

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT Austria	FR France	ML Mali
AU Australia	GA Gabon	MR Mauritania
BB Barbados	GB United Kingdom	MW Malawi
BE Belgium	HU Hungary	NL Netherlands
BG Bulgaria	IT Italy	NO Norway
BJ Benin	JP Japan	RO Romania
BR Brazil	KP Democratic People's Republic of Korea	SD Sudan
CF Central African Republic	KR Republic of Korea	SE Sweden
CG Congo	LI Liechtenstein	SN Senegal
CH Switzerland	LK Sri Lanka	SU Soviet Union
CM Cameroon	LU Luxembourg	TD Chad
DE Germany, Federal Republic of	MC Monaco	TG Togo
DK Denmark	MG Madagascar	US United States of America
FI Finland		

1 DRYER FELT RUN
DESCRIPTION

5 This invention relates in general to the paper making art, and is more particularly concerned with a new and improved method of and apparatus for drying freshly formed paper web.

10 As is customary in the paper making industry, after the paper web has been formed from a water slurry of paper stock, the web is dried by traveling through one or more drier sections aided by means of endless porous belts commonly referred to as drier felts regardless of their composition. These drier felts support and guide the web over and in contact with one or more series of heated drier rolls. In some drier section installations, the heated drier rolls are arranged in vertical stacks. In other drier installations, the rolls are arranged in horizontal tiers, and it is to the horizontal arrangement that the present invention is directed.

20 It has been found that single drier felt carrying and guiding of the paper web is, at least for some grades of paper web, more efficient because the web is caused to travel directly in contact with the heated drier rolls. By way of example of single felt, and direct web contact with the drier rolls, U.S. Patent 3,868,780 is referred to. In the disclosure of that patent, both vertical and horizontal stack arrangements of the drier rolls are disclosed, and guide rollers are provided for assuring reasonable wrap of the web on the drier roll perimeters.

30 On the other hand, for more efficient drying in one pass travel through the horizontal drier section, the web should be guided by the drier felt in a path which causes the web to wrap drying cylinders, or
35 drier rolls, and hereinafter identified as dryers, in

1 both an upper and a lower tier. To attain this
result, guide rollers are required to be located
within the fairly restricted working space afforded in
the generally triangular pockets defined between the
5 upper and lower tiers of dryers. That may present a
problem of handling the broke in the event of a break
in the web. The apparatus and method of the present
invention solve that problem.

To this end, the present invention provides a
10 paper web drier section having an upper horizontal
tier of a plurality of dryers spaced from one another
less than the diameter of the dryers, a lower
horizontal tier of dryers spaced from one another and
adjacently spaced from the upper tier dryers, and with
15 the upper tier dryers forming with the lower tier
dryers respective generally triangular pockets. An
endless drier felt is trained to run a paper web
sinuously successively in direct contact on the upper
perimeter areas of the upper and lower tier dryers.
20 All of the dryers and the felt run in the same
direction. A pair of felt rolls is located in each
pocket for maximizing the wrap of the felt, and
thereby the web, on the dryer perimeters. A first of
the pair of felt rolls in each pocket is located for
25 controlling running of the felt and web from the lower
tier dryer located at the onrunning side of the pocket
and into the pocket and then onto the onrunning side
of the upper tier dryer defining the pocket. The
other of the pair of felt rolls in each pocket
30 controls running of the felt and web from the off-
running side of the upper tier dryer back into the
pocket and then onto the onrunning side of the lower
tier dryer at the offrunning side of the pocket. The
other felt roll forms with the drier felt and the
35 first felt roll a generally downwardly opening broke

1 receiving and ejecting sub-pocket within the dryer-
defined pocket.

The foregoing described apparatus is utilized
to practice the method of so guiding the web in the
5 dryer pockets that broke is purged therefrom.

There are no open draws throughout the drying
process in the drier section. The paper web is
supported continually by the drier felt.

Other objects, features and advantages of the
10 invention will be readily apparent from the following
description of the representative embodiments thereof,
taken in conjunction with the accompanying drawings,
although variations and modifications may be effected
without departing from the spirit and scope of the
15 novel concepts embodied in the disclosure, and in
which:

The Figure is a schematic illustration of a
horizontal drier section embodying the invention.

A typical two tier horizontal drier section 5
20 is shown in the drawing. This drier section may be
used alone or may be one of a series of drier
sections, depending upon particular requirements
dictated by any of the numerous parameters that may be
involved in making any particular paper. An upper
25 horizontal tier of a plurality of dryers 7, herein
shown as five in number, and spaced from one another
less than the diameter of the dryers, cooperates with
a lower horizontal tier of dryers herein shown as five
in number, which are spaced from one another and
30 adjacently spaced from the upper tier dryers. The
upper tier dryers 7 are relatively offset with respect
to the lower tier dryers 8 and define therewith
respective generally triangular pockets 9.

An endless drier felt 10 is trained to run a
35 paper web W sinuously, successively and in direct
contact on the upper perimeter areas of the upper and

1 lower tier dryers in a manner avoiding any open draw
of the web. That is, the web W is at all times, in
running through the drier section 5, in contact with
the drier felt 10.

5 Conventional means, identified schematically as
a drive 11, are provided for driving all of the dryers
7 and 8 and the felt 10 in one direction, that is from
the right to the left as viewed in the drawing.
Although the drive means may be of the kind which will
10 positively drive all of the dryers 7 and 8 in
coordinated relation, it may be sufficient merely to
drive the upper tier dryers 7 and rely upon tensioning
of the drier felt 10 to drive the lower dryers 8. In
this instance, a common gear drive 12 is schematically
15 depicted for the upper dryers 7. Various guide
rollers 13 are shown for controlling the return run of
the drier felt 10. A tensioning roller 14 permits
adjusting the drier felt tension.

The paper web W to be dried may be delivered to
20 the entry end of the drier section 5 as by means of a
delivery belt or felt 15 which partially wraps a roll
17 and from which the wet web is transferred to the
drier run of the felt 10. After the web has been
transferred to the felt 10, a guide roller 18 guides
25 the drier felt and the web W carried thereby onto the
first in the series of lower dryers 8 and on the
perimeter of which there is a partial wrap of the
felt. The web W is in direct contact with the dryer 8
as the felt 10 runs to a vacuum or grooved or plain
30 felt roll 19 depending upon speed of machine and
weight of the web within the first dryer-defined
pocket 9. The roll 19 functions in cooperation with
the guide roller 18 to improve the extent of drying
wrap on the perimeter of the first lower tier dryer
35 8.

1 The felt roll 19 also functions for controlling
running of the drier felt 10 and the carried paper web
W from the first lower tier dryer 8 at the onrunning
side of the first pocket 9 into such pocket and then
5 in onrunning direction onto the upper tier dryer 7
defining the pocket. In effect, the felt roll 19
tucks the felt 10 and the carried web W generally
under the onrunning side of the dryer 7 for maximizing
wrap of the felt and web about the perimeter of the
10 dryer 7.

 Under the offrunning side of the upper dryer 7,
a second vacuum felt roll 20 controls running of the
felt 10 and web W into the pocket 9 and then onto the
onrunning side of the next succeeding lower tier dryer
15 8. As will be observed, the felt roll 20 forms with
the drier felt 10 and the felt roll 19 a generally
downwardly opening broke-receiving and ejecting
subpocket 21 within the pocket 9 under the associated
upper tier dryer 7. Should there be a break in the
20 paper web W resulting in broke, the broke will be
influenced by the downrunning felt toward and about
the felt roll 20 to be diverted away from the dryer 7
past the felt roll 19 toward the onrunning side dryer
8 which is travelling peripherally in the same
25 direction as the felt 10 is travelling toward the felt
roll 20. Thereby, the broke tends to be ejected
downwardly away from the drier section 5 without
clogging the drier system. Rethreading the paper web
through the drier section is thus facilitated.

30 In each succeeding pocket 9, there is the same
arrangement of first and second felt rolls 19 and 20
and subpocket 21 to the same effect as described in
connection with the first of the pockets 9 and its
subpocket in the series. Any or all of the felt rolls
35 18, 19 and 20 are desirably suction rolls although
they may be grooved or plain.

 From the offrunning end of the drier section 5,
the drier felt 10 and the web W carried thereby may be

1 guided away from the last lower dryer 8 by means of a
felt roll 22 to run onto the final dryer 7, in the
upper tier of dryers. From the final dryer 7, the
drier felt 10 and web W may be guided by a felt roll
5 24 for directing the web to diverge from the start of
the return run of the felt 10 and away from the last
dryer 7 for further processing.

The drier felt 10 should have a smooth surface
on its surface which engages the web W, and with a
10 permeability of between 25 and 100 CFM at 1/2" H₂O
pressure per sq. ft.

It will be understood that variations and
modifications may be effected without departing from
the spirit and scope of the novel concepts of this
15 invention.

1 CLAIMS

1. A paper web drier section having:
an upper horizontal tier of a plurality of
rotary dryers spaced from one another less
than the diameter of the dryers;
a lower horizontal tier of rotary dryers spaced
from one another and adjacently spaced
from said upper dryers, and with said
upper dryers forming with the lower dryers
respective generally triangular pockets;
an endless drier felt trained to run a paper
web sinuously successively and in direct
contact on the upper perimeter areas of
said upper and lower dryers;
means for effecting running of all of said
dryers and said felt in one direction; and
a pair of felt rolls in each pocket for
maximizing the wrap of the felt, and
thereby the web, on the dryer perimeters,
a first of said pair of felt rolls in each
pocket located for controlling running of
said felt and web from the lower dryer
located at the onrunning side of the
pocket into said pocket and then in
onrunning direction onto the upper dryer
defining the pocket and a second of said
pair of felt rolls in each pocket
controlling running of the felt and web
from the offrunning side of the upper
dryer into the pocket and then onto the
onrunning side of the lower dryer at the
offrunning side of said pocket, and said
second felt roll forming with the drier
felt and said first felt roll a generally
downwardly opening broke-receiving and
ejection subpocket under said upper dryer
and within said pocket.

1 2. A drier section according to claim 1,
wherein said first felt rolls are located generally
above said second felt rolls and form a short tuck of
the felt into said pockets.

5 3. A drier section according to claim 1,
wherein said first felt rolls are located generally
above said second felt rolls within said pockets.

10 4. A method of operating a paper web drier
section having an upper horizontal tier of a plurality
of rotary dryers spaced from one another less than the
diameter of the dryers, a lower horizontal tier of
rotary dryers spaced from one another and adjacently
spaced from said dryers, and with said upper dryers
forming with the lower dryers respective generally
15 triangular pockets:

running a paper web on an endless drier felt
sinuously successively and in direct
contact on the upper perimeter areas of
said upper and lower dryers;

20 running all of said dryers and said felt
carrying said web in one direction;
maximizing the wrap of the felt, and thereby
the web, on the dryer perimeters by
running the felt over and about a pair of
25 felt rolls in each pocket;

by a first of said pair of felt rolls in each
pocket controlling running the felt and
web from the lower dryer located at the
onrunning side of the pocket into said
30 pocket and then in an onrunning direction
onto the upper dryer defining the pocket;

by means of a second of said pair of felt rolls
in each pocket controlling running of the
felt and web from the offrunning side of
35 the upper dryer into the pocket and then
onto the onrunnings side of the lower
dryer at the offrunning side of said
pocket; and

1 by means of said second felt roll forming with
the drier felt and said first felt roll a
generally downwardly opening broke-
receiving and ejection subpocket within
5 said pocket.

5. A method according to claim 4, which
comprises locating said first felt roll in said pocket
above said second felt roll.

6. A method according to claim 4, comprising
10 locating said first felt roll above the second felt
roll in said pocket, and forming a short tuck of the
felt into the pocket.

7. A method of operating a paper web drier
section having an upper horizontal tier of a plurality
15 of rotary dryers spaced from one another, a lower
horizontal tier of rotary dryers spaced from one
another and adjacently spaced from said upper dryers,
and with said upper dryers forming with the lower
dryers respective generally triangular pockets and
20 comprising:

training an endless drier felt to run a paper
web sinuously successively and in direct
contact on the upper perimeter areas of
said upper and lower dryers;

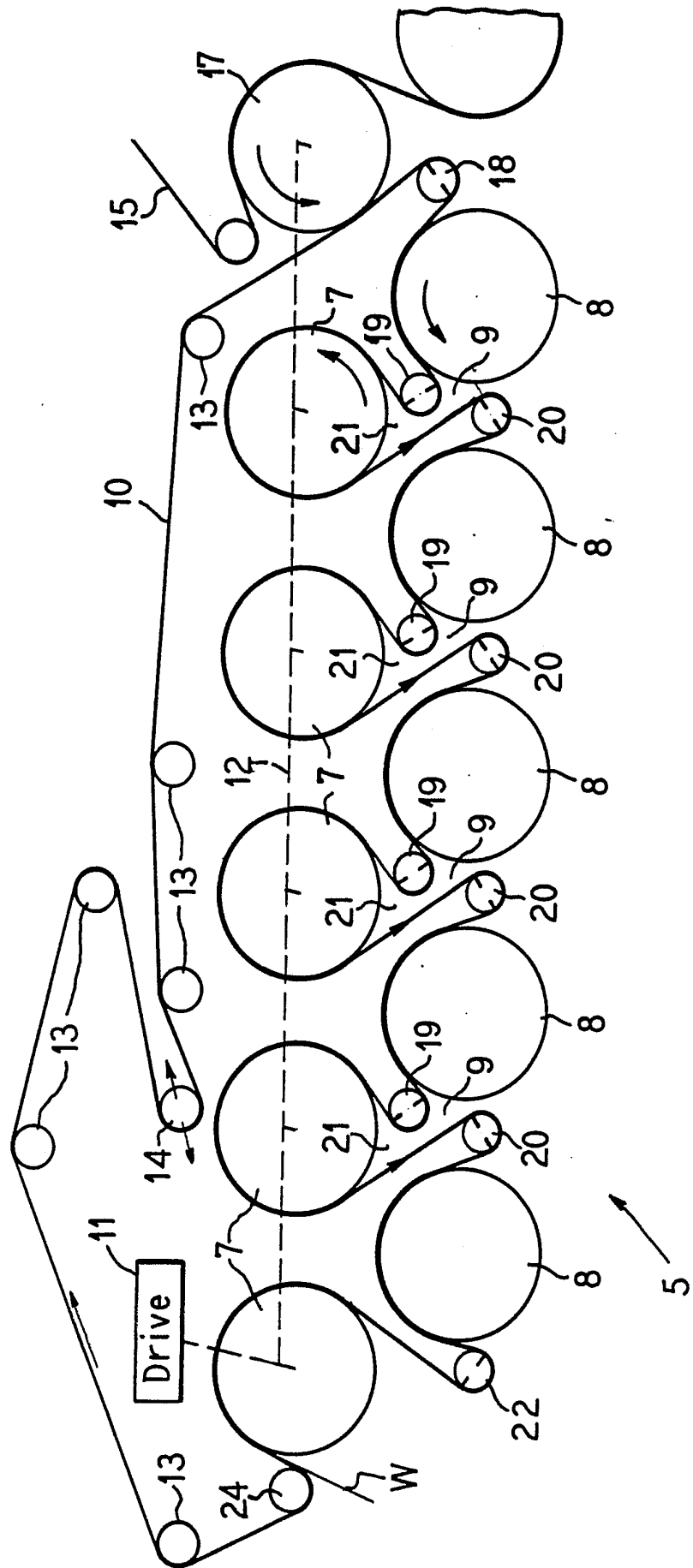
25 running all of said dryers and said felt in one
direction; and

in each pocket controlling the felt and thereby
the web carried by the felt to run from
the lower tier dryer located at the
30 onrunning side of the pocket into said
pocket and then in an onrunning direction
onto the upper tier dryer, and then from
the offrunning side of the upper dryer
controlling running of the felt and web
35 onto the onrunning side of the lower dryer
at the offrunning side of said pocket; and
ejecting broke downwardly from within said
pocket.

1 8. A method according to claim 7, which
comprises forming within said pocket a subpocket for
receiving and ejecting the broke.

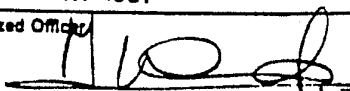
5 9. A method according to claim 7, which
includes ejecting broke downwardly from both the
onrunning and offrunning sides of said pocket.

 10. A method according to claim 7, which
comprises training said felt and web over and about
felt rolls in said pocket.



INTERNATIONAL SEARCH REPORT

International Application No PCT/US 86/00799

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : D 21 F 5/04		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	D 21 F; F 26 B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US, A, 3868780 (SOININEN) 4 March 1975 cited in the application --	
A	US, A, 3753298 (ELY) 21 August 1973 -----	
<p>⁹ Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
4th December 1986		22 JAN 1987
International Searching Authority		Signature of Authorized Officer
EUROPEAN PATENT OFFICE		M. VAN MOL 

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 86/00799 (SA 12985)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 18/12/86

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3868780	04/03/75	None	
US-A- 3753298	21/08/73	CA-A- 961636 GB-A- 1411772 JP-A- 48067838	28/01/75 29/10/75 17/09/73

For more details about this annex :
see Official Journal of the European Patent Office, No. 12/82