

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 665 328 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **95200680.7**(51) Int. Cl.⁶: **D21F 3/02**(22) Date of filing: **10.10.91**

This application was filed on 21 - 03 - 1995 as a divisional application to the application mentioned under INID code 60.

(30) Priority: **11.10.90 US 595910**(43) Date of publication of application:
02.08.95 Bulletin 95/31(60) Publication number of the earlier application in accordance with Art.76 EPC: **0 480 868**(84) Designated Contracting States:
DE FR GB IT SE

(71) Applicant: **BELOIT CORPORATION**
1 St. Lawrence Avenue
Beloit
Wisconsin 53511 (US)

(72) Inventor: **Cronin, Dennis Callahan**
703 Prairie Avenue
Rockton, IL 61072 (US)

(74) Representative: **Waxweiler, Jean et al**
Dennemeyer & Associates Sàrl
P.O. Box 1502
L-1015 Luxembourg (LU)

(54) **Papermaking apparatus for pressing and drying a web.**

(57) The present invention includes a papermaking apparatus (46) for pressing and drying a web (w). The apparatus (46) includes a press (47) and a drying section (48) disposed downstream relative to the press (47). The press (47) further includes a press member (50) and a backing roll (52) which cooperates with the press member (50) for defining therebetween a press nip (54) for pressing the web (w). A fabric (10) is disposed contiguously relative to the web (w) and extending through the nip (54) for supporting and guiding the web (w) through the nip (54). A felt (56) extends through the nip (54), the felt (56) being disposed on the opposite side of the web (w) relative to the fabric (10). The fabric (10) defines a relatively smooth surface (40) towards the web (w) such that when the web (w) exits the nip (54) and the fabric (10) and felt (56) diverge relative to each other, the web (w) follows the smooth surface (40) of the fabric (10) without being rewetted thereby. The dryer section (48) includes an upstream dryer (60) and a guide roll (62) which cooperates with the upstream dryer (60). The fabric (10) extends for the nip (54) to and around a portion of a heated outer surface (66) of the upstream dryer (60), the fabric (10) thereafter being guided away from the upstream dryer (60) by the guide roll (62) such that the web (w) is guided without open draw from the nip (54) to

the dryer section (48) without rewetting thereof by the fabric (10).

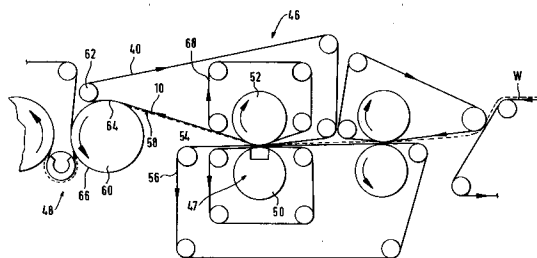


Fig. 3

EP 0 665 328 A1

FIELD OF THE INVENTION:

The present invention relates to a papermaking apparatus for pressing and drying a web.

INFORMATION DISCLOSURE STATEMENT:

In the papermaking art, a formed web is guided through a press section for removing as much water as possible from the formed web before guiding the pressed web into a drying section.

In view of the high thermal input requirements of a typical drying section, it is essential to remove as much water as possible from the web during passage through the press section.

A long-standing problem has been experienced in transferring a pressed web from a press section to a dryer section. Ideally, a press felt for supporting the web during passage through a pressing nip of the press section would thereafter convey the web towards and around at least an initial portion of the dryer section.

However, the aforementioned ideal arrangement has not proved practical because the press felt normally absorbs a large quantity of water from the web during passage of the web and press felt through the press nip, and unless the web and press felt are caused to diverge relative to each other immediately downstream relative to the press nip, the web becomes rewetted by the water laden press felt.

Accordingly, in the prior art, typically the press felt is guided around at least one guide roll such that the press felt diverges relative to the web immediately downstream relative to the press nip. Subsequently, a press-to-dryer transfer felt is led into guiding relationship with the web downstream relative to the press nip for guiding and supporting the web into and around the dryer section.

Alternatively, in many press-to-dryer transfer arrangements, a dryer felt will be extended into proximity with the press section such that the web is supported by the dryer felt and conveyed thereby to the dryer section.

In the aforementioned press-to-dryer transfer arrangements, the web, at some point between the press nip and the dryer section, is unsupported by either the press felt, a press-to-dryer transfer felt, or a dryer felt. Accordingly, such "open draw" of the web has necessitated relatively complex threading techniques in order to thread a tail of the web from the press section into a downstream dryer section.

The aforementioned "open draw" also involves handling the web when the web is relatively fragile and subject to web breakage.

U.S. Patent No. 4,483,745 to L. Wicks et al teaches a "no draw" press-to-dryer transfer utiliz-

ing a non-porous blanket which extends from an extended nip press arrangement to a downstream dryer section such that the web is conveyed by the non-porous blanket from the extended nip to the subsequent dryer section.

However, the aforementioned non-porous blanket, which supports the web, necessitates one-sided removal of the water pressed from the web during passage through the extended nip. Although in certain applications such one-sidedness of the resultant web is acceptable, if "two-sidedness" or uniformity in surface characteristics of the resultant web is required, the web must in some way be reversed in order to achieve the desired two-sidedness of the web.

Therefore, it is a primary object of the present invention to provide a papermaking apparatus for pressing and drying a web that makes a considerable contribution to the papermaking art and that overcomes the abovementioned problems of the prior art.

Another object of the present invention is to provide a papermaking apparatus permitting complete support of the web without "open draw" from the press nip to the dryer section and which permits water to be absorbed thereby while inhibiting rewetting of the web.

Another object of the present invention is the provision of a papermaking apparatus utilizing a fabric having a relatively smooth surface towards the web such that the web predictably follows the fabric when a felt and the fabric diverge relative to each other downstream of a double felted press arrangement.

Other objects and advantages of the present invention will be evident to those skilled in the art by a consideration of the detailed description contained hereinafter taken in conjunction with the annexed drawings.

SUMMARY OF THE INVENTION

The present invention includes a papermaking apparatus for pressing and drying a web. The apparatus includes a press and a drying section disposed downstream relative to the press.

The press further includes a press member and a backing roll which cooperates with the press member for defining therebetween a press nip for pressing the web.

A fabric is disposed contiguously relative to the web and extending through the nip for supporting and guiding the web through the nip. Furthermore, a felt extends through the nip, the felt being disposed on the opposite side of the web relative to the fabric. The fabric defines a relatively smooth surface towards the web such that when the web exits the nip and the fabric and felt diverge relative

to each other, the web follows the smooth surface of the fabric without being rewetted thereby.

The dryer section includes an upstream dryer and a guide roll which cooperates with the upstream dryer. The fabric extends from the nip to and around a portion of a heated outer surface of the upstream dryer, the fabric thereafter being guided away from the upstream dryer by the guide roll such that the web is guided without open draw from the nip to the dryer section without rewetting thereof by the fabric.

The fabric has a caliper within the range 1.27 to 2.54 microns (1/20 thousandth of an inch to 1/10 thousandth of an inch).

In a preferred embodiment of the present invention, the press also includes a backing felt which is disposed contiguously relative to the fabric for backing the fabric such that water from the web passes through the fabric into the backing felt. The fabric also inhibits flow of water from the backing felt that would otherwise cause rewetting of the web.

Although the need for the aforementioned fabric has long been recognized in the art, the manufacture of such fabric has eluded the efforts of press and dryer felt manufacturers.

The present invention was made and the unexpected results were obtained therefrom by passing a particular sample felt patch through a heated extended nip press of the type described in U.S. Patent No. 4,738,752. The resultant fabric had a caliper in the range of 1.7 microns (1/15 thousandth of an inch) and displayed a relatively smooth web supporting surface. When the fabric continued to support the web downstream relative to the heated extended nip, the unexpected discovery was made that water had been absorbed by the fabric, but the web had not been appreciably rewetted by the fabric during passage of the fabric supported web downstream relative to the press nip.

Consequently, the implications of such non-rewetting fabric became immediately apparent. One application of such fabric would be as a press felt extending directly from a press nip to and around at least an initial portion of a dryer section. Such press-to-dryer transfer arrangement would permit complete support of the web without "open draw" from the press nip to the dryer section without the aforementioned problems of rewetting.

Furthermore, in view of the relatively smooth surface of the fabric, in the case of double felted pressing, it was evident that the web would consistently follow the smooth surface of the fabric rather than the comparatively rough surface of the felt on the other side of the web. Therefore, the web could be automatically guided from the press nip to and through the dryer section in a double felted press configuration without the need of suction or transfer

blow boxes and the like.

The fabric includes a base which defines a first and a second side. The base comprises a plurality of hydrophobic filaments. A first layer of fibers is disposed contiguously relative to the first side with the first layer of fibers being applied onto the first side of the base. A second layer of fibers is disposed contiguously relative to the second side of the base with the second layer of fibers being applied onto the second side of the base. At least one of the layers of the fibers includes a mixture of hydrophobic and hydrophilic fibers. The layers and the base are combined such that the fabric has a low permeability which permits water to be absorbed thereby while inhibiting rewetting of the web.

In a more particular embodiment of the present invention, the base includes a first plurality of the filaments which are disposed in a machine direction and a second plurality of the filaments disposed in a cross-machine direction with the machine and cross-machine directional filaments being woven together.

In one embodiment of the present invention, the hydrophobic filaments are of TEFLON, and the layers are needled into the first and the second sides respectively of the base. Furthermore, the mixture is of TEFLON and fiberglass fibers with the first and second layers of fibers having a denier which is less than the denier of the filaments.

In another embodiment of the present invention, both layers of fibers include a mixture of TEFLON and fiberglass fibers.

In a preferred embodiment of the present invention, the mixture of TEFLON and fiberglass fibers is in a ratio within the range 9:1 to 2:1.

In one embodiment of the present invention, the layers and the base are at least partially fused together by the application of pressure and heat. The fabric has an application particularly as a press fabric or as a press-to-dryer transfer fabric.

Many modifications and variations of the present invention will be evident to those skilled in the art by a consideration of the detailed description contained hereinafter, taken in conjunction with the annexed drawings. However, such modifications and variations fall within the

scope of the present invention as defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1 is a sectional view of a fabric according to the present invention;

Figure 2 is a diagrammatic representation showing the steps of weaving a base, needling fibers therein, and pressing the resultant mat according to the present invention; and

Figure 3 is a side-elevational view of a paper-making apparatus according to the present invention including the fabric shown in Figure 1.

Similar reference characters refer to similar parts throughout the various views of the drawings.

DETAILED DESCRIPTION OF THE DRAWINGS:

Figure 1 is a sectional view of a fabric generally designated **10** for supporting a web in a papermaking machine. The fabric **10** includes a base generally designated **14** which defines a first and a second side **16** and **18** respectively. The base **14** also includes a plurality of hydrophobic filaments generally designated **20** and **22** respectively. A first layer of fibers **24** is disposed contiguously relative to the first side **16** with the first layer **24** of fibers being applied onto the first side **16** of the base **14**.

A second layer of fibers **26** is disposed contiguously relative to the second side **18** of the base **14**. The second layer of fibers **26** is applied onto the second side **18** of the base **14**. At least one of the layers of fibers **24**, **26** includes a mixture of hydrophobic and hydrophilic fibers, and the layers **24** and **26** and the base **14** are combined such that the fabric **10** has a low permeability permitting water to be absorbed thereby while inhibiting rewetting of the web.

As shown in Figure 1, the base **14** also includes a first plurality of filaments **28** which are disposed in a machine direction as indicated by the arrow **MD**. A second plurality of the filaments **30,31,32,33,34** and **35** are disposed in a cross-machine direction as indicated by the arrow **CD** with the machine and cross-machine directional filaments **28** and **30-35** being woven together.

The hydrophobic filaments **28** and **30-35** are of TEFLON, and the layers **24** and **26** are needled into the first and the second sides **16** and **18** respectively of the base **14**. TEFLON is a registered trademark of E. I. DuPont De Nemours & Company.

The second layer of fibers **26** is a mixture of fibers. The mixture of fibers includes TEFLON and fiberglass fibers, and the individual fibers of the first and second layers **24** and **26** have a denier which is less than the denier of the filaments **28** and **30-35**.

In a preferred embodiment of the present invention, as shown in Figure 1, both layers of fibers **24** and **26** include a mixture of TEFLON and fiberglass fibers **36** and **37** respectively. The mixture of TEFLON and fiberglass fibers is in a ratio within the range 9:1 to 2:1.

Figure 2 shows a process for making the aforementioned fabric **10** and shows the layers **24** and **26** and the base **14** as being at least partially fused

together by the application of pressure and heat.

According to the present invention, the fabric **10** is a press fabric which extends through either a conventional roll couple defining a press nip or a press fabric extending through an extended nip press defined between an elongate press member and a cooperating backing roll for defining an extended nip.

The fabric **10** is also a press-to-dryer transfer fabric for fully supporting the web from a press nip to a downstream dryer section.

Figure 2 shows a process for making the fabric **10** for supporting a web **12** in a papermaking machine. The process comprises the steps of weaving a base **14** from a first plurality of machine directional TEFLON filaments **28** and a second plurality of cross-machine directional TEFLON filaments **30-35** such that the woven base **14** defines a first and a second side **16** and **18** respectively. A first layer of fibers **24** is needled by a needling means **25** into the first side **16** of the base **14**, and a second layer of fibers **26** is needled by a needling means **27** into the second side **18** of the base **14**. The first and the second layers of fibers **24** and **26** respectively are a mixture of TEFLON and fiberglass fibers **36** and **37** such that the base **14** and the layers **24** and **26** form an uncompressed mat **38**.

The mat **38** is then pressed at an elevated temperature by a roll press **39** such that the layers **24** and **26** and the base **14** are at least partially fused together so that the resultant fabric **10** attains a relatively smooth surface **40** while retaining water-absorbing capabilities and inhibiting rewetting of the web.

Preferably, the mat **38** is passed through a nip **42** of the press **39**, which is heated by induction heaters **44**, such that the layers **24** and **26** and the base **14** at least partially fuse together.

Figure 3 is a side-elevational view of a paper-making apparatus generally designated **46** for pressing and drying a web **W** shown by the dashed line. The apparatus **46** includes an extended nip press generally designated **47** and a drying section generally designated **48** disposed downstream relative to the press **47**. The press **47** further includes a press member **50** and a backing roll **52** cooperating with the press member **50** for defining therebetween a press nip **54** for pressing the web **W**.

The fabric **10**, as described hereinbefore, is disposed contiguously relative to the web **W** and extends through the nip **54** for supporting and guiding the web **W** through the nip **54**.

A felt **56** extends through the nip **54** with the felt **56** being disposed on the opposite side **58** of the web **W** relative to the fabric **10**.

The fabric **10** defines a relatively smooth surface **40** towards the web **W** such that when the

web **W** exits the nip **54**, and the fabric **10** and felt **56** diverge relative to each other, the web **W** follows the smooth surface **40** of the fabric **10** without being rewetted thereby.

The drying section **48** includes an upstream dryer **60**. A guide roll **62** cooperates with the upstream dryer **60**, and the fabric **10** extends from the nip **54** to and around a portion **64** of a heated outer surface **66** of the upstream dryer **60**. The fabric **10** thereafter is guided away from the upstream dryer **60** by the guide roll **62** such that the web **W** is guided without open draw from the nip **54** to the drying section **48** without rewetting thereof by the fabric **10**.

In a preferred embodiment of the present invention, the fabric **10** has a caliper within the range 1.27 to 2.54 microns (1/20 thousandth of an inch to 1/10 thousandth of an inch).

In a preferred embodiment of the present invention, as shown in Figure 3, the press **47** also includes a backing felt **68** which is disposed contiguously relative to the fabric **10** for backing the fabric **10** such that water from the web **W** passes through the fabric **10** into the backing felt **68**. The fabric **10** inhibits flow of water from the backing felt **68** that would otherwise cause rewetting of the web **W**.

The present invention provides a unique fabric which permits absorption thereby of water from a web supported on the fabric while inhibiting rewetting of the supported web. Additionally, the present invention enables the fabric of the present invention to support the web from the press nip to the dryer without rewetting the web while assuring predictable transfer of the web to the fabric in the case of a double felted pressing configuration.

Claims

1. A papermaking apparatus (46) for pressing and drying a web (W), said apparatus (46) comprising:
 - a press (47);
 - a drying section (48) disposed downstream relative to said press (47);
 - said press (47) further including:
 - a press member (50),
 - a backing roll (52) cooperating with said press member (50) for defining therebetween a press nip (54) for pressing the web (W),
 - a fabric (10) disposed contiguously relative to the web (W) and extending through said nip (54) for supporting and guiding the web (W) through said nip (54),
 - a felt (56) extending through said nip (54), said felt (56) being disposed on the opposite side of the web (W) relative to said fabric (10),
 - said fabric (10) defining a relatively smooth

surface (40) towards the web (W) such that when the web (W) exits said nip (54) and said fabric (10) and felt (56) diverge relative to each other, the web (W) follows said smooth surface (40) of said fabric (10) without being rewetted thereby;

said dryer section (48) including:
an upstream dryer (60),

a guide roll (62) cooperating with said upstream dryer (60), and

said fabric (10) extending from said nip (54) to and around a portion (64) of a heated outer surface (66) of said upstream dryer (60), said fabric (10) thereafter being guided away from said upstream dryer (60) by said guide roll (62) such that the web (W) is guided without open draw from said nip (54) to said dryer section (48) without rewetting thereof by said fabric (10).

2. A papermaking apparatus as set forth in claim 1, wherein said fabric (10) has a caliper within the range 1.27 to 2.54 microns (1/20 thousandth of an inch to 1/10 thousandth of an inch).
3. A papermaking apparatus as set forth in claim 1, wherein said press (47) further includes:
 - a backing felt (68) disposed contiguously relative to said fabric (10) for backing said fabric (10) such that water from the web (W) passes through said fabric (10) into said backing felt (68), said fabric (10) inhibiting flow of water from said backing felt (68) that would otherwise cause rewetting of the web (W).
4. A papermaking apparatus as set forth in claim 1, wherein said fabric (10) comprises:
 - a base (14) defining a first and a second side (16,18);
 - said base 10 including:
 - a plurality of hydrophobic filaments (20,22),
 - a first layer of fibers (24) disposed contiguously relative to said first side (16), said first layer (24) of fibers being applied onto said first side (16) of said base (14),
 - a second layer of fibers (26) disposed contiguously relative to said second side (18) of said base (14), said second layer of fibers (26) being applied onto said second side (18) of said base (14);
 - at least one of said layers of fibers (24, 26) including:
 - a mixture of hydrophobic and hydrophilic fibers; and
 - said layers (24, 26) and said base (14) being combined such that the fabric (10) has a

low permeability permitting water to be absorbed thereby while inhibiting rewetting of the web (W).

5. A papermaking apparatus as set forth in claim 4, wherein said base (14) further includes:
 a first plurality of said filaments (28) disposed in a machine direction (MD);
 a second plurality of said filaments (30-35) disposed in a cross-machine direction (CD);
 said machine and cross-machine direction filaments (28, 30-35) being woven together. 5 10
6. A papermaking apparatus as set forth in claim 4, wherein said hydrophobic filaments (28,30-35) are of TEFLON. 15
7. A papermaking apparatus as set forth in claim 4, wherein said layers (26,28) are needled into said first and second sides (16,18) respectively of said base (14). 20
8. A papermaking apparatus as set forth in claim 4, wherein said mixture (26) is of TEFLON (36) and fiberglass fibers (37). 25
9. A papermaking apparatus as set forth in claim 4, wherein said fibers of said first and second layers (24, 26) of fibers have a denier which is less than the denier of said filaments (28, 30-35). 30
10. A papermaking apparatus as set forth in claim 4, wherein both layers of fibers (24, 26) include a mixture of TEFLON (36) and fiberglass fibers (37). 35
11. A papermaking apparatus as set forth in claim 4, wherein said mixture of TEFLON (36) and fiberglass fibers (37) is in a ratio within the range 9:1 to 2:1. 40
12. A papermaking apparatus as set forth in claim 4, wherein said layers (24, 26) and said base (14) are at least partially fused together by the application of pressure and heat. 45

50

55

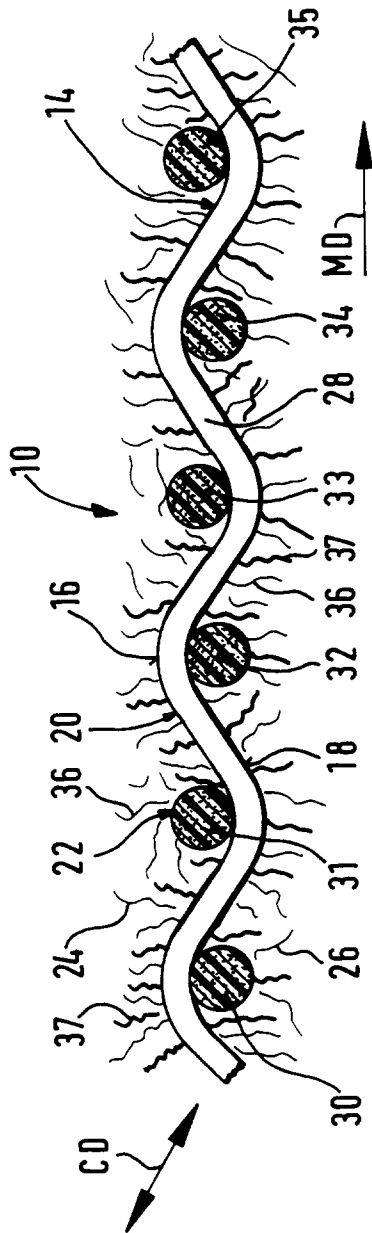


Fig. 1

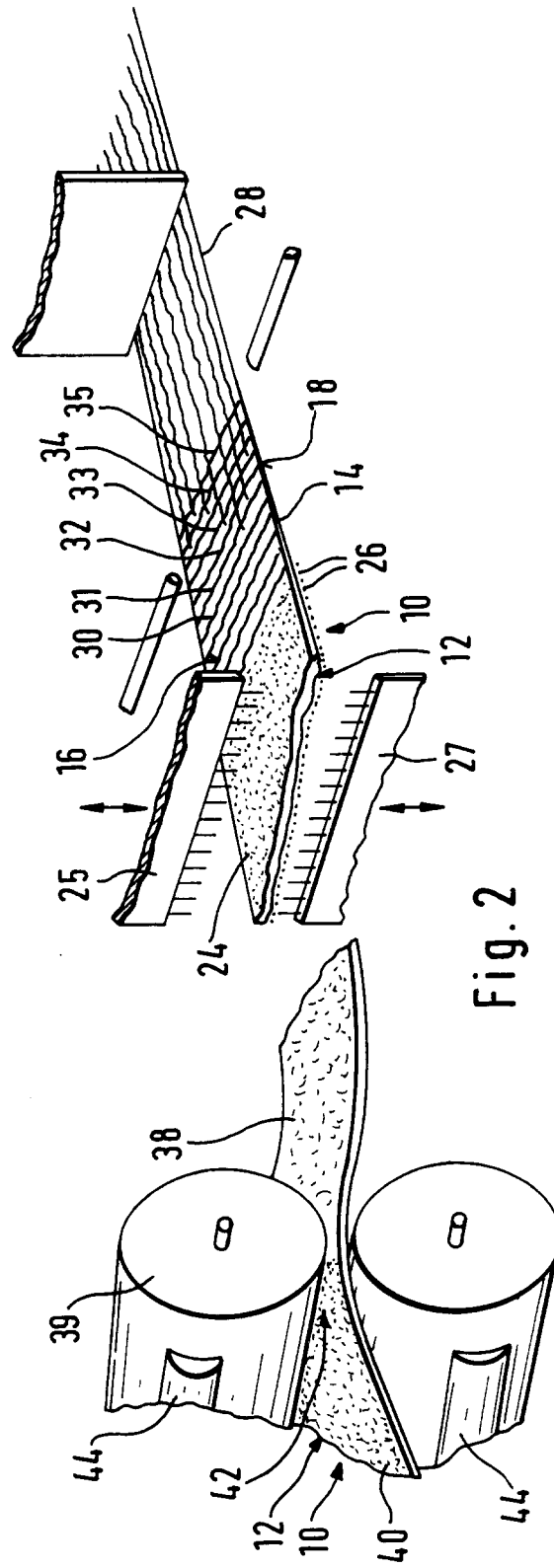


Fig. 2

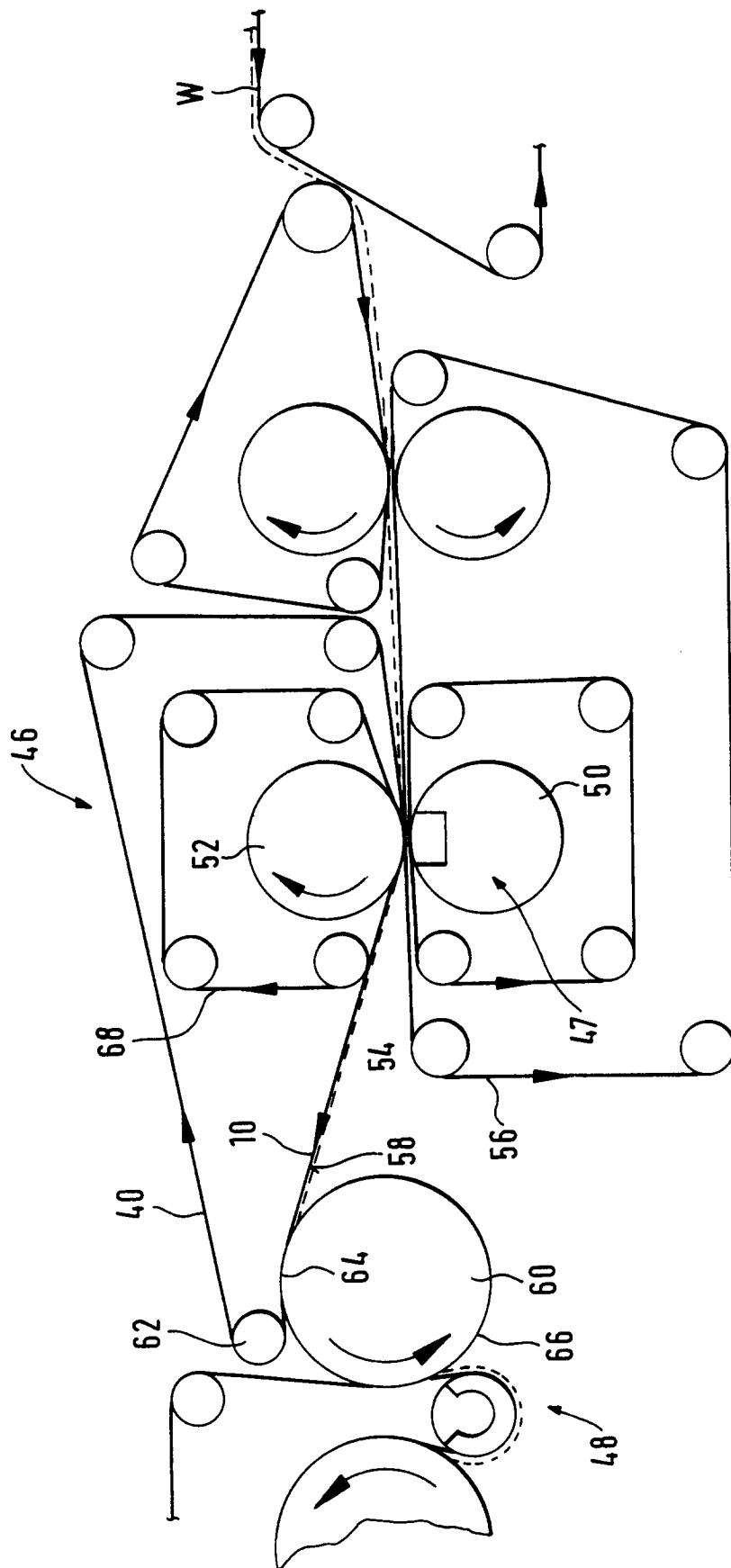


Fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 95200680.7
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	<u>US - A - 4 861 430</u> (ANDERSSON) * Totality *	1	D 21 F 3/02
D, A	<u>US - A - 4 483 745</u> (WICKS) * Totality *	1	
A	<u>AT - B - 301 325</u> (MICHISUKE KINOSHITA) * Totality *	5, 7	
A	<u>US - A - 4 529 643</u> (LUNDSTRÖM) * Totality *	5, 7	
A	<u>US - A - 3 401 467</u> (KOESTER) * Totality *	5, 7	
D, A	<u>US - A - 4 738 752</u> (BUSKER) -----		TECHNICAL FIELDS SEARCHED (Int. Cl.5) D 21 F 3/00 D 21 F 5/00 D 21 F 7/00 D 21 F 9/00 D 21 G 9/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 09-05-1995	Examiner KRUMPSCHMID
<div>CATEGORY OF CITED DOCUMENTS</div> <div>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</div> <div>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document</div>			