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(71) Applicant: BELOIT CORPORATION [US/US]; 1 St. Lawrence Avenue, Beloit, WI 53511 (US).

(72) Inventor: CRONIN, Dennis, C.; 703 Prairie Avenue, Rockton, IL 61072 (US).

(74) Agents: VAN SANTEN, James et al.; Hill, Van Santen, Steadman, Chiara & Simpson, 70th Floor Sears Towers, Chicago, IL 60606 (US).

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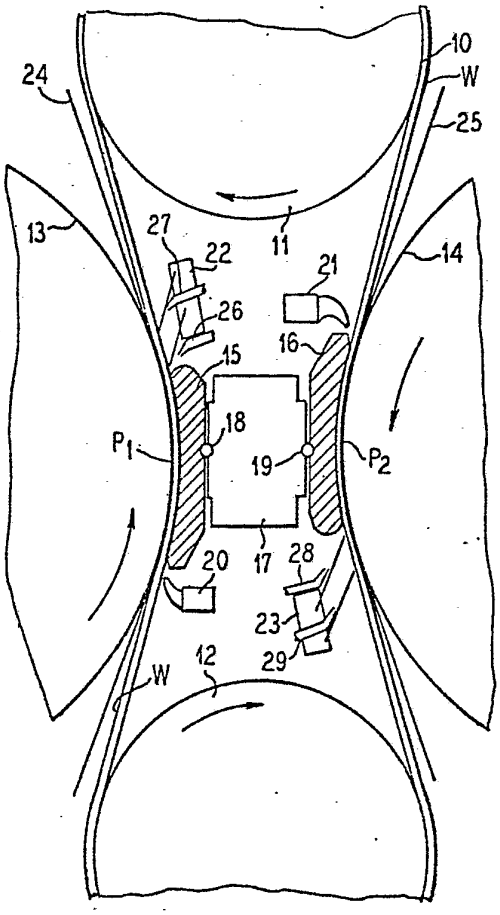
(54) Title: EXTENDED NIP PRESS

(57) Abstract

An extended press mechanism for removing liquid from a travelling fibrous web (w) including a press nip (P1) formed between first and second members with one of the members being a travelling flexible impervious belt (10) and force means engaging the inner surface of the belt including a sliding shoe (15) facing the belt with the shoe extending transversely across the belt usually of a width less than the belt and also extending in the direction of the belt travel to form an elongated press nip with means for pressing the shoe toward the belt (17) with a predetermined force, means for providing a film of lubricating fluid between the shoe and belt (20) and means for removing the excess of lubricating fluid downstream from the shoe (22) including a wiper blade (23a) extending toward the belt flexed against the belt to wipe off the lubricant with means to remove the lubricant which is wiped off (26, 27) and means at the side of the shoe to wipe lubricant off the uncompressed portion of the belt and means such as ribs and grooves at the edge of the belt to prevent the lubricant from migrating around the edge onto the web side of the belt.



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DESCRIPTION

"Extended Nip Press"

The present invention relates to improvements in extended nip presses pressing water from a traveling fibrous web wherein the nip is formed by a sliding shoe having a hydraulic film of lubricating fluid between the shoe and the belt and more particularly, the invention relates to improvements in controlling the lubricating fluid for removing it from the belt downstream of the shoe and preventing the fluid from being carried along with the belt and preventing it from migrating around the edge of the belt onto the web side.

In a conventional paper making machine, after the web is formed, it is carried through a press section where the water is mechanically expressed from the fibrous web. Improvements in press sections have changed from the conventional two roll press to what has been known as an extended nip press wherein the web is subjected to a continuing pressure for a longer period of time than with the simple two roll press. Developments in these extended nip presses have included a roll as one of the pressing members with the other pressing member being a continuous impervious belt pressed toward the roll by an arcuate sliding shoe which develops a film of hydraulic lubricant between the belt and the shoe to eliminate friction and help aid in developing uniform pressure completely across the pressing zone through which the web passes. Examples of these improved sliding shoe presses are shown in U.S. Patent No. 3,783,097, E. J. Justus and an application copending herewith, Serial No. 939,449, Mohr et al.

The lubricating fluid which is delivered to form the hydraulic film between the shoe and traveling belt must be uniformly delivered across the web and in one form of

mechanism, is provided by a series of nozzles arranged and controlled so that they deliver a lubricating fluid such as oil to the leading edge of the shoe which is relieved and forms a uniform hydraulic film completely across the shoe. As this film is formed, lubricant adheres to the belt and travels along with the belt trailing out from behind the shoe. This lubricating oil must then be controlled so that it does not continue to travel along on the surface of the belt so as to be compressed or fly off of the belt surface as the belt is carried over guide rolls. Further, the lubricating oil must be controlled so that it does not migrate toward the edge of the belt and pass over the edge where it will fly out into the surrounding atmosphere or will pass out over the edge of the belt and travel onto the web side of the belt so as to contaminate the web. The web is carried against a felt or between two felts, and these felts must be maintained to receive the water expressed from the web and satisfactory operation dictates that the lubricant cannot get into the felts to affect their water receptivity and to contaminate the web. Various means have been attempted to control and remove lubricant from the surface of the belt, but problems are presented with a belt that is traveling at speeds of 300 to 5,000 feet per minute. Further, the removal must be effected uniformly across the surface so that lubricant is not continued to be carried in streaks or ridges along with the belt so as to possibly return on the belt surface into the nip between the belt and the shoe to adversely affect the uniform pressure which must be maintained in the hydraulic film between the shoe and the belt. Further, complete removal particularly along the edges must be effected so as to prevent lubricating oil from getting out to the

edges where it is thrown off by centrifugal force onto surrounding parts and where it can migrate around the edge onto the surface of the belt.

Another difficulty which is inherent in the operation of the mechanism is that the width of the belt for optimum design is wider than the shoe. This means that the portion of the flexible belt which passes beneath the shoe is compressed and is of less thickness as it emerges from beneath the shoe as compared with the portions of the belt on each side of the shoe that have not been compressed. This difference in thickness caused by the compression plus the nonuniform density of the lubricating oil across the face of the belt at the edge of the shoe makes it difficult to apply a simple removal element which treats the belt uniformly across its entire width. In other words, while the belt recovers its thickness after it passes out from beneath the shoe, at high speeds this recovery occurs after the belt has traveled some distance beyond the trailing edge of the shoe. Also, the lubricating oil which is applied between the belt and shoe must be essentially uniform across the entire width of the shoe face and yet a minimum amount of lubricating oil should be present beyond the edges of the shoe to avoid having excess oil which will fly off the belt and tend to travel outwardly to the belt edge where it can get onto the other face of the belt and contaminate the web and felts. It is also possible that a variation in viscosity can occur in the lubricating oil due to the heat generated in the lubricating oil as it passes beneath the shoe as contrasted with the oil at the edge which is not compressed between the shoe and the belt.

It is accordingly an object of the present invention to provide a method and mechanism for the removal and control

of lubricating oil used to provide a hydraulic lubrication film between the shoe and belt of an extended nip press.

A further object of the invention is to provide an improved method and mechanism which permits operation of an extended nip press at high speeds and prevents the migration and escape of lubricating oil to the other parts of the machine and to the edges of the belt and around the edges onto the surface of the belt which carries the felts and the web.

Other objects, advantages and features as well as equivalent methods and structures which are intended to be covered herein will become more apparent with the teaching of the principles of the present invention in connection with the disclosure of the preferred embodiments in the specification, claims and drawings in which:

DRAWINGS

Figure 1 is a side elevational view partially in section, shown somewhat schematic, of an elongated nip press with two successive press stages constructed and operating in accordance with the principles of the present invention;

Figure 2 is a fragmentary sectional view illustrating one form of lubricant wipers;

Figure 3 is an inverted sectional view taken across a shoe on the downstream end showing edge wipers;

Figure 4 is another inverted sectional view similar to Figure 3 showing another form of edge wipers;

Figure 5 is an enlarged side elevational view, partially in section showing a preferred form of lubricant wipers;

Figure 6 through Figure 8 are fragmentary perspective views showing three forms of lubricant supply

nozzles;

Figure 9 is a fragmentary perspective view showing a form of lubricant wiping blade arrangement; and

Figures 10 through 12 are fragmentary sectional views showing edge constructions of belts.

DESCRIPTION

Figure 1 illustrates an extended nip press construction of the general type referred to in the above referred-to patent application, Serial No. 939,449, the disclosure of which is incorporated herein by reference.

The press includes an endless impervious belt 10 supported on separated parallel drive and guide rolls 11 and 12. The belt passes over two press rolls 13 and 14 to form first and second press nips P_1 and P_2. While the special arrangement showing the two nips provides advantages in two successive nips with the web W being supported on the belt being carried automatically through two nips, the principles employed are those shown in the above referred-to Justus Patent 3,783,097, the disclosure of which is incorporated herein by reference.

In Figure 1, the press nip P_1 is formed between the roll 13 and the belt 10 and a sliding pressure shoe 15 bears against the smooth surface of the belt and has an inner smooth surface and a hydraulic film of lubricating oil is built up between the belt and the shoe with the oil being supplied by an elongate nozzle 20 which extends across ahead of the shoe with the oil being caught between the relieved leading edge of the shoe 15. The shoe is supported on a roll pin 18 and is forced toward the belt by a piston and cylinder arrangement shown schematically at 17. This piston and cylinder arrangement also supports an opposite shoe 16 which presses toward the roll 14 to

form the second press P_2. The piston and shoe arrangement 17 presses the shoe 16 against the belt on a roll pin 19 so that the forces applied by the piston and cylinder assembly 17 are equal and opposite for cancellation of forces.

Lubricating oil is delivered to the lead end of the shoe 16 through a nozzle arrangement 21 so that a film of lubricating fluid is built up between the shoe 16 and the belt 10. A felt 24 passes through the first press to receive water expressed from the web, and a felt 25 passes through the second press to receive water expressed from the web.

As the web W is carried on the belt through the two presses, it is subjected to pressing pressure over the length of the elongate concave arcuate face of each of the shoes 15 and 16 to permit water to be pressed from the fibrous web and to migrate into the felts 24 and 25.

Lubricating oil which builds up the hydraulic film between the shoe and belt is carried with the belt on the trailing end of the shoe and must be removed so that it is not carried up with the belt around the rolls 11 and 12 and so that it is not permitted to be thrown off the edge of the belt or to migrate around the edge of the belt onto the web face of the belt. The structures for removal of the lubricating oil from the inner surface of the belt are shown at 22 and 23. The unit 22 for removal of the lubricating oil includes blades in sequence which have their leading edge in close running contact with the belt to doctor the oil from the surface. The oil is picked up by oil removal means such as suction nozzles, not shown.

For the oil removal apparatus 23, blades 23a and 23b are provided with their leading edges in close running contact with the inner smooth surface of the belt and the removed oil is picked up by suitable means.

The extended presses are operable at machine speeds of up to 5,000 feet per minute, and the lubricating oil which forms the hydraulic film between the shoes and the belts operates at shoe pressures of 600 psi. The oil must provide an adequate flow of lubricating oil so as to aid in maintaining uniform press pressure between the belt and the web and to prevent scuffing of the belt and it has been discovered that oil must be provided in volumes of .2 - 1.0 gallons per minute per inch of machine width, and these quantities of oil must be provided and again removed to eliminate the possibility of contaminating the closely adjacent newly formed web.

The hydraulic oil must be provided at a uniform controlled rate which does not provide an excess of oil or risk a deficiency of oil. Examples of nozzles for providing oil in advance of the shoe are shown in Figures 6, 7 and 8. Each of nozzles shown therein is provided with an oil supply that delivers oil into the chamber throughout the elongate nozzle to flow out to the delivery means onto the belt. The nozzle arrangement shown in Figure 6 is a preferred form and has an elongate continuous slot 33 to deliver oil onto the belt. The arrangement of Figure 7 has a series of separate openings 34 for the delivery of oil. The arrangement of Figure 8 has an open gap so that oil fills the channel below the gap to flow out in a wier type of effect onto the traveling belt.

It has been discovered that to prevent the escape of oil onto adjacent machine parts and onto the newly formed web, approximately 95% or more of the oil must be removed from the inner surface of the belt on the offrunning side of the shoe. A preferred arrangement for the removal of the oil is the employment of a flexible

plastic wiper blade which has a free leading edge in close running contact with the smooth surface of the belt. A plastic blade formed of a polycarbonate plastic such as sold under the General Electric tradename "Lexan" has proven desirable with a thickness in the range of .020"-.060" with a length of approximately 3". A preferred form of structure wherein the elasticity of the blade is used to hold it into contact with the belt is shoen in Figure 5 wherein first and second blades 36 and 37 are clamped and held in a blade support 40. The leading edges 38 and 39 are in sliding contact with the smooth surface of the belt 10. Means are provided for removal of the oil which creeps over the inner surface of the blade as the blade doctors the oil off the belt with these means being in the form of nozzles, not shown in Figure 5.

Figure 2 illustrates a plurality of these blades being carried in an assembly with the blades being shown at 44 supported on a back 43. Additional blades or fewer blades may be provided and/or a second assembly spaced slightly downstream from the first assembly may be additionally provided, each adjusted so that the leading edge of the blade projects toward and is in sliding contact with the belt.

Figures 3 and 4 illustrate edge wipers positioned in sliding contact with the belt outwardly beyond the outer edges of the shoe 15. The belt 10 is wider than the shoe 15 and to prevent the oil which is squeezed out from beneath the edge of the shoe from migrating laterally around the edge of the belt, longitudinal wiper blades 51 and 52 supported in backs 49 and 50 are provided in sliding contact with the surface of the belt. These blades 51 and 52 have a lower flexible edge projecting inwardly in the direction of the shoe and elastically pressing against

the belt surface.

Figure 4 shows another form wherein holders 45 and 46 carry sliding wipers 47 and 48 at their lower edge in sliding contact with the belt 10 outside the outer edge of the shoe 15.

As will be noted from Figures 3 and 4, the portion of the belt which passes beneath the shoe is compressed, and the portion laterally outside the edge of the shoe is uncompressed. The belt is formed of a very tough fibrous rubber material, but at nip pressures of 600 psi, compression or a squeezing of the belt will occur so that the portion of the belt which passes out from under the trailing end of the shoe will be thinner than the portion of the belt immediately beside the shoe. The lubricating oil should be removed as soon as possible, and at high speeds the belt will not yet have regained its normal thickness. Thus, in the arrangement illustrated in Figure 9, the wiping blade is arranged in segments with a primary wiping blade 71 being of the width of the shoe to engage that portion of the belt. An auxiliary wiping blade 72 engages the uncompressed area of the belt. Thus, the primary wiping blade 71 has its leading edge operating at a different level than the auxiliary wiping blade 72 to accommodate the difference in thickness of the belt. As will be seen from Figure 9, the portion 69a of the belt is compressed, and the portion 69b is uncompressed, and the felt 70 is shown on the web side of the belt 69. In some instances it may be desirable to also include means such as a wiper blade on the web side of the belt 69 in the area laterally beside the felt to remove any lubricant that may possibly migrate around the belt edge.

In Figures 10 through 12, means are provided to aid in preventing the migration of the lubricant onto the web side

of the belt. In Figure 10, the belt is shown at 60 with a felt 65 carrying the web. At the edge of the belt on the shoe face thereof is a longitudinal groove 61 which extends continuously. This groove will provide lateral faces at each side of the groove which will tend to throw the oil and prevent the oil from passing laterally around the edge of the belt.

The arrangement of Figures 11 employs a belt 62 with a felt 65 and two parallel grooves 63 and 64 at the belt edge outside of the shoe, on the shoe surface of the belt.

In the arrangement of Figure 12, the belt 65 is provided with a groove 66 on the shoe face and an additional groove 67 on the web face of the belt, both of which function to prevent the migration of lubricating oil around the edge of the belt to contaminate the web.

In operation as illustrated in Figure 5, the belt 10 will be carrying a layer of hydraulic lubricant with it out from under the shoe 15, and this lubricant will be continually wiped from the belt by the thin elastic flexible plastic blades 36 and 37, and the collected lubricant will be drawn off by suction nozzles. In continuous operation, speeds up to 5,000 feet per minute can be accomplished with the superior dewatering effect which is possible with an extended press.

CLAIMS

1. A press mechanism for removing liquid from a traveling fibrous web comprising in combination: a looped endless press belt; first and second elongate press nips through which said belt travels; inner belt supporting means within the belt opposite said press nips; first and second outer belt supporting means outside of said belt opposite said respective nips; one of said belt supporting means forming elongate shoe surfaces pressing the belt toward the other of said belt supporting means for applying pressure to the web along the elongate nips; water receiving means passing through the nips for receiving water received from a wet traveling web passing through said first and second nips; lubricant delivery means delivering lubricating fluid between the shoe surfaces and the belt on the upstream side of each of the shoes; a lubricant removable blade means having a leading edge in close running contact with the belt on the off-running side of each of the nips doctoring lubricant off of the belt surface; and means for removing lubricant doctored off the belt.

2. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 1: wherein said blade means includes first and second sequential edges extending across the belt for removing lubricant therefrom.

3. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 1: wherein said blade means includes an arcuate flexible plastic blade with a support positioned so that the blade edge is in resilient engagement with the surface of the belt.

4. A press mechanism for removing liquid from a

traveling fibrous web comprising in combination: a press nip formed between first and second members for receiving a traveling web therebetween; one of said members being a traveling flexible impervious belt; force means engaging the surface of said belt including a sliding shoe having a surface facing the belt with the surface extending transversely across the belt and extending in the direction of belt travel to form an extended press nip; means for pressing the shoe toward the belt with a predetermined force; means for receiving liquid pressed from the web between said members; lubricant delivery means positioned ahead of the shoe for providing a film of lubricant between the shoe and belt with the leading edge of the shoe being relieved to form a hydraulic wedge of lubricating fluid between the shoe and belt; and a lubricant removal blade on the down-running side of the shoe having a leading edge in close running contact with the belt and extending across the belt to skim lubricant off of the smooth belt surface as it is carried along with the belt after the belt passes the shoe surface.

5. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 4: wherein said blade means is in the form of a thin resilient arcuate blade member supported at its base end with a free end in sliding contact with the belt surface for doctoring lubricant off of the belt.

6. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 4: wherein said blade means includes first and second blades positioned in sequence with their edges extending transversely across the belt for doctoring lubricant off of the belt.

7. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 4: wherein said blade means is formed of a flexible plastic having a thickness in the range of .020" to .060".

8. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 4: wherein said blade means includes a wiping blade portion extending across the belt for substantially the exact width of the shoe and includes a second wiping blade portion in doctoring relationship with the belt and extending at the side of the shoe engaging the portion of the belt which has been uncompressed and has passed beside the shoe.

9. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 4: wherein said blade means is of substantially the exact width of the shoe so as to engage only the compressed part of the belt which has passed beneath the shoe and a portion of the belt extends wider than the width of said shoe.

10. A press mechanism for removing liquid from a traveling fibrous web comprising in combination: a press nip formed between first and second members for receiving a traveling web therebetween; one of said members being a traveling flexible impervious belt; force means engaging the surface of said belt including a sliding shoe having a surface facing the belt with said shoe surface extending transversely across the belt of a width less than the belt and also extending in the direction of belt travel to form an extended press nip; means for pressing the shoe toward the belt with a predetermined force; means for delivering a film of lubricating fluid between the shoe and

the belt; means for receiving liquid pressed from the web between said members; and lubricant migration preventing means extending along said belt edge laterally outside of the shoe to prevent lubricant from traveling laterally along the belt surface and over its edge onto the web side of the belt.

11. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 10: wherein said migration prevention means includes a groove in the belt surface extending parallel to the direction of belt travel.

12. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 10: wherein said migration prevention means includes a rib on the belt surface extending parallel to the direction of belt travel.

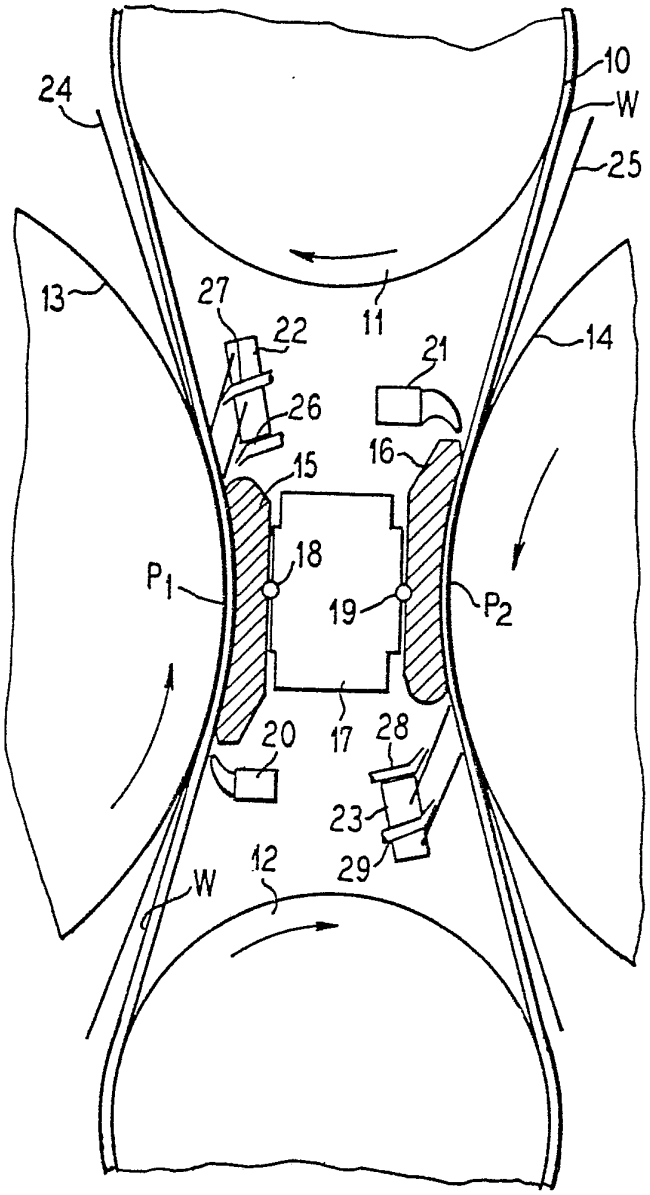
13. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 10: wherein said migration prevention means includes grooves in both surfaces of the belt extending parallel to the direction of belt travel along both edges of the belt beside the shoe.

14. A press mechanism for removing liquid from a traveling fibrous web comprising in combination: a press nip formed between first and second members for receiving a traveling web therebetween; one of said members being a traveling flexible impervious belt; force means engaging the surface of said belt including a sliding shoe having a surface facing the belt with said surface extending transversely across the belt and being of a width less than the belt and also extending in the direction of belt travel to form an extended press nip; means for pressing the shoe toward the belt with a predetermined force; means

for providing a film of lubricating fluid between the shoe and the belt; means for receiving a liquid pressed from the web between said members; and means for removing lubricant from the belt edge from the uncompressed belt area which has passed alongside the shoe.

15. A press mechanism for removing liquid from a traveling fibrous web constructed in accordance with claim 14: wherein said removal means removes lubricant from the web side of the belt.

Fig. 1



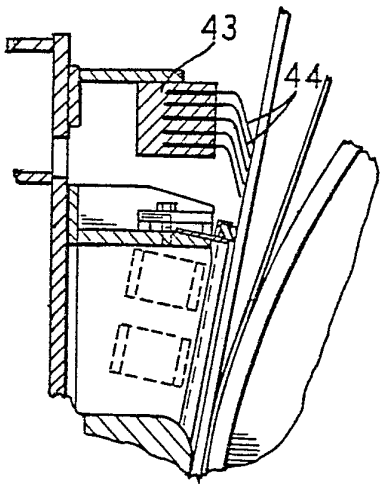


Fig. 2

Fig. 3

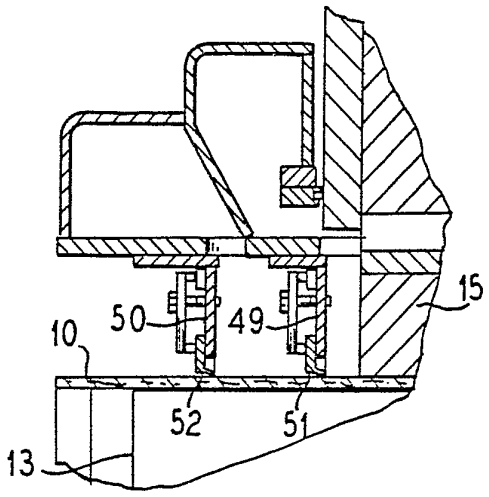


Fig. 4

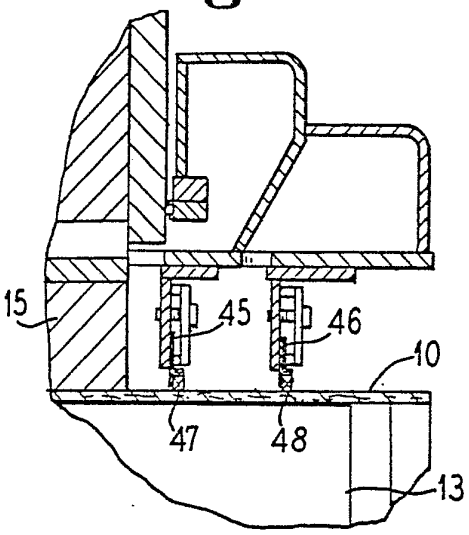


Fig. 5

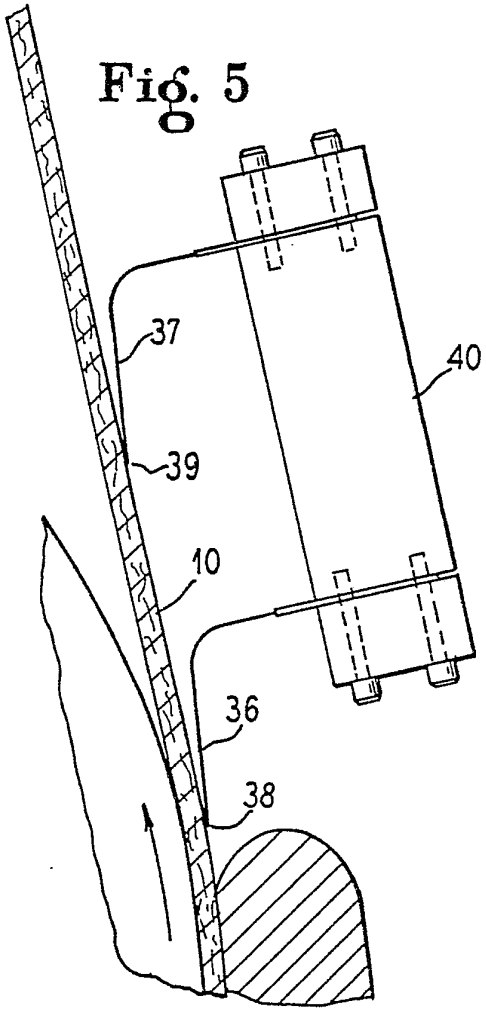


Fig. 6

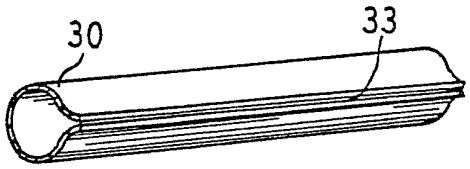


Fig. 7

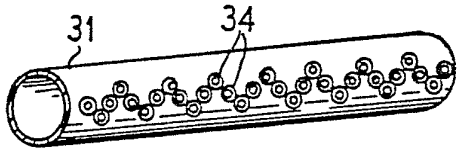


Fig. 8

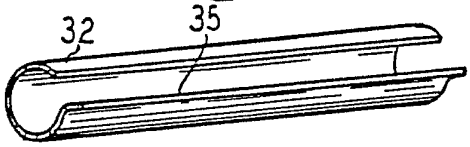


Fig. 9

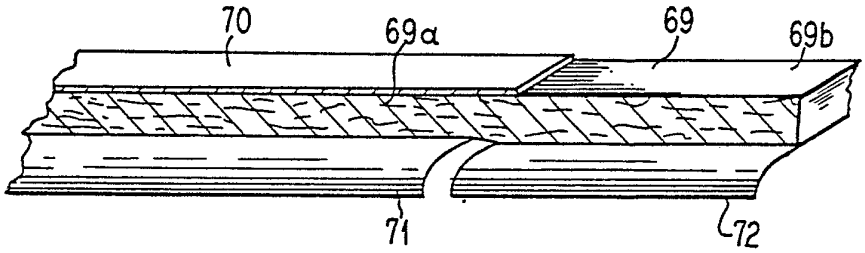


Fig. 10

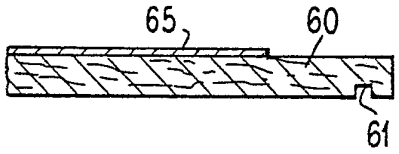


Fig. 11

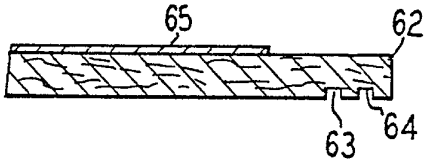
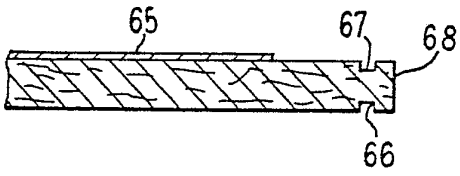


Fig. 12



INTERNATIONAL SEARCH REPORT

International Application No PCT/US81/00088

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[3] D21F 3/02
U.S. Cl. 162/358

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
US	100/154 162/272,274,275,279,358,360R,360DP

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X P	US, A, 4,201,624, Published 06 May 1980 Mohr et al	1-15
A	US, A, 3,839,147 Published 01 October 1974 Daane	1-15

* Special categories of cited documents: [15]

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"T" later document published on or 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

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
14 April 1981	06 MAY 1981
International Searching Authority [1]	Signature of Authorized Officer [20]
ISA/US	Peter Chin