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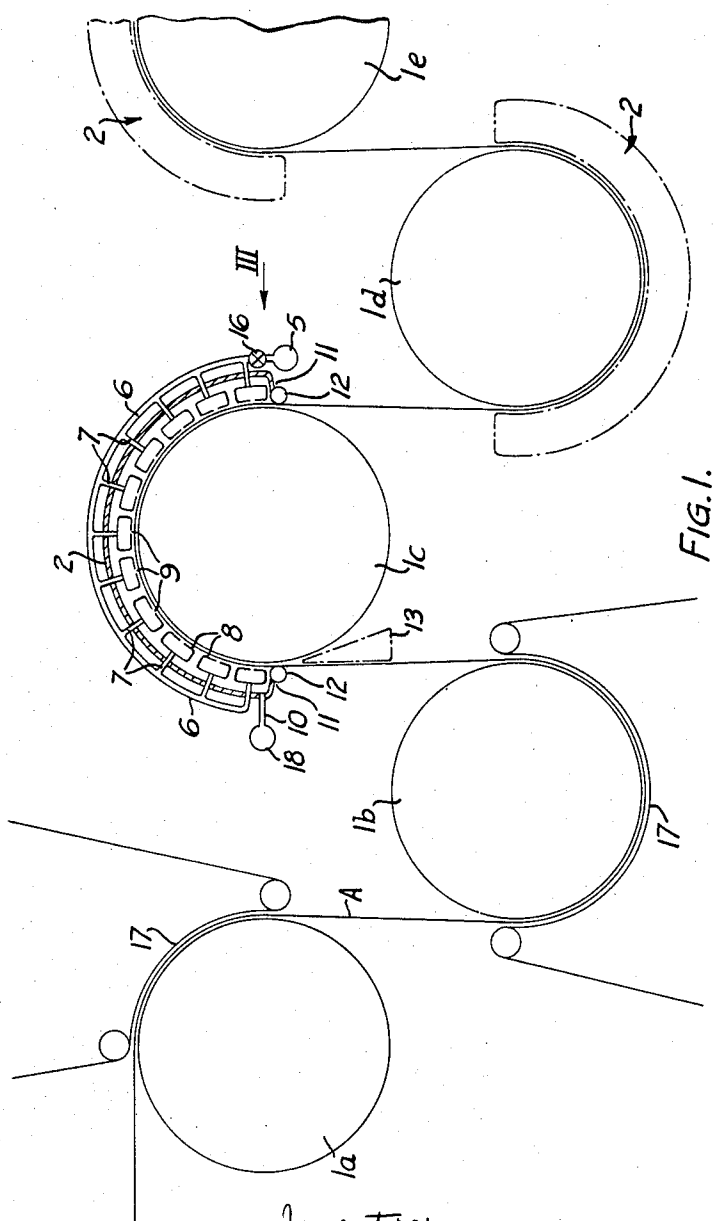
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PROCESS OF PAPERMAKING

Filed April 15, 1955

2 Sheets-Sheet 1



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By their attorneys:
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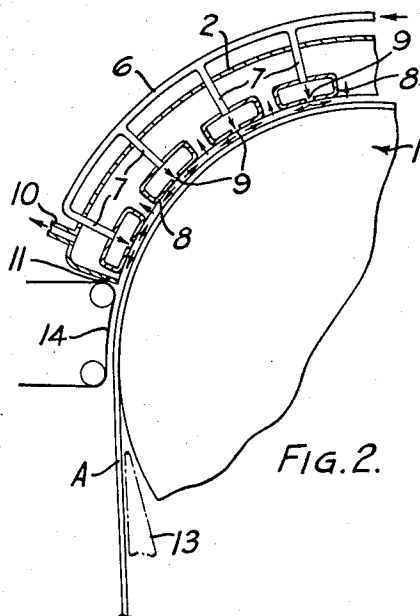
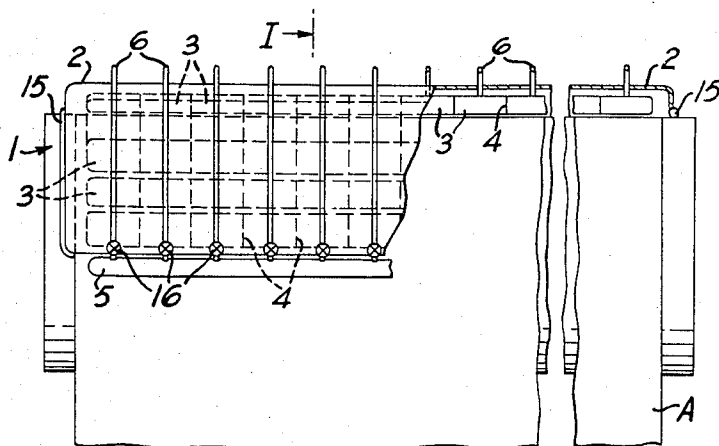
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FIG. 3.

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6 Claims. (Cl. 34—114)

This invention relates to a process of and apparatus for papermaking, more particularly to that stage of a papermaking process in which the wet web is dried.

In a typical papermaking machine the paper web, after leaving the wire, is passed, supported by felts, between press rolls with or without internal suction boxes, so that the web is subjected to pressure and also, in many cases, to vacuum to consolidate it and remove water. After leaving the press part of the machine the normal procedure is to pass the web, still containing some 60 to 70% moisture, over a relatively large number of drying cylinders arranged in such a way that each side of the paper alternately comes in contact with the surface of the drying cylinders, the contact being made as intimate as possible by means of felts which press the paper against the drying cylinders. This pressing action helps to promote the transfer of heat to the paper and thus the rate of drying is increased.

Dryer felts are designed to have two opposing qualities, they are designed to be porous to allow for the passage of air and water vapour and they are also made absorptive to help carry away some of the moisture from the web. It is found, however, that felts, even under the best possible operating conditions including the provision of adequate felt dryers, hinder the ventilation of the web and thus slow down the rate of water removal.

The object of the invention is to provide a process of papermaking in which the paper web is dried more rapidly and under better control than has been possible heretofore.

This object is achieved, according to the invention, by a process of papermaking in which the paper web is dried by entrainment around a plurality of heated drying cylinders wherein the web is maintained in close but non-adhesive contact with the cylinder surfaces by the force of air acting on the exposed surface of the web, the air being caused to flow over the exposed surface and thus helping to remove moisture expelled from the web by the action of the heated cylinders.

The main advantages of the process according to the invention are:

a. Due to the increased rate of drying the overall size of the drying section of a papermaking machine employing the above process may be made smaller than those used at present.

b. As a consequence of the paper being exposed on one side to the atmosphere or to the air flow all or substantially all the time it is being heated, the removal of moisture across the width of the sheet will be much more readily controllable enabling the finished sheet to have a moisture content substantially uniform across the full width even before the paper is dampened, should this be necessary for any reason.

c. The paper can more easily be allowed to shrink naturally during the drying process and therefore it will possess stretching properties which will reduce the risk of rupture under tensile stress.

In the preferred process the main air flow is in a direc-

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tion opposite to and parallel with the direction of movement of the web.

The invention also provides a drying section for a papermaking machine which comprises a plurality of heated drying cylinders around which the web to be dried will be entrained, hoods arranged circumferentially with respect to some at least of the cylinders, means for urging the web into close but non-adhesive contact with each cylinder as the web is about to enter under a hood, and means for forcing air through the hoods to flow over the exposed surface of the web and maintain it in close non-adhesive contact with the cylinder so as to remove the moisture expelled from the web.

In certain instances the shrinkage of the paper during drying provides a tension in the web which has the effect of assisting in holding the web in contact with the cylinders. This effect is most pronounced when the web has dried to the point where its moisture content is around 25 to 35 percent.

The force exerted on the exposed surface of the web is only sufficient to maintain the web in contact with the cylinders and is not so great as to cause the web to stick to the cylinders as is usual in the manufacture of glazed papers.

Preferably the hoods are divided into a plurality of sections parallel to the direction of movement of the web and each section is provided with a plurality of circumferentially spaced air ducts having orifices for directing air into the web and connected through a control valve to a suitable air supply.

The means for initially urging the web into contact with each cylinder may comprise either a nip roll or a felt acting in conjunction with the cylinder, or a suction device adapted to create a partial vacuum in the wedge-shaped space where the web meets the cylinder.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 shows diagrammatically an elevation of part of the drying section of a papermaking machine in accordance with the invention, partly in section on the line I—I in Figure 3,

Figure 2 shows in section on an enlarged scale a modified form of a portion of the machine shown in Figure 1, and

Figure 3 shows, partly in section, an end view of part of the machine taken in the direction of the arrow III in Figure 1, certain parts being omitted for clarity.

The drying section of a papermaking machine comprising several rotatable heated cylinders 1a, 1b, 1c . . . , five only being shown in Figure 1, of a larger diameter than are normally used. A convenient diameter may be, for example, between eight and twelve feet. The cylinders are arranged at two levels, the center of a cylinder at one level being midway between the centers of the adjacent two cylinders at the other level as is clearly shown in Figure 1. The paper web A is entrained about the first two cylinders 1a, 1b with supporting felt 17 and about the remaining cylinders without the use of felts and the portion of the circumference of each of the remaining cylinders 1c, 1d, 1e . . . with which the web is in contact is surrounded by a hood 2. Each hood 2 is divided into sections 3 as shown in Figure 3 by partitions 4 running in the direction of the paper web and the number of sections may be as great as twelve or so, so that the air conditions applying over different portions of the width of the paper may be independently controlled.

An air supply manifold 5 is provided adjacent each hood 2 and axially parallel therewith and from each manifold 5 distributor pipes 6 are carried over the hood in a direction substantially parallel to the direction of

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motion of the web A on the cylinder. A control valve 16 is provided for each distributor pipe 6. There is a distributor pipe 6 corresponding to each section 3 disposed substantially centrally with respect to the section, and from each pipe 6 further connecting pipes 7 connect the distributor pipe to a number of ducts 8 within the hood 2, each duct having an orifice 9 arranged to direct air within the duct, and fed from the manifold 5 through the distributor and connecting pipes 6, 7, onto the outer surface of the web A as it passes over the surface of the cylinder.

Adjacent the main edge of each hood 2, at which the paper web A enters, an exhaust pipe 10 connects each section 3 to an exhaust manifold 18. The exhausted air may be allowed to pass out to the atmosphere or it may be re-circulated to the supply manifold through suitable drying and compressing means for re-use.

The partitions 4 of each hood 2 extend as close to the paper web A as normal engineering practice will permit, but it is by no means essential that leakage from one section 3 to another should be avoided.

Seals at the main edges of the hood 2 parallel to the axis of the cylinder may be produced by providing these edges with a flexible doctor blade or rubbing strip 11 and positioning this to bear on a roll 12 which itself is bearing on the paper on the drying cylinder. One of the rolls 12 may constitute a nip roll to bring the paper web A entering upon the drying cylinder into close contact with the cylinder.

Instead of using a nip roll to ensure that the paper, when it comes to a drying cylinder, will get closely into contact with the cylinder there may be employed means for sucking air out of the wedge-shaped space 13 between the paper and the drying cylinder.

In a modification, a short length of felt 14 may be provided as shown in Figure 2 to bring the web onto the cylinder surface, the hood being sealed by a flexible doctor blade 11 as before.

The side edges of each hood are sealed by resilient members 15 bearing on the surface of the cylinder thereunder.

The air which is forced through the hoods is at a pressure above atmospheric pressure, a suitable value being of the order of about 0.5 lb. per square inch, or possibly less.

An important feature of the invention is that it will allow the amount of air used for removing the water from the web to be closely controlled by means of the valves 16 across the width of the web A. The amount of air admitted to each section of the hood and the temperature of the supply is controllable enabling, for example, more air to be sent to the middle of the machine, where paper often tends to be more difficult to dry, and less air to either or both the edges where the paper may dry more quickly.

It will be appreciated that the process according to the invention may be applied to existing papermaking machines and that although drying cylinders of larger diameter than normal are preferred, normal sized cylinders may be used.

What is claimed is:

1. A drying section for a papermaking machine comprising a plurality of heated drying cylinders around which the paper web to be dried will be entrained, a plurality of hoods arranged circumferentially with respect to at least some of the cylinders, means for urging the web into close but non-adhesive contact with each of said hooded cylinders as the web is about to enter under the hood, a plurality of partitions spaced apart along the length of each hooded cylinder within the associated hood and dividing the hood into a plurality of sections, a plurality of separate air supply pipes associated with each of said sections, and a plurality of separate ducts within each section, each of said ducts being connected to a different one of said air supply pipes

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and having a discharge orifice in proximal relationship to the associated hooded cylinder and each of said ducts providing an air chamber enlarged in relation to the associated air supply pipe and discharge orifice.

2. A drying section for a papermaking machine comprising a plurality of heated drying cylinders around which the paper web to be dried will be entrained, a plurality of hoods arranged circumferentially with respect to at least some of the cylinders, means for urging the web into close but non-adhesive contact with each of said hooded cylinders as the web is about to enter under the hood, a plurality of partitions spaced apart along the length of each hooded cylinder within the associated hood and dividing the hood into a plurality of sections, a plurality of separate air supply pipes associated with each of said sections, a plurality of separate ducts within each section, each of said ducts being connected to a different one of said air supply pipes and having a discharge orifice in proximal relation to the associated hooded cylinder and each of said ducts providing an air chamber enlarged in relation to the associated air supply pipe and discharge orifice, a plurality of distributor pipes respectively connected to the air supply pipes associated with said sections, and separate valves for individually controlling the flow of air into said distributor pipes.

3. A drying section for a papermaking machine comprising a plurality of heated drying cylinders around which the paper web to be dried will be entrained, a plurality of hoods arranged circumferentially with respect to at least some of the cylinders, means for urging the web into close but non-adhesive contact with each of said hooded cylinders as the web is about to enter under the hood, a plurality of partitions spaced apart along the length of each hooded cylinder within the associated hood and dividing the hood into a plurality of sections, a plurality of separate air supply pipes associated with each of said sections, a plurality of separate ducts within each section, each of said ducts being connected to a different one of said air supply pipes and having a discharge orifice in proximal relationship to the associated hooded cylinder and each of said ducts providing an air chamber enlarged in relation to the associated air supply pipe and discharge orifice, sealing means along the edges of the hoods adjacent the surfaces of the hooded cylinders for preventing egress of air from said hoods, and exhaust manifold means for receiving air to be discharged from within said hoods.

4. A drying section for a papermaking machine comprising a plurality of heated drying cylinders around which the paper web to be dried will be entrained, a plurality of hoods arranged circumferentially with respect to at least some of the cylinders, a plurality of partitions spaced apart along the length of each hooded cylinder within the associated hood and dividing the hood into a plurality of sections, a plurality of separate air supply pipes associated with each of said sections, and a plurality of separate ducts within each section, each of said ducts being connected to a different one of said air supply pipes and having a discharge orifice in proximal relationship to the associated hooded cylinder and each of said ducts providing an air chamber enlarged in relation to the associated air supply pipe and discharge orifice.

5. A drying section for a papermaking machine comprising a plurality of heated drying cylinders around which the paper web to be dried will be entrained, a plurality of hoods arranged circumferentially with respect to at least some of the cylinders, a plurality of partitions spaced apart along the length of each hooded cylinder within the associated hood and dividing the hood into a plurality of sections, a plurality of separate air supply pipes associated with each of said sections, a plurality of separate ducts within each section, each of said ducts being connected to a different one of said air supply pipes and having a discharge orifice in proximal relation to the associated hooded cylinder and each of said ducts provid-

ing an air chamber enlarged in relation to the associated air supply pipe and discharge orifice, a plurality of distributor pipes respectively connected to the air supply pipes associated with said sections, and separate valves for individually controlling the flow of air into said distributor pipes. 5

6. A drying section for a papermaking machine comprising a plurality of heated drying cylinders around which the paper web to be dried will be entrained, a plurality of hoods arranged circumferentially with respect to at least some of the cylinders, a plurality of partitions spaced apart along the length of each hooded cylinder within the associated hood and dividing the hood into a plurality of sections, a plurality of separate air supply pipes associated with each of said sections, a plurality of separate ducts within each section, each of said ducts being connected to a different one of said air supply pipes and having a discharge orifice in proximal relationship to the associated hooded cylinder and each of said ducts providing an air chamber enlarged in relation to the associated air supply pipe and discharge orifice, sealing means along the edges of the hoods adjacent the surfaces of the 10 15 20

hooded cylinders for preventing egress of air from said hoods, and exhaust manifold means for receiving air to be discharged from within said hoods.

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