H. LIEBECK.

MEANS FOR DRYING PAPER.

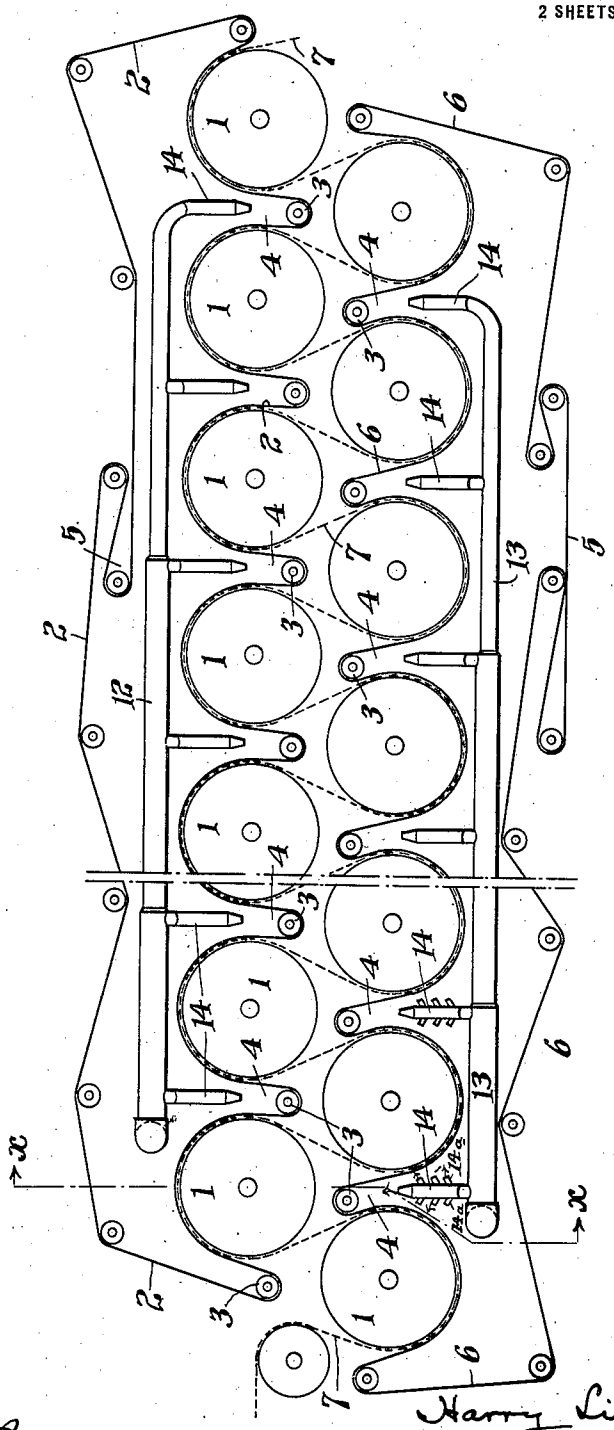
APPLICATION FILED APR. 28, 1915.

1,199,394.

Patented Sept. 26, 1916.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES

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E. W. Smith

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Harry Liebeck

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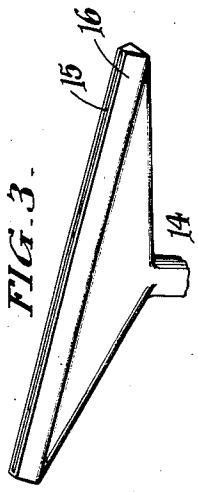


FIG. 3.

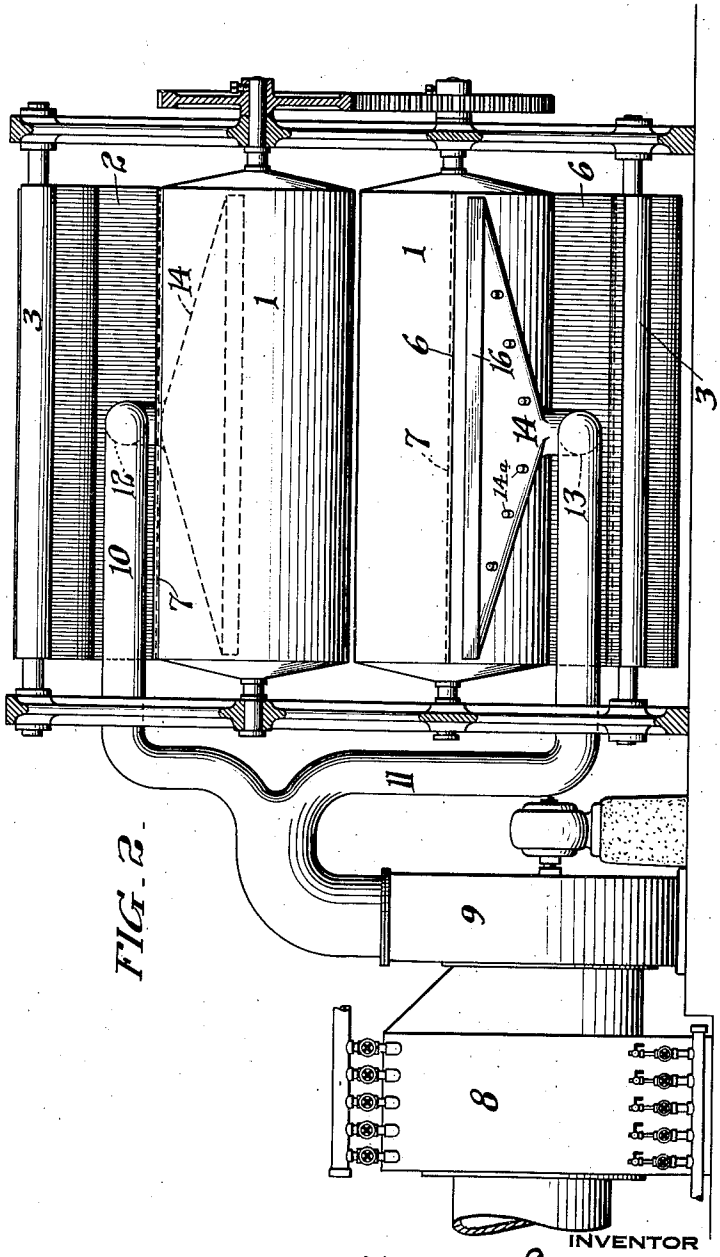


FIG. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

HARRY LIEBECK, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO SCOTT PAPER COMPANY, A CORPORATION OF PENNSYLVANIA.

MEANS FOR DRYING PAPER.

1,199,394. Specification of Letters Patent. Patented Sept. 26, 1916.

Application filed April 28, 1915. Serial No. 24,421.

To all whom it may concern:

Be it known that I, HARRY LIEBECK, a citizen of the United States, and resident of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Means for Drying Paper, of which the following is a specification.

This invention relates to paper drying machines and has for an object to provide a mechanism wherein the paper, entering the machine in the usual wet condition, passes over the drying cylinders in the custody of traveling felts, said felts being made to act as moisture absorbing pads with respect to the paper and arranged to be dried by currents of air, preferably heated, which do not impinge directly upon the paper.

In drying machines for paper making machines, as heretofore constructed, it has been the practice to pass the wet paper web through the machine in direct contact with the drying air blasts with the result that the moisture is driven off in the form of vapor and becomes re-absorbed by other parts of the web. It has been found that paper treated in this manner is dried too rapidly, and owing to the variations in its condition throughout the machine is subject to the blast pressure and liable to whip or vibrate and stretch unevenly as it is conveyed through the machine.

The present invention has been devised to overcome the foregoing defects and to provide a means embodying endless webs of air dried textile material such as felt, knit or canvas webs or the like; between which and the drying cylinders the paper passes and is dried by contact therewith. Further, these felt webs are so arranged as to form pockets between the drying cylinders into which the heated air is blown, and since a portion of the felt walls of the several pockets is out of contact with the paper, the tendency of the heated air blast is to blow through that portion and dry the felt before it comes again into contact with the paper to absorb more moisture.

A further object of the invention is to provide a plurality of nozzles for delivering heated air for drying purposes each nozzle having a relatively long narrow discharge opening extending substantially the width of the felt webs and arranged to project the heated air in a direction to impinge directly against the said felt at places where it is relatively free from the paper web.

More particularly, my object is to dry a porous paper in a rapid and thorough manner with the employment of a minimum number of drying cylinders, the drying taking place in a more or less uniform manner from start to finish; and in accomplishing this object I provide means for directly absorbing the moisture from the wet paper web during its passage about each of the drying cylinders and means for subjecting the absorbing means to a drying air blast at intervals to cause it to give up its absorbed moisture or a portion thereof at periods, more especially when the paper web is passing from one drying cylinder to the next in the series, whereby said absorbing means are maintained in effective operative condition for drying the paper web.

With the above and other objects in view, the nature of which will be more fully understood from the description hereinafter, the invention consists in the novel construction of paper drying machine as hereinafter more fully described and defined in the claims.

Referring to the drawings: Figure 1 represents a side elevation of a portion of a drying machine more especially for a paper making machine and embodying my invention; Fig. 2 represents a section of the same on line x—x of Fig. 1; Fig. 3 represents a perspective of one of the blast nozzles for discharging the drying air medium.

While the drying apparatus is ordinarily employed with a paper making machine, it may be used in other relations and hence is shown simply as a drying machine for whatever special use it may be found adapted.

1 designates the drying cylinders of the machine which, as here shown, are arranged in substantially horizontal sets one above the other and driven by any suitable power transmitting devices. These cylinders are heated with steam in any of the usual and well known manners. 2 designates a continuous length or endless web of felt or like material arranged to pass over the cylinders of the upper set, being properly guided by idler rolls 3 which are respectively rotatably mounted and located between adjacent drying cylinders of the same row. By this construction the felt web 2 is properly held

about a portion of the respective drying cylinders 1, and since one of the idler rolls 3 is located between each pair of said cylinders 1 there is a pocket 4 formed by the felt web as it passes from one cylinder to the next. Suitable tension devices 5 or slack adjusters are provided to maintain the desired working conditions.

6 designates a similar length or endless web of felt arranged about the lower set of drying cylinders and which is similarly provided with idler guide rolls. For convenience, the same reference numeral 3 has been applied to these idler guide rolls, since they are relatively located similarly to the upper set and provide the pockets 4 as already described.

The web of paper 7 enters the machine at one end, being passed about the first drying cylinder and held firmly against the same by the felt 6; it then passes upwardly about the adjacent drying cylinder of the upper set, being similarly held against its surface by the felt 2; it then passes downwardly around the adjacent drying roll of the lower set and so continues throughout the length of the machine, passing alternately about a lower cylinder and then an upper cylinder until it emerges at the discharge end of the machine.

8 designates a heater of any suitable type through which air is drawn by the fan 9 and delivered in a heated condition to the distributing pipes 10 and 11, the former terminating in a conduit 12 extending substantially the length of the machine above the upper set of drying cylinders, and the latter similarly terminating in a conduit 13 arranged in like manner below the lower set of drying cylinders. Each conduit is provided with a plurality of discharge or blast nozzles 14 which extend laterally from the respective conduits into the space between adjacent drying cylinders and have their discharge ends arranged to project the heated air directly into the pockets 4 of the felt web so that it strikes directly against the surface of the felts to tend to dry them. These nozzles 14 may each have a plurality of secondary blast nozzles 14^a, if so desired, to provide lateral air blasts to the main blast from the openings 15 of the nozzles. In this manner the felt webs are subjected to a heating and drying medium projected transversely to the plane of their bodies and direction of travel, so that moisture absorbed from the paper by the felt is quickly removed and the web again in condition to contact with the paper web passing about the next drying cylinder. It will thus be seen that the hot air or heating medium used, is discharged directly against the felt instead of parallel to and over the surface of the paper web and consequently causes the paper to be dried more evenly and positively and substantially eliminates any tendency of the paper to warp, buckle or break during the drying operation. In connection with the discharge nozzles 14, it will be seen by reference to Fig. 3 that each is of laterally flared construction from its inlet end and terminates in a relatively long narrow discharge slot 15, which preferably extends from substantially one edge of the felt to the other, in order that all parts may be in the path of the discharged heated air. The walls 16 bounding the discharge slot 15 are suitably tapered toward the opening to increase the velocity of the discharged air so that it impinges with some force against the surface of the felt to provide a sufficient circulation to disperse the moisture laden air from adjacent the felt. The effect of this is to blow out the moisture vapor produced and collected in the pockets of the felt webs and leave them drier whereby they may reabsorb more moisture when it again contacts with the wet paper.

In the operation of the device the heated air is discharged by the sets of nozzles into the respective pockets 4 and transversely of the felt bodies. The wet paper enters the machine between the first drying cylinder and the felt, and while passing about the cylinder some of its moisture is initially absorbed into the felt. The moisture so absorbed is carried by the felt around the pocket bounding a discharge nozzle 14 and is there blown out or evaporated, leaving the felt drier for contact again with the paper. The paper leaves the cylinder and passes around the adjacent cylinder of the upper set where it is further dried by the other felt web operating in conjunction with that set. Thus, the paper passes through the machine from one end to the other, alternately as to the cylinders and felt webs and becoming gradually dried in a positive and more or less uniform manner. Since both the upper and lower felt web are moving continuously, that moisture laden portion of each which leaves the wet paper is subjected to the blast of heated air from an adjacent nozzle and becomes reduced in moisture content before again coming in contact with the paper upon the next cylinder. While the absorbed moisture is being blown or evaporated out of the felt web the paper is passing over a cylinder of the other set and being further dried by contact with the felt for that set. This action continues alternately throughout the length of the machine so that at the discharge end the paper not only leaves in a uniformly dry condition, but smooth and free from wrinkled or buckled portions.

In the drying of soft unsized papers with crinkled or crushed surfaces it is manifest that any undue tension on the paper itself when in the wet condition would destroy the texture of the paper and unfit it for its

special purpose, and it is therefore important that the air blast be not allowed to directly impinge upon the paper to cause it to whip, vibrate or stretch, and my improved method and means herein set out accomplish the objects sought in a highly efficient and positive manner.

By providing the wide flaring discharge nozzles arranged to project the heated air directly against the felt webs and their guiding means, it is possible to utilize the full value of the heating medium and secure uniform even treatment of the felt. Furthermore, since the felt webs are interposed between the paper and the heated air blast, the danger of stretching, buckling or breaking the moistened paper is eliminated.

In machines wherein the heated air is brought into direct contact with the paper it has been necessary to discharge such air in a direction parallel to the surface of the paper, with the result that a larger volume of air is required for drying purposes than would otherwise be the case could the air be blown directly transverse to the surface of the paper. This method of parallel blowing of the air also causes uneven drying of the paper since one lateral part of the surface thereof meets the hottest part of the air while the remaining portion is presented to air gradually diminishing in temperature. Furthermore, the air most distant from the nozzles contains more moisture than that near the nozzles and hence the drying of the paper web near one edge is not so well accomplished as near the middle and other edge. By my present invention I have overcome and eliminated such disadvantages in that the discharged air contacts with the felt at all points of its width at substantially the same temperature thereby promoting even action upon the paper.

It will now be apparent that I have devised a novel and useful method and construction which embody the features of advantage enumerated as desirable, and while I have in the present instance shown and described the preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that I do not restrict myself to the details, as the same are susceptible of modification in various particulars without departing from the spirit or scope of the invention.

Having now described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a drying apparatus, the combination of a plurality of drying cylinders over which a web of paper to be dried is adapted to travel, a continuous web of felt passing about said cylinders to maintain said paper in contact with the respective cylinders, guiding means for said felt between adjacent cylinders arranged to bend the felt web to form pockets, and means to deliver a current of heated air into each pocket in a direction transverse to the surface of the felt web whereby said felt is subjected to a drying action between contact periods with the paper and be brought to a condition to absorb moisture from said paper.

2. In a drying apparatus, the combination of a plurality of drying cylinders over which a web of paper to be dried is adapted to travel, said cylinders arranged in two rows one above the other, a separate continuous web of felt for each row of cylinders, guiding means for the respective felt webs arranged to bend the felt webs to form pockets at intervals throughout the length of felt web, and means to deliver a current of heated air into each pocket in a direction transverse to the surface of the felt web, whereby said felt is caused to absorb moisture from said paper and then at the pocket portions give said moisture up by the action of the heated air currents.

3. In a drying apparatus, the combination of a plurality of drying cylinders over which a web of paper to be dried is adapted to travel, a continuous web of felt passing partly about each of said cylinders and adapted to maintain said paper in contact with the cylinders, guiding means for the paper to and from the cylinders, guide rolls for said felt arranged to hold the felt web in contact with the cylinders and form pockets in the felt web between the cylinders, and means to deliver a current of heated air into each pocket of the felt, whereby the felt web is subjected to a drying manipulation at intervals to maintain it in a sufficiently dry condition to absorb moisture from said paper.

4. In a drying apparatus, a plurality of cylinders over which a web of paper to be dried is adapted to travel, said cylinders being arranged in rows one above the other, a separate continuous web of felt for each row of cylinders adapted to maintain the paper in contact with said cylinders and whereby the paper may travel about the cylinders of the two rows alternately, guiding means for each felt web arranged to form pockets in the felt respectively located between juxtaposed cylinders of the same row and the pockets of the two webs directed in opposite directions, and oppositely directed nozzles to deliver currents of heated air into the pockets of the respective webs whereby the felts are maintained in a relatively dry condition to absorb moisture from said paper.

5. In a drying apparatus, a plurality of cylinders arranged in rows one above the other, over which a web of paper to be dried is adapted to travel alternately passing about a cylinder of the lower row and then

about a cylinder of the upper row; an endless web of felt for each row of cylinders adapted to maintain the paper in contact with said cylinders, guiding means for each web of felt arranged to form oppositely directed pockets in the respective webs of felt, two sets of nozzles located respectively in said pockets having flaring walls forming a wide discharge opening extending substantially the width of the adjacent webs of felt and arranged to deliver heated air in opposite directions to impinge directly against the webs of felt whereby both felt bodies are maintained in relatively dry condition to absorb moisture from the paper.

In testimony of which invention, I hereunto set my hand.

HARRY LIEBECK.

Witnesses:
P. L. PAISONS,
R. M. HUNTER.