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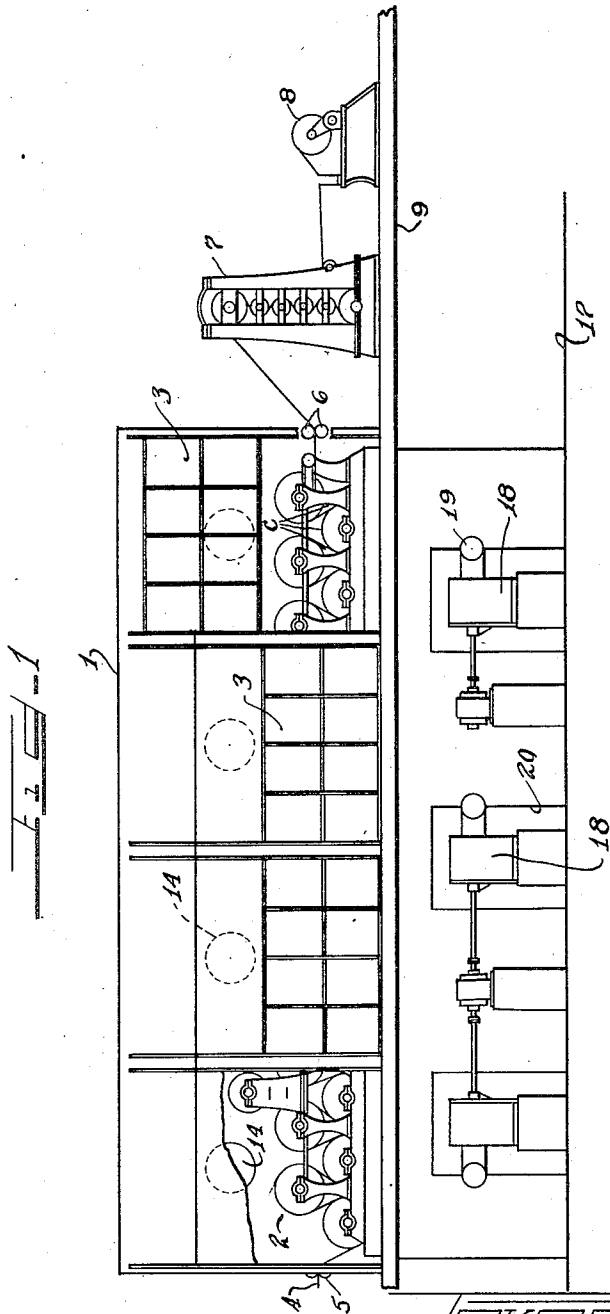
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PAPER DRYING PROCESS AND APPARATUS

Filed April 18, 1931

2 Sheets-Sheet 1



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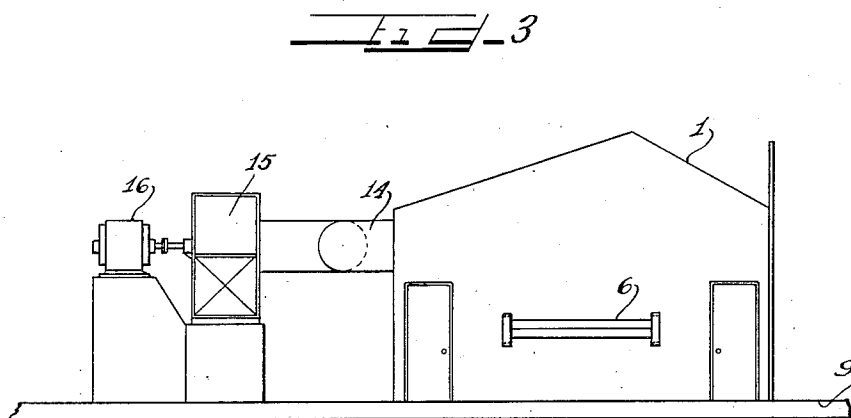
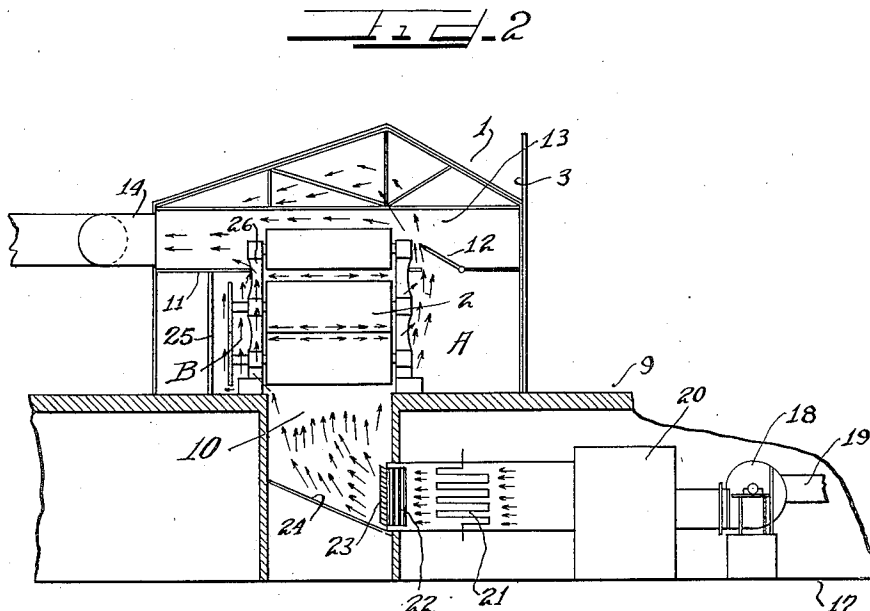
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PAPER DRYING PROCESS AND APPARATUS

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4 Claims. (Cl. 34-48)

This invention relates to a paper drying process and apparatus and more particularly to a method of and apparatus for drying paper and other web material within a closed housing by supplying thereto regulated quantities of conditioned air.

It has heretofore been proposed to enclose the dry end of paper machines and either to dry the paper in such enclosed spaces under a substantial vacuum or at least with the exclusion of substantial quantities of outside air. It has also been proposed and is common practice to provide a hood over the drier section of paper machines with side walls extending slightly below the level of the top driers, so as to prevent the heated and vapor filled air resulting from the drying operation from spreading out into the machine room.

The provision of a housing to permit the carrying out of the drying operation under substantial vacuum is expensive, since the material of the housing must be capable of withstanding the differential pressure between the inside and the outside of the housing and must be well sealed against the admission of air to the interior thereof. Moreover, where the drying operation is carried out under reduced pressure or in the absence of substantial quantities of air, it is greatly complicated due to the difficulty of obtaining access to the interior of the housing should a break of the paper occur or the felt require changing.

Where the paper drying equipment is only partially enclosed, as by a hood with dependent side walls, the heat economy possible through the use of a vacuum drier cannot be attained but access to the drying equipment is so much simpler and the construction so much more inexpensive that this is by far the commoner type of drying apparatus for paper and like web material.

It is an object of the present invention to provide a completely enclosed drying apparatus for paper and like web material wherein regulated quantities of conditioned air are supplied to the interior of the drying housing in order to facilitate the drying of the paper and permit the use of lower drying temperatures than has heretofore been possible in the open or semi-enclosed type of drying equipment.

It is a further object of this invention to provide a method of drying paper and like web material wherein relatively cool, conditioned air is supplied at points beneath the driers into the interior of a housing enclosing the driers so that the cooled, conditioned air may pass upwardly at both the front and rear sides of the drier drums and thereby induce an outward flow of air and water vapor from the vapor pockets formed between the drier drums, felt and paper web.

It is a further important object of this invention to provide a novel method of and apparatus for drying paper and like web material wherein gradual and low temperature dryings may be

effected with consequent increased heat economies and the production of superior quality of paper.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a side elevational view of drying apparatus embodying the principles of my invention, shown more or less diagrammatically.

Figure 2 is an end view of the same with an end wall removed and with parts in section.

Figure 3 is another end view of the same.

As shown on the drawings:

The reference numeral 1 indicates as a whole a housing for enclosing the usual drier drums 2 of a machine for making paper or like web material. The housing 1 is preferably formed of water and fireproof material, such as asbestos board or the like, secured to metal framework. In order to facilitate access to the interior of the housing, vertically slidable doors 3 are provided all along the front or operating side of the machine. The web of paper 4 to be dried is passed between resilient covered rolls 5 which serve to seal the interior of the housing 1 against the admission of substantial quantities of air along with the paper web. The paper web 4 then passes under and over the various drier drums of the drying section and out of the housing 1 between similar resilient covered rolls 6 to a calender stack 7 and winder 8.

The housing 1 and drier drum 2 are mounted upon a flooring 9 that is cut away underneath the drier drums 2 to provide a continuous passageway 10 the entire length thereof. Said passageway 10 opens directly underneath the drier drums 2 into the interior of the housing 1 for the purpose of supplying cooled, conditioned air to the interior of the housing, as will later be more fully explained. The upper part of the space enclosed by the housing 1 is divided off by horizontal baffles 11 provided with regulating devices 12 to control the rate of flow of air into the upper space 13, from which the exhaust gases are drawn through a plurality of conduits 14 by means of exhaust fans 15 operated by motors 16.

All of the apparatus for supplying cooled, conditioned air to the interior of the housing 1 is suitably positioned upon a flooring 17 at a lower level than that of the flooring 9. This apparatus comprises a blower 18 having a fresh air inlet 19 and from which the fresh air is delivered to an air wash 20, which may be of any standard construction. The washed air is then passed through cooling coils 21 to bring the air below its dew point and free it from an excess of water

vapor. From the cooling coils 21 the air passes through a coil heater 22, or other suitable heating device, and thence through an adjustable shutter controlled opening 23 into the passageway 10. The bottom wall 24 of the passageway 10 is preferably inclined upwardly away from the shutter controlled opening 23 to aid in directing the flow of cooled conditioned air up into the interior of the housing 1.

The conditioning apparatus is so operated and controlled as to provide air of relatively low humidity at a temperature of about 50° F. The temperature and humidity of the entering air will obviously be varied to meet the requirements of the particular drying operation but in general the air will be supplied at a relatively low temperature and humidity in order that it may have a large capacity for taking up and absorbing water vapor emanating from the paper being dried.

The capacities of the fans 15 on the exhaust conduits 14 are intentionally somewhat greater than the capacities of the supply fans 18 in order that the flow of air through the interior of the housing 1 may be in fairly definite, predetermined paths. The air flows upwardly from the passageway 10 and spreads out under the drier drums, since its upward path is obstructed by the drums themselves and the felt and paper web passing over the drums, and continues upwardly along both the front and rear sides of the drier drums, as at A and B, respectively. A vertical baffle 25 extending in spaced relation along the rear side of the driers 2 confines the upward flow of air to the restricted space B. This upward flow of air along the front and rear sides of the drier drums induces an outward flow of heated air and water vapor from the vapor pockets, generally denoted by the letter C formed between the drums, the felts and paper webs. The tendency is for the heated air and water vapor from the vapor pockets C to flow outwardly toward both front and rear sides of the drier section and there be mixed with the upward flow of cooled conditioned air, which, because of its low temperature and relative humidity, is capable of absorbing all of the water vapor thus removed from the vapor pockets C. The vapor laden air continues its upward flow through the dampers or other control devices 12 at the front side of the drier section and also through spaces 26 provided along the rear ends of the drier drums. The exhaust fans 15 continually remove the vapor laden and now heated air from the upper portion of the interior of the housing 1.

It will be understood that in conjunction with the means and method disclosed for supplying cooled conditioned air, the principle of gradual drying may also be employed by controlling in a manner well known to those skilled in the art the temperatures of the various drying drums 2 in various units or groups to obtain gradient heating. The combination of the gradual drying principle with my method of supplying cooled, conditioned air results in much greater uniformity of drying and greatly increases the quality of the paper produced. Instead of being dependent upon the outside atmospheric conditions, a drying unit embodying the principles of this invention is always supplied with air of predetermined temperature and relative humidity so as

to be entirely independent of the atmospheric conditions. The paper made by my method is, in general, more uniformly dried across the web and does not suffer from over drying at the edges, as is frequently the case on the usual type of paper machine drier. There is also a less tendency to overdry the paper or dry it too rapidly. The operating cost of the drier units are likewise reduced because of longer life of the drier felts and less lubrication trouble when drying at lower temperatures.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. The method of drying a continuous traveling web of paper, which comprises passing the paper web over heated surfaces in an enclosed space, continuously introducing a stream of relatively cool conditioned air into said enclosed space to travel upwardly at both sides of the traveling web, thereby inducing an outward flow of heated air and water vapor from the immediate vicinity of said heated web into the upwardly traveling stream of conditioned air for admixture therewith, and continuously withdrawing such admixture.

2. The method of drying a continuous traveling web of paper, which comprises subjecting a portion of the paper web to locally applied heat in a confined space from which unregulated supplies of air are excluded, introducing into said confined space at points below the traveling web a regulated supply of relatively cool conditioned air for passage upwardly on both sides of the traveling web, thereby inducing an outward flow of heated air and water vapor from the immediate vicinity of said traveling web into the conditioned air stream to be admixed therewith and removing the resulting admixture from said confined space at a point above the traveling web.

3. In a paper drying apparatus, heated rolls for drying a travelling web of paper, a housing completely enclosing said heated rolls, said housing having openings for the passage of the web therethrough, pressure means about said opening to prevent the ingress of air, vent means in the top of said housing, a passageway beneath said rolls for introducing air to said housing, pressure means in said passageway for forcing air therethrough and into said housing, cooling and drying means located in said passageway and means including baffles for directing the air about said rolls so as to draw the vapor-laden air from between said rolls into the air current caused by said pressure means.

4. In a paper drying apparatus, in combination, a plurality of drier rolls, a housing for completely encasing said rolls, a passageway beneath said rolls, means for introducing air through said passageway, and partitions for directing the air from said passageway upwardly alongside of the rolls to thereby draw heated air from the rolls into the air current caused by the air introduced through the passageway.

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