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3,367,035

DRYING ON AIR SUPPORTED BELT

Filed May 31, 1966

2 Sheets-Sheet 1

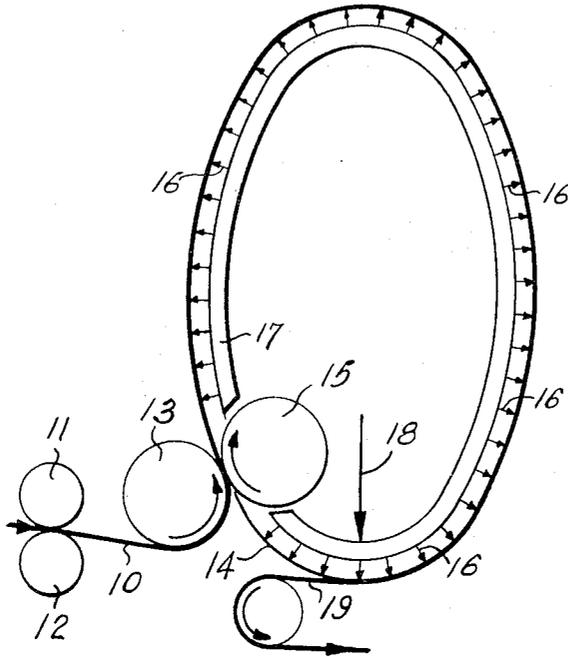


FIG. 1

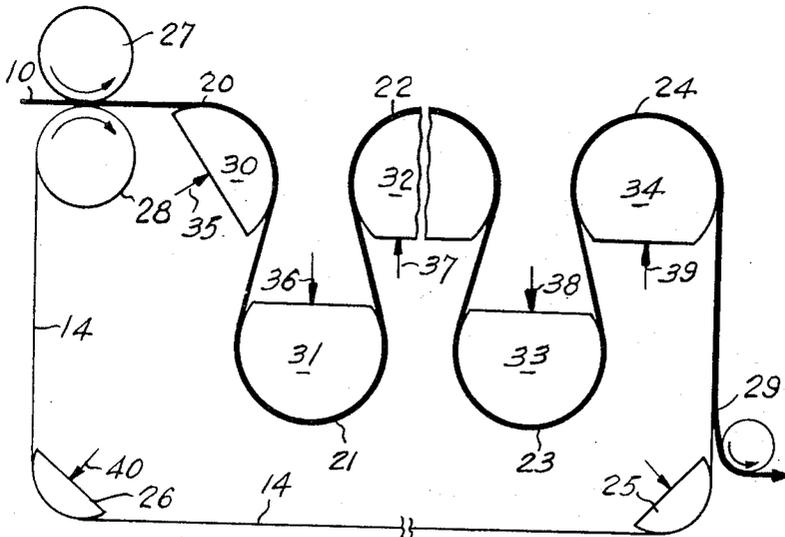


FIG. 2

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2 Sheets-Sheet 2

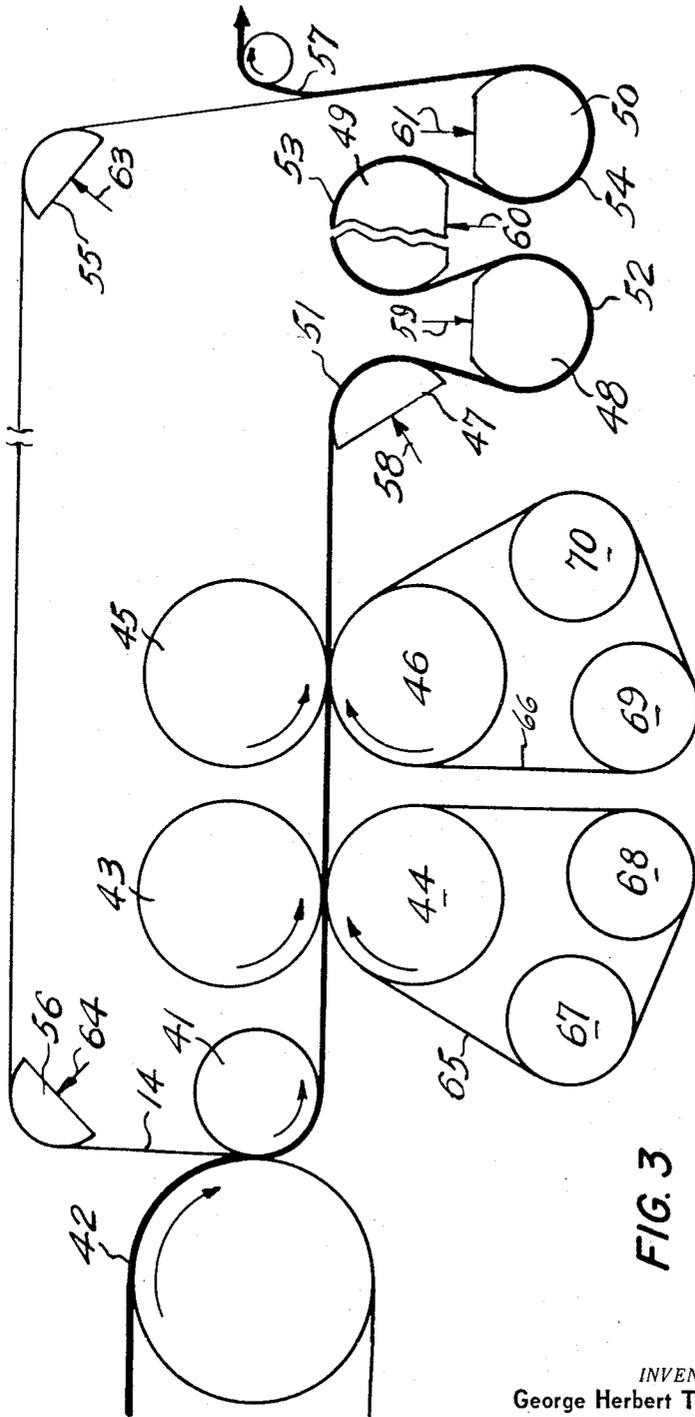


FIG. 3

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DRYING ON AIR SUPPORTED BELT

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23,663/65

8 Claims. (Cl. 34-10)

The present invention relates to paper-making machines and is more particularly concerned with the drying sections thereof.

In present day paper making, the wet paper sheet, after dewatering and pressing, is passed to a dryer section where it is dried, generally on drum dryers.

A modern machine for producing newsprint will have about 40 to 60 dryers having a diameter of about 5'. For certain papers a large drum dryer having a diameter of up to 20' is used for the major drying operation. Such a dryer, known as a Yankee dryer, allows the production of sheets having a very smooth surface on the side of the sheet which is dried in contact with the drum and papers produced in this way are known as machine-glazed sheets. The size of Yankee dryer drums are limited by practical engineering considerations and the temperature must be kept reasonably low to prevent the formation of steam pockets between the sheet and the heating surface. This materially reduces the amount of water that can be removed per unit time.

The present invention allows the production of machine glazed or dry-creped papers without the limitation of dryer size and drying surface temperature imposed by conventional Yankee dryers.

By the method of this invention the wet paper web, as it comes from the press section, is transferred to a continuous belt which may be made of metal, plastic or other suitable material and which is carried on a heated air stream as it passes on convex surfaces, this air forming the bearing on which the belt moves. The belt may make a single loop of either circular or elliptical form or it may undergo a number of reversing loops where the belt and the paper web are alternatively on the bearing side and subjected to the hot air stream. In either case hot air can be blown against the non-bearing side with the partially saturated and cooled air being removed by known means. The temperature of air on both bearing and non-bearing sides can be staged for different zones in order to allow removal of moisture at rates appropriate to its moisture content for each zone not being so great in the early stages that it disrupts the sheet or separates it from the belt.

The belt can be driven from a single point by means of a driven suction roll, a nip roll or other appropriate means.

If desired the paper sheet may be separated from the belt before completion of drying and the drying completed by carrying the unsupported web over one or more air bearings.

By another embodiment of this invention dried paper sheets may be produced under conditions where the paper is allowed to shrink during the drying operation rather than under "restraint" due to contact with a polished surface as described above, thus obtaining qualities that may be desired for certain purposes.

By still another embodiment the wet web may be transferred to the drying belt prior to the wet pressing operation. For instance the web can be directly couched onto the belt from the forming wire then carried through the presses on the belt and then dried, or partially dried, still in contact with the belt. By eliminating the so-called

wet draws the normal tensioning of the sheet with consequent fibre alignment is eliminated.

It is also possible to coat or impregnate the sheet with the resultant coated sheet being dried on an air cushion or alternatively against a second metal belt in order to obtain a cast coated surface.

The hot air used for drying and for supporting the belt may be obtained by means of direct combustion of fuel. This may be suitably obtained from the exhaust of a gas turbine engine with the power output of the engine being used for driving the pumps, etc., required at the wet end, fans for recycle of the partially cooled gas and for driving the forming wire, the dryer belt and the wind-up reel.

The invention will be further described by way of example with reference to the accompanying drawings, in which:

FIG. 1 illustrates diagrammatically one embodiment of the present invention, in which a belt makes a single loop;

FIG. 2 illustrates diagrammatically a second embodiment of the invention in which a belt indicates a number of reversing loops, and

FIG. 3 illustrates diagrammatically a third embodiment in which wet web is transferred to a drying belt prior to a wet pressing operation.

In the arrangement illustrated in FIG. 1, paper web 10 emerging from the nip between rolls 11, 12, of the press section of a paper-making machine, passes around a roll 13 and is transferred on to the surface of a continuous belt 14, which passes through the nip between roll 15 and roll 13 and is carried on a heated air stream indicated diagrammatically by the arrows 16 which emerge from a shaped chamber 17 to which the heated air is supplied, as at 18. The streams of air 16 form a bearing on which the belt 14 moves. The belt makes a single loop and the paper web is separated from the belt as at 19, in at least a partially dried condition. The rolls 13 and 15 can serve as driving means for the belt 14.

In the embodiment illustrated in FIG. 1, the path of the belt 14 is elliptical but other forms of path of the belt are contemplated such as circular. In addition hot air may be blown against the outer side of the belt and the paper web thereon, by means, not shown, and partially saturated and cooled air removed in any conventional manner.

Also, instead of a single inlet 18 there may be a plurality of air inlets so that the belt may pass through a plurality of successive zones of different temperature whereby the drying temperature, applied to the belt, may progressively be increased as the paper dries, i.e. the temperature may be increased as the sheet dries and is less susceptible to blistering or being disrupted from the belt. In this case the belt would require some cooling in the interval it is free of contact with the paper. Since the belt is thin it is relatively easy to heat and cool as compared with conventional dryers.

The above described embodiment, wherein a smooth metal belt or the like is used, is an ideal substitute for the conventional Yankee dryer. The latter is exceedingly bulky and cannot be operated at the high speeds possible with the apparatus described above. Since applicant's drying surface is not the rigid surface of a large drum, but is only a thin belt, it may readily be made as long as desired.

In the embodiment illustrated in FIG. 2, the path of the belt 14 includes a number of reversing loops 20, 21, 22, 23, 24 and passes through the nip between rollers 25, 26, which serve to drive the belt. In each of the reversing loops 20 to 24 the belt is carried on heated air streams in the same manner as it is in the embodiment illustrated in FIG. 1. The path of the belt 14 is com-

3

pleted by air bearings 25 and 26 which are constructed in a manner analogous to that illustrated in FIG. 1 and the driving nip between rolls 27 and 28. Paper web 10 is pressed onto the belt 14 at the nip between rolls 27 and 28 and lies on the outer surface of the belt 14 through the loops 20, 22 and 24, but is on the inner surface of the belt through the loops 21 and 23, being separated from the belt at 29 in either fully or partially dried condition. If the web is not fully dried, drying may be completed by carrying paper web unsupported through one or more supported air bearings, not shown. Since in each of the reversing loops 20, 21, 22, 23, 24, the belt is carried on heated air streams, it is convenient to refer to the assemblies which create these loops as bearings 30, 31, 32, 33, 34. Heated air is supplied to the air bearings as at 35, 36, 37, 38, 39 on the air bearings 27 and 40.

In the embodiment illustrated in FIG. 3 the belt 14 passes a pick-up roll 41 disposed adjacent fourdrinier wire 42, between press rolls 43, 44 and 45, 46, over air bearings 47, 48, 49, 50, which create a number of reversing loops 51, 52, 53, 54 and returned via two air bearings 55, 56 to complete the loop. In this embodiment wet web is transferred to the belt 14 at the roll 41 prior to a wet pressing operation between press rolls 43, 44, and 45, 46, and then dried or partially dried while passing through the reversing loops 51, 52, 53, 54 and is separated from the belt at 57. Heated air is supplied to the air bearings 47, 48, 49, 50 as at 58, 59, 60, 61 and to the air bearings 55, 56 as at 63, 64. The paths of press felts 65, 66 pass inbetween the press rolls 43, 44, and 45, 46 respectively and may be completed by turning rolls 67, 68, 69, 70, or air bearings may be employed instead.

In each of the embodiments illustrated in FIGS. 2 and 3 hot air can be blown against the outer side of the belt and the web thereon by means, not shown, whilst passing through the reversing loops 20 to 24 or 51 to 54 respectively, and partially saturated and cooled air removed in any convenient manner by means not shown.

The type of finish desired determines the type of belt used. If a non-shrunk sheet is desired, i.e. to produce a sheet with a surface as formed by drying on a Yankee drum, a polished metal belt will be used. If shrinking during drying is to be permitted, conventional dryer felts may be used. Special effects may also be obtained by using belts with special physical characteristics.

The non-dried web particularly as it leaves the couch roll, but also as it leaves the final wet press, is extremely fragile and this normally causes major problems in high speed paper machines. By transferring the web to a con-

4

tinuous supporting belt as taught by the present invention, very high operating speeds may be obtained without the normal hazard of web breakage and the accumulation of broke. Furthermore, feed of the wet web through the dryer is simplified when using the instant invention.

I claim:

1. A method of drying a web comprising; pressing a wet web against a surface of a traveling belt, adhering said wet web to said surface, passing said belt through at least one loop while supporting said belt on fluid bearings, heating said web to dry same by means of a supporting fluid which supports said belt on said fluid bearings and removing said web from said belt.

2. A method as defined in claim 1 wherein said web is prevented from shrinking while it is adhered to said belt.

3. A method as defined in claim 2 wherein said web is permitted to shrink in at least one direction while it is adhered to said belt.

4. An apparatus for drying a web comprising; a flexible endless traveling belt, means to drive said belt, means to apply a wet web onto said belt, fluid bearing means for guiding and supporting said belt, said fluid bearing means directing heated fluid toward said belt thereby to heat said belt and dry said web and means for conducting said web away from said belt.

5. An apparatus as defined in claim 4 wherein said belt has a polished surface to which said web adheres whereby said web is prevented from shrinking.

6. An apparatus as defined in claim 4 further comprising at least one pair of press rolls through which said belt passes.

7. An apparatus as defined in claim 4 wherein said belt travels in a torturous path.

8. An apparatus as defined in claim 5 wherein said belt is a metal belt.

References Cited

UNITED STATES PATENTS

756,600	4/1904	Dodge	198—108
2,135,763	11/1938	Nicholson	100—154 XR
2,689,196	9/1954	Daniels	34—156 XR
3,065,098	11/1962	Brooks	34—156 XR
3,140,930	7/1964	Justus	34—156
3,307,270	3/1967	Kruger	34—10

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,367,035

February 6, 1968

George Herbert Tomlinson

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 17, for the claim reference numeral "2" read -- 1 --; line 34, after "path" insert -- whereby said heated fluid is directed toward one side of said belt in one of said fluid bearing means and toward the other side of said belt in another of said fluid bearing means --; same column 4, after line 36, insert the following:

9. A method as defined in claim 1 wherein said belt is directed to travel on a tortuous path and wherein said supporting fluid is directed toward one side of said belt in one of said fluid bearings and toward the other side of said belt in another of said fluid bearings.

in the heading to the printed specification, line 9, for "8 Claims" read -- 9 Claims --.

Signed and sealed this 15th day of April 1969.

(SEAL)
Attest:

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