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PRESSURE GLAND FOR TAIL TRANSFER

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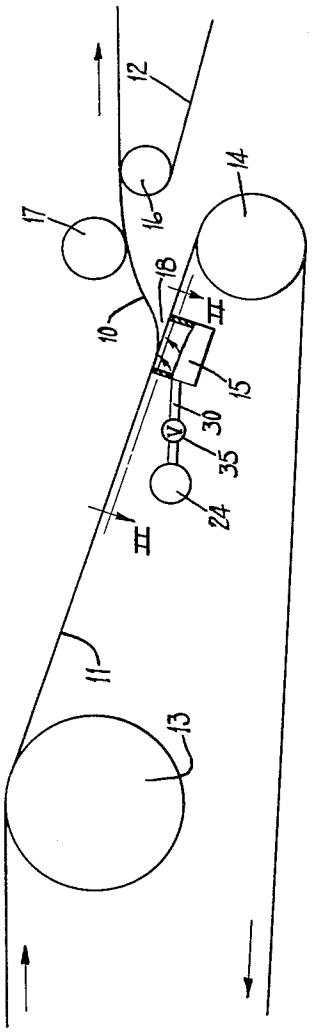


Fig-1

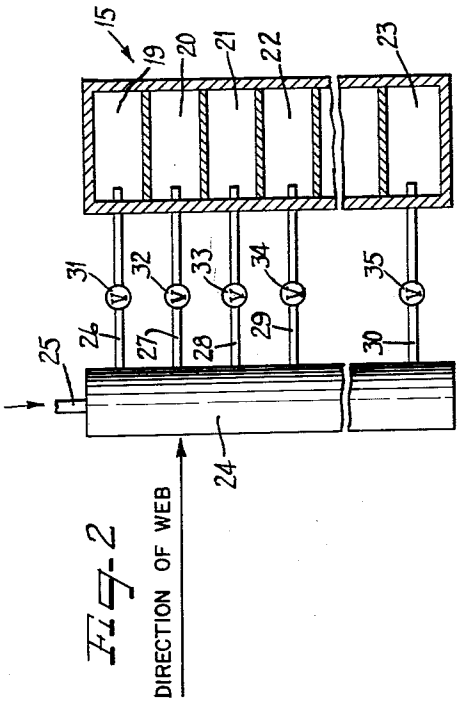


Fig-2

Inventor

Lloyd Hornbostel

by Hill, Sherman, Meroni, Gross & Simpson Attys

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PRESSURE GLAND FOR TAIL TRANSFER

Lloyd Hornbostel, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

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This invention relates to a device for assisting in the transfer of a sheet of material such as the tail of a web of paper from one conveying means such as a Fourdrinier wire to another conveying means such as the first press carrying felt in paper-making apparatus. More particularly, this invention relates to such a device having a pressure gland for releasing the sheet of material to which gland a gas such as air is supplied through a restrictive delivery means at a controlled predetermined maximum pressure sufficient to assist in releasing the sheet of material from the conveying means but insufficient to shatter or tear the sheet of material.

Previous devices bearing a superficial resemblance to that of the present invention have failed to solve the problem of facilitating the transfer of the tail of a paper web because the air or other gas supplied has not been under sufficient control to lift the tail without shattering it. In such previous devices, whenever the sheet has been lifted from the wire by the force of air from below, the pressure of the air being delivered has escaped through the opening provided by the first lifting of the web. The resulting outrush of air has shattered or shredded the web at that point and no further lifting force was then provided in the remainder of the nozzle.

With the foregoing in mind, it is an object of this invention to provide a controlled pressure gland for assisting in the transfer of a sheet of material from a gas pervious conveying means.

It is a further object of this invention to provide such a device which will overcome the above-noted difficulties of previously known devices.

It is a further object of this invention to provide such a pressure gland wherein pressurized air is fed from a plenum chamber through a plurality of restrictive tubes to a plurality of pocket chambers in the gland in order to limit the volume of air delivered from the gland.

Other objects, features, and advantages of the present invention will be more fully apparent to those skilled in the art from the following detailed description taken in connection with the accompanying drawing in which like reference characters refer to like parts throughout and wherein:

FIGURE 1 is a diagrammatic view schematically illustrating the application of the device of the present invention to paper-making machinery.

FIGURE 2 is a sectional view partly in elevation taken on the line II—II in FIGURE 1.

Turning now to the drawings, there is shown a sheet of material such as a web of paper **10** which is to be transferred from one conveying means such as the Fourdrinier wire **11** to another conveying means such as the first press carrying felt **12**. The Fourdrinier wire is entirely conventional and is shown trained over first and second rollers **13** and **14**. It will of course be understood that the wire **11** is connected over means not shown to form an endless conveyor belt which moves in the direction of the arrows in FIGURE 1 and conveys the paper web **10** down to a pressure gland **15**. The press carrying felt **12** is also entirely conventional and in practice forms an endless loop, one end of which is shown trained over a roller **16**. Another roller **17** is positioned in close proximity to and above the roller **16** so that the paper web **10** after being released from the wire **11** may be trained under the roller **17** and over

the roller **16** to be received on the upper surface of the felt **12**.

The gland **15** comprises a housing of generally rectangular cross-section which may conveniently extend across the entire width of the wire **11** and has a preforated top surface **18** which is co-planar and substantially in contact with the underside of the wire or other pervious conveying means **11** in order that air or gas supplied under pressure through the top **18** of gland **15** may assist in lifting or releasing the paper web **10** or other sheet material from the wire **11**. The gland **15** is partitioned internally into a series of pocket chambers or cells such as shown by way of example as the cells **19**, **20**, **21**, **22** and **23**. A plenum chamber **24** is connected by any convenient means such as pipe **25** to a source of gas under pressure. The gas used is preferably compressed air but any other suitable gas can of course be used. The plenum chamber **24** preferably extends across the underside of wire **11** substantially co-extensively with the gland **15**. Although the plenum chamber is shown herein as being separate in construction from the gland **15**, it will be obvious to those skilled in the art that it could be made integral therewith or attached thereto in any suitable manner. Furthermore, although the plenum chamber **24** and gland **15** may, as noted above, extend the full width of the Fourdrinier wire **11**, it should also be noted that the plenum chamber and gland may alternatively be constructed and advantageously operated to extend only partially across the wire so as to transfer only a segment of tail which may be as small as a few inches in width. Also, as indicated by the break in the showing in FIGURE 2, the number of separate cells in gland **15** and the width of plenum chamber **24** may readily be varied to suit the needs of any particular application.

Each of the cells of gland **15** is connected to the plenum chamber **24** by a restrictive delivery means such as the restrictive delivery tubes **26**, **27**, **28**, **29** and **30** which serve to control the pressure of the gas escaping from each cell of the gland and in particular serve to establish a predetermined maximum pressure so as to control the maximum volume of air supplied from each cell to a value which is sufficiently high to assist in releasing the paper web but which is also sufficiently low so that the air will not shatter or tear the web after the first lifting action. Because of the well-known critical flow behavior, these tubes permit only a fixed or adjustably fixed delivery of air to the series of pockets in the gland. The restrictive delivery means **26**, **27**, **28**, **29** and **30** are sized to provide the desired volume of gas either by sizing the tube itself or by providing an adjustable orifice valve or the like in each of the tubes. Such valves **31**, **32**, **33**, **34** and **35** are shown in FIGURE 2 as being interposed in each of the restrictive tubes **26**, **27**, **28**, **29** and **30** respectively. When these valves are provided a given gland structure may thereby be adjusted to meet different operating requirements of different apparatus and applications. It will, however, be understood that the valves **31** through **35** need not necessarily be used since the restrictive delivery tubes can themselves be dimensioned to provide the desired control function. Because of the above referred to critical flow behavior, these tubes when properly dimensioned will permit only a fixed delivery of air to the series of pockets. This delivery rate may be made adjustably fixed by the provision of the valve means shown in FIGURE 2.

Superficially similar prior art devices have in practice proven impractical because whenever the sheet of material such as the paper web **10** has been lifted from the wire by the force of air applied to the undersurface of the wire, the pressure of the air being delivered has escaped through the opening provided by the first lifting

of the web. The resulting outrush of air has shattered or shredded the web at and just after the point where it leaves the wire and no lifting force could thereafter be provided. In the device of the present invention, the air delivered to each of the cells in the gland is controlled by the capacity of the restrictive tubes and/or by the setting of the orifice valves therein. This permits the operating force to be effective over the full width of the gland **15** without exceeding either the pre-set velocity or the pre-set pressure of the air applied to release the paper web **10**.

The actual lifting force on the paper is provided by the volume of air delivered which air should be at a pressure greater than atmospheric pressure by an amount slightly in excess of the pressure exerted by the actual weight of the sheet of paper at the release point. The optimum volume of air to be delivered should be experimentally determined for each weight and grade of paper being carried at a given speed of the Fourdrinier wire. The required volume varies as a function of both the weight of the paper and the speed of the wire. When the desired volume has been experimentally determined, the restrictive tubes are then sized to provide this desired volume either by sizing the tube itself or by adjusting the orifice valve or the like in the tube. The air pressure in the plenum chamber **24** is preferably and normally in the range from two to four atmospheres.

As noted above, the plenum chamber and the gland structure are shown for convenience of illustration as being separate members but they could obviously be combined in a single integral structure while still providing separate enclosures connected by suitable restrictive delivery means. It should also be noted that the device of the present invention may be applied to release and assist in transferring various sheet materials from various different types of gas pervious conveyor means. In particular, the device may be successfully applied to the related problem of transferring a paper web from one felt to another rather than from the wire to the felt.

It is pointed out that devices attempting to lift a web off a wire using air pressure from beneath had been suggested in the art. The difficulty with these devices is that they tended to destroy the web. One of the reasons for this is that the individual fibers of the web tend to become stapled onto the wire and resist removal of the integrated web from the wire. This resistance is not uniform. The lack of uniformity is caused by the differences in stapling effect, differences in moisture content, relatively small differences in web thicknesses, etc. transversely across the web. As a result, the web does not "lift" from the wire along a straight line extending transversely of the direction of travel of the web. Instead, the line of "lift" or line of separation between the wire and the web is curvilinear rather than rectilinear. A portion of the web may lift rather readily whereas the portion immediately adjacent thereto will resist lifting, so that in the practice of the instant device (as well as the prior art devices) the portion of the web tending to resist lifting will actually separate from the wire at a fraction of a second later than the readily separable portion will. Measured longitudinally, this fraction of a second difference is represented by a slight distance—which cannot ordinarily be observed by the eye. The fact remains that there are these variations in distance which result in the curvilinear line of separation between the web and the wire.

Although it is not desired to limit the invention to any particular theory, it is applicant's present belief that the tearing or other destruction of the web which results from the use of the prior art devices is brought about by the fact that when the web attempts to separate from the wire along such curvilinear line or path, the net effect is a tendency for a substantial portion of the lifting gas to escape prematurely from the lifting gland in the immediate region of those portions of the web which tend to lift more readily. Thus, if a portion of the web which tends to lift quite readily does lift from the wire a very short distance before the immediately adjacent portion of web, all of the gas under pressure which is exerting a force against both of these portions of the web will tend to escape through the wire immediately upon the lifting of the more readily separable portion of the web—and in the immediate region of separation. This results in a tendency to tear or otherwise disrupt the web not only because of the "velocity" effect of the air rushing past the underside of the portion of web which has separated from the wire, but also because of the reduction in air pressure against the portion of the web which has not yet separated from the wire.

An essential feature of the instant invention appears to reside in the provision of a rather small cell opposite a rather small portion or area of the web. Until such portion of the web is actually lifted, the air under pressure in this cell cannot escape and cause any tearing or other harmful effect. But when the web portion over this cell does lift from the wire, then the total quantity of air under pressure which will rush out beneath the web portion that has actually lifted will be a relatively small volume of air. This relatively small volume of air will not cause the tearing or other destructive effect obtained when substantial volumes of air attempt to escape from an entire gland in a similar manner, as in prior art devices. Accordingly, the small cell structure coupled with the restricted delivery device for feeding air under pressure to the cell makes possible this improvement over the prior art.

While a particular exemplary preferred embodiment of the invention has been described in detail above, it will be understood that modifications and variations therein may be effected without departing from the true spirit and scope of the novel concepts of the present invention as defined by the following claims.

I claim as my invention:

1. Pressure gland apparatus for transferring a rectilinearly moving paper web across a gap distance between first gas-pervious conveying means and second conveying means positioned in space relation thereto comprising a pressure gland positioned beneath said first conveying means, said gland being subdivided into a plurality of separate cells, a plenum chamber, means to maintain a gas under pressure in said plenum chamber, and a plurality of restrictive delivery means connecting each of said cells in said gland to said plenum chamber to admit gas to said cells at a controlled predetermined pressure sufficient to lift said rectilinearly moving web from said conveying means but insufficient to shatter the web.

2. Pressure gland apparatus for transferring the tail of a rectilinearly moving web of paper comprising, gas pervious means for conveying said web of paper, a pressure gland positioned immediately adjacent and beneath said conveying means and provided with outlets to supply gas upwardly through said conveying means and against said web, said gland being subdivided internally into a plurality of separate and distinct transversely aligned cells, a plenum chamber, means to maintain a gas under pressure in said plenum chamber, and a plurality of restrictive delivery means connecting each of said cells in said gland to said plenum chamber to admit gas to said cells at a controlled predetermined pressure sufficient to lift said rectilinearly moving tail from said conveying means but insufficient to shatter the web, and adjustable valve means for controlling said delivery means.

3. Pressure gland apparatus for transferring the tail of a rectilinearly moving paper web from a Fourdrinier wire across a gap distance to felt carrying means comprising, a pressure gland positioned immediately adjacent and beneath said wire and having a plurality of outlets for supplying gas under pressure upwardly through said wire and against said tail, said gland being subdi-

vided internally into a plurality of separate and distinct transversely aligned cells, each of said cells being in communication with one of said outlets, a plenum chamber comprising a pipe extending substantially parallel to the longitudinal axis of said gland, means to maintain a gas under pressure in said plenum chamber, and a plurality of restrictive delivery means connecting each of said cells in said gland to said plenum chamber to admit gas to said cells at a controlled predetermined pressure sufficient to lift said rectilinearly moving tail but insufficient to shatter the web.

4. Pressure gland apparatus for transferring the tail of a rectilinearly moving paper web from a Fourdrinier wire across a gap distance to felt carrying means comprising, a first plurality of roller means supporting said wire for movement in a continuous loop, a second plurality of roller means supporting said felt for movement in a continuous loop, said felt rollers being positioned so that the upper run of the felt begins at a point slightly above and laterally spaced from the wire web release point, a web guide roller having a bottom surface positioned intermediate between said wire release point and the web pickup point of said felt, a pressure gland positioned immediately adjacent and beneath said wire in proximity to said web release point, said pressure gland

having a plurality of outlets for supplying gas under pressure upwardly through said wire and against said web, a plurality of separate and distinct transversely aligned cells in said gland communicating with said outlets, a plenum chamber comprising a pipe extending substantially parallel to the longitudinal axis of said gland, means to maintain a gas under pressure in said plenum chamber, a plurality of restrictive delivery means connecting each of said cells in said gland to said plenum chamber for admitting gas to said cells at a controlled predetermined pressure sufficient to lift said rectilinearly moving tail from said wire and to transfer the tail while otherwise unsupported to the pick-up point of said felt without shattering said web, and valve means for controlling said delivery means.

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