust-conduit E, the roller-gates C, C', and C'', C''', allowing the web and the endless aprons to pass, while ex-
10 cluding the air, the endless aprons A, A', the adjustable guide-rollers R, R', R, R', outside the chamber, and within, the separating guide-rollers r, r, r', r', arranged in pairs between

the pairs of pressing-cylinders, and roller-gates C''''', C'', C, C', &c., all arranged for joint 15 action, substantially as specified.

In testimony whereof I have signed my name as administratrix to this specification, in the presence of two subscribing witnesses, on this 2d day of April, A. D. 1897.

ADA H. COLBY,
Administratrix of the estate of Frank A. Colby,
deceased.

Witnesses:

HERBERT I. GOSS,
WILLIAM C. PERKINS.