United States Patent [19]

Lesh et al.

[11] **3,854,222**

[45] **Dec. 17, 1974**

[54] **METHOD AND APPARATUS FOR SEALING THE INTERFACE OF ZONES HAVING DIFFERENT ENVIRONMENTAL CONDITIONS WITH AN OPENING IN THE INTERFACE FOR PASSING MATERIAL BETWEEN THE ZONES**

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[52] **U.S. Cl.** ..... **34/15,** 34/242, 68/5 E

[51] **Int. Cl.** **F26b 5/04**

[58] **Field of Search** ..... 34/15, 242; 432/115, 242; 68/5 E; 277/237, DIG. 7

[56] **References Cited**

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2,298,906	10/1942	Sperry	34/242
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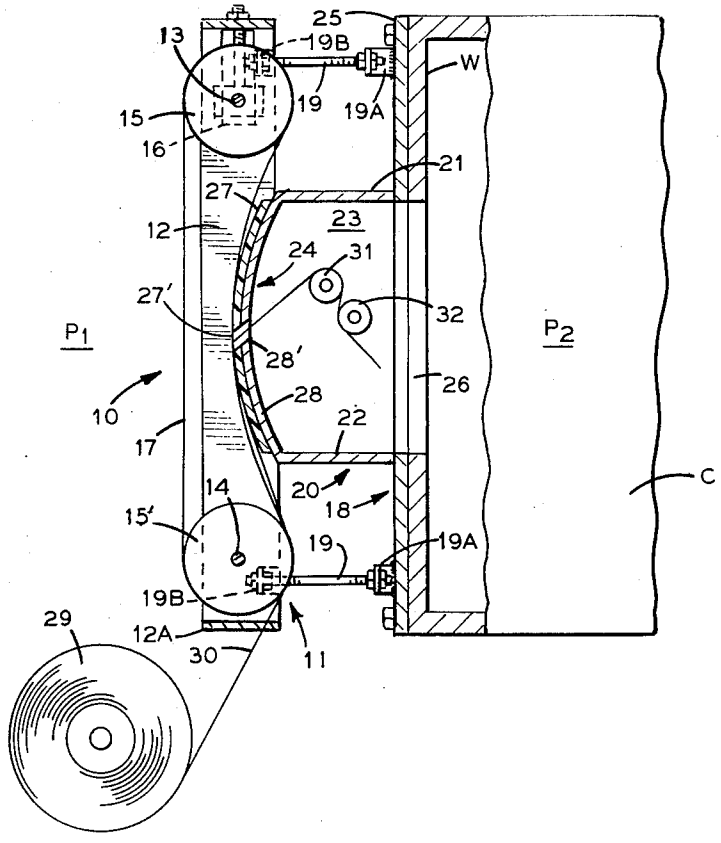
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Primary Examiner—Kenneth W. Sprague

[57] **ABSTRACT**

Apparatus and method for sealing the interface defining a pair of zones respectively at different environmental conditions, such as pressure, atmospheres or the like, the interface having an opening for passing material, such as a web, strands, etc. between the zones, the seal including an arcuate surface having a facing of low friction material with an opening or openings therein for passing the material therethrough, together with resilient belt means arranged for pressing the material against the facing of low friction material over an extended area thereof in advance of the opening or openings.

13 Claims, 4 Drawing Figures



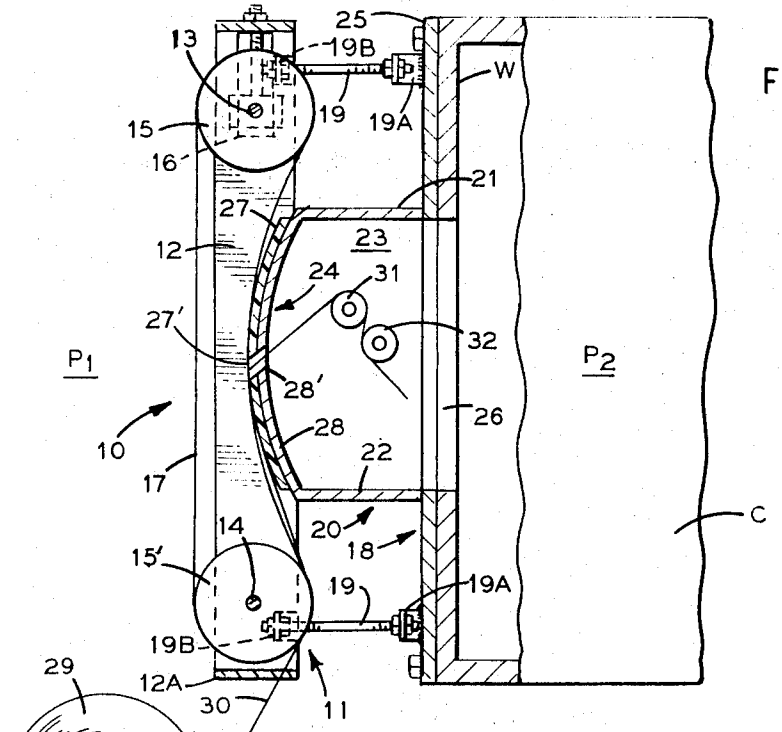

25
13
19B
W
19
19A
15
16
21
27
12
23
24
31
27'
32
P1
P2
28'
26
10
28
22
17
20
18
C
14
15'
19
19A
19B
29
12A
30
11

FIG.1

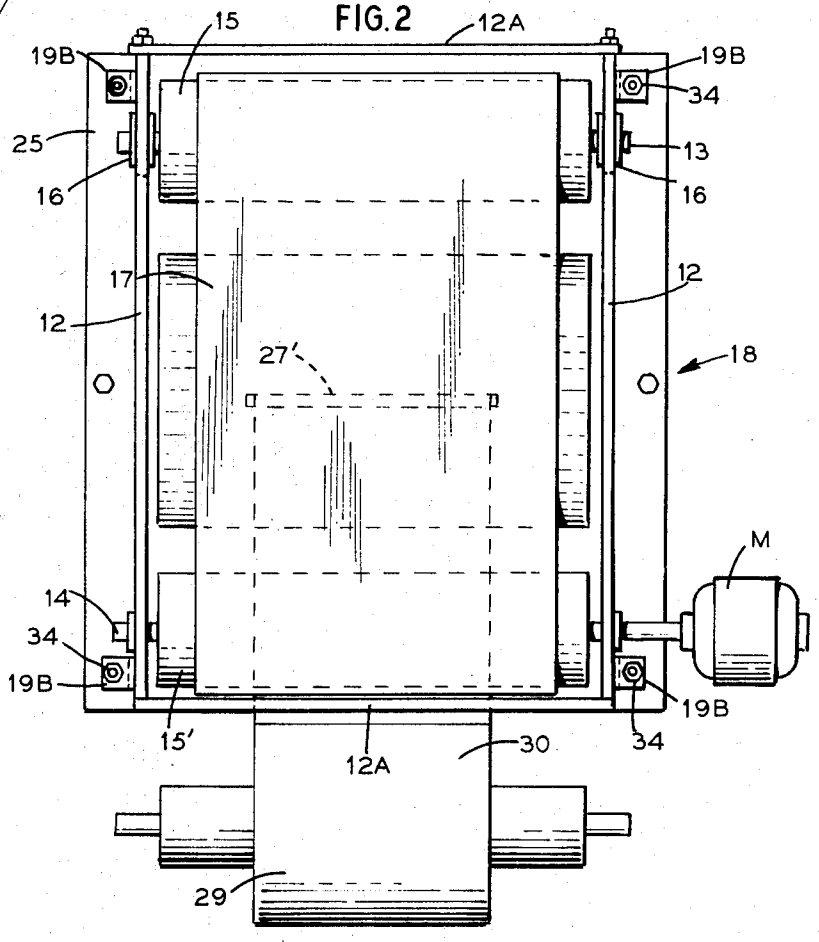

15
12A
19B
19B
34
25
13
16
16
17
12
12
27'
18
M
14
34
19B
19B
15'
12A
30
34
29

FIG.2

FIG. 3

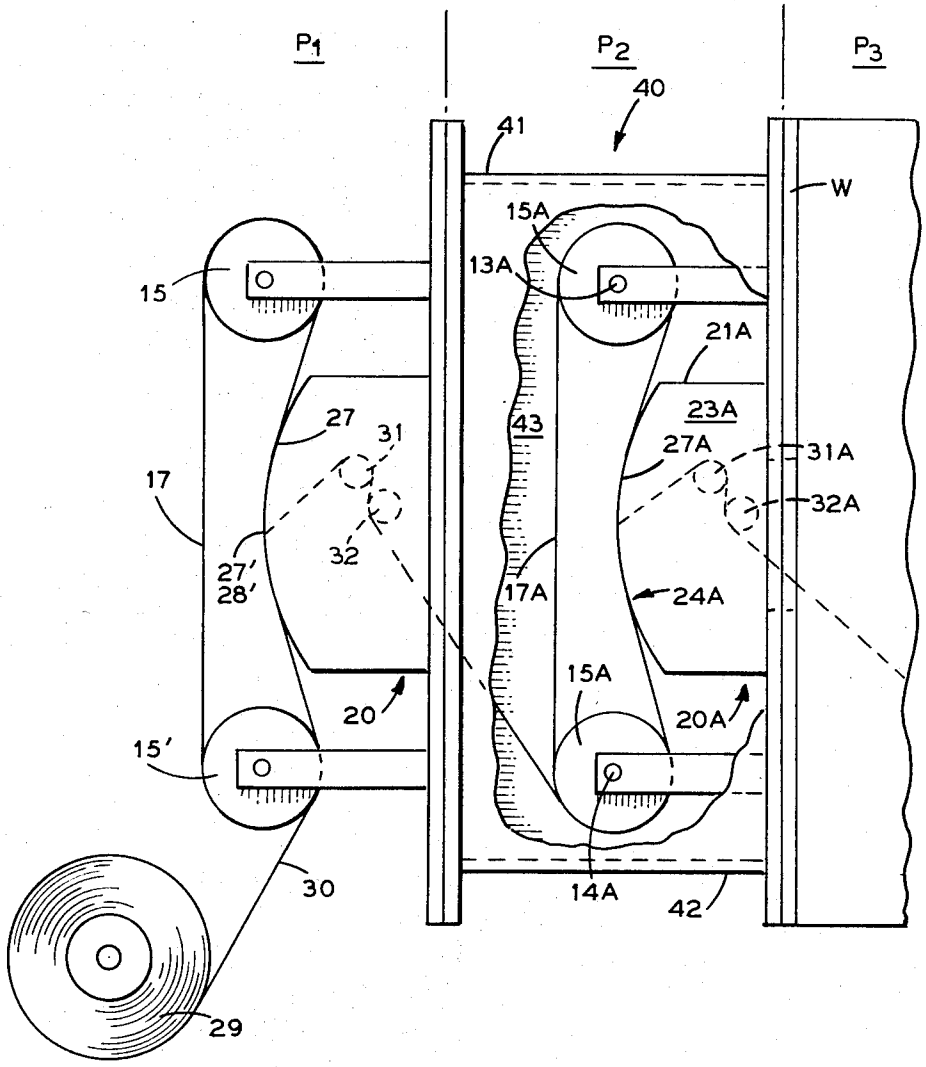
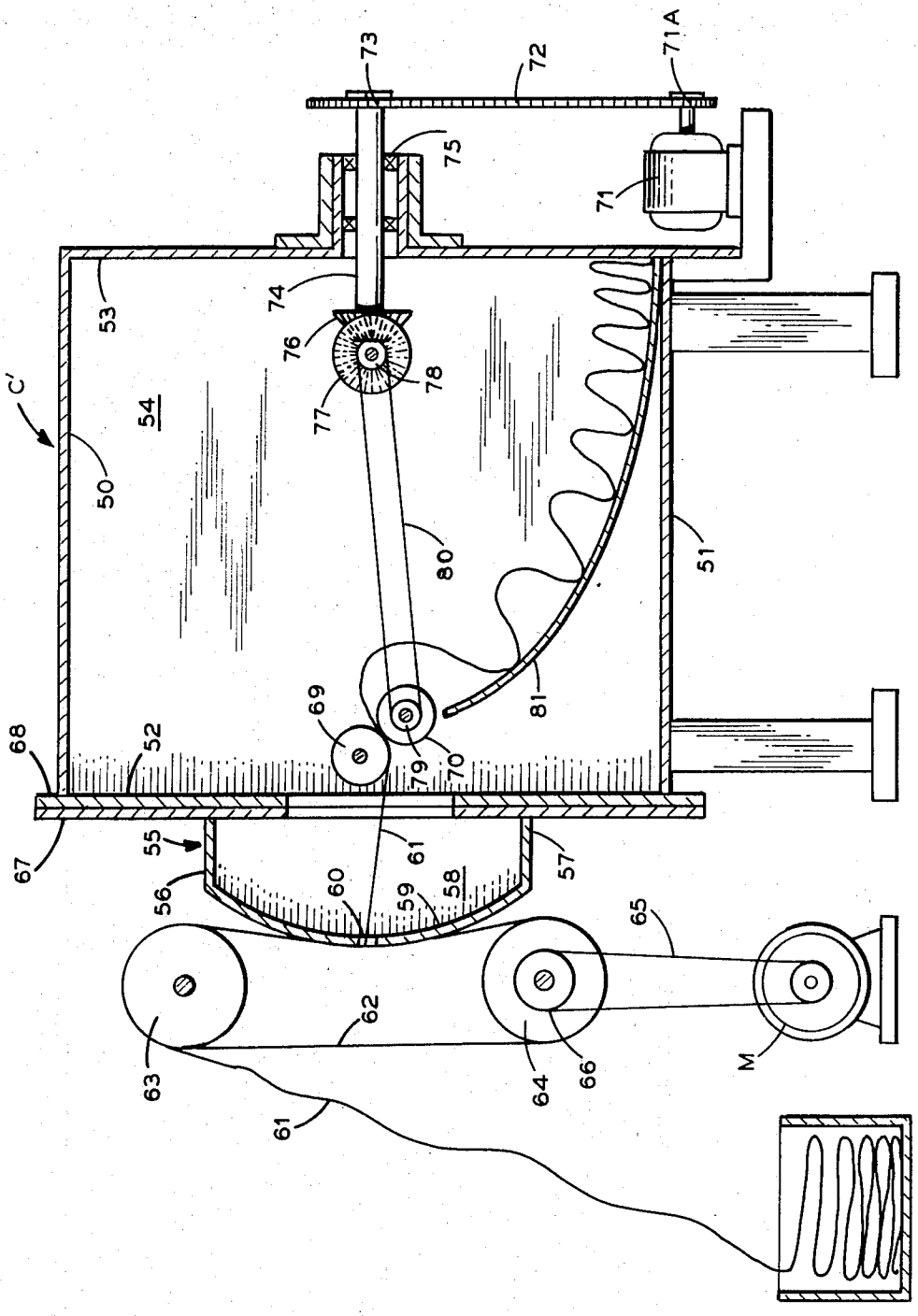

P1
P2
P3
40
41
W
15A
13A
15
21A
23A
43
27
31
27A
31A
32A
17
32
27'
28'
17A
24A
15A
20
20A
15'
30
14A
42
29

FIG.4


C'
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
71A
72
73
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80
81
M

METHOD AND APPARATUS FOR SEALING THE INTERFACE OF ZONES HAVING DIFFERENT ENVIRONMENTAL CONDITIONS WITH AN OPENING IN THE INTERFACE FOR PASSING MATERIAL BETWEEN THE ZONES

BACKGROUND OF THE INVENTION

Webs and sheets of various materials are frequently subjected to pressure conditions different from the ambient pressure condition. This is usually accomplished by moving the web or sheet into a chamber having an internal pressure greater or less than the pressure externally of the chamber. An opening or slot must be formed in a wall portion of the chamber to pass the web or sheet into or out of the chamber. Under conditions of differential pressures on either side of the chamber wall opening, seals are provided at the opening for reducing leakage at the opening.

Such known seals take various forms, including the use of a pair of parallel inflatable tubes with a gap therebetween to define the passage for the web. The web is passed through the gap between the tubes, which are then fully inflated to affect a seal, allowing the chamber provided with such seal to be maintained at desired low or high pressures. Such a seal can only be used in a batch process, since after treatment of the web, the tubes must be deflated to allow for removal of the threaded web and the introduction of another web for the next cycle.

It has also been suggested to use the inflated tubes for continuous sealing operation. However in such case, the tubes are held at a single, uniform pressure, but the web must be lubricated or may be of a self lubricating character. It will be apparent that the lubricant may be a contaminant in some cases, which necessarily limits the use of this type of seal.

Another form of seal is shown in U.S. Pat. No. 3,170,576 where multiple rollers in tangential relation are used. However, such construction has been found to show substantial leakage, particularly when used in multiple stages. Such leakage can give rise to contamination.

Other expedients have been suggested but they have rather limited use since they are (1) very costly; or (2) are of a complex construction.

Accordingly, an object of this invention is to provide an improved seal for a web treating chamber where the operation may be optionally of the batch or continuous operation type.

Another object of this invention is to provide a seal which does not require lubricants and thus provides for a web treatment which is free of contaminant lubricants.

A further object of this invention is to provide a seal of the character described, which is of a construction which materially limits leakage to very low values and thus avoids the introduction of contaminants into the sealed chamber.

Yet another object of this invention is to provide a seal assembly which is of simple construction, readily fabricated, simple to adjust to suit varying operational conditions; and economical to manufacture.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic showing in side elevation, with parts in section, of a seal assembly embodying the invention;

FIG. 2 is a front elevational view thereof;

FIG. 3 is a side elevational view, with parts broken away, showing the seal in multi-stage form; and

FIG. 4 is a side elevational view showing the seal applied to a web treating chamber.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The instant invention relates to a seal which is disposed at the interface of two zones at respectively different pressures. Thus, the seal may be used in a web treating chamber, where the web enters or leaves the chamber by way of an elongated slot at a length commensurate with the wide of the web being treated; the pressure within the chamber being lower or higher than the pressure externally of the chamber.

The seal comprises essentially a chest arranged on a wall of the chamber for communication therewith. The chest includes a wall formed with an elongated slot. The wall is on an arcuate shape and formed of a low friction material such as nylon or the like. The web or other material to be treated by introducing the same into the chamber by way of the slot, moves over the arcuate outer surface of the slotted wall and is simultaneously pressed against the low friction surface by a flexible member such as an endless resilient belt having a width somewhat greater than the width of the web.

Thus, the belt overlaps the web and tightly presses that portion of the web which is advanced toward the slot; the extent of the web portion so pressed against the low friction surface may be varied by adjusting the position of the belt mounting assembly toward and away from the low friction surface, thereby varying the contact arc of the web with respect to the low friction surface.

As shown in FIGS. **1, 2** a seal assembly embodying the invention, is generally indicated at **10.** Such assembly includes a frame **11** having side members **12** and end members **12A**, which are held in spaced relation by roller shafts **13, 14** upon which rollers **15, 15'** are mounted respectively. The shaft **13** is mounted in bearings **16** slidably mounted in slots formed in the upper end portions of members **12.** The lower roller **15'** may be coupled by way of its shaft **14** to a drive motor M. An endless belt **17** of Neoprene or the like is entrained about rollers **15, 15'.**

The frame **11** is mounted on a rectangular flanged member **18** by way of threaded members **19** fixed at their inner ends to angle members **19A** secured to the flanged member **18.** The outer ends of members **19** are connected to angle members **19B** which are secured to members **12,** with lock nuts for fixing the position of the frame **11** relative to member **18.** Also mounted on member **18** is a chest **20.** Chest **20** comprises a top wall **21,** a bottom wall **22,** end walls **23** and a concavoconvex front wall **24.** The chest **20** is open at the rear and the flange portions **25** of member **18** are adapted to be fixed to a wall W of a chamber C which is adapted to be maintained at a pressure **P2** by suitable means not shown, which is greater or less than the pressure of the zone outside of chamber C. The wall W has an opening

26 to provide for communication between the interior of chest 20 and the interior of chamber C.

The front wall 24 is formed of a low friction material such as nylon, Teflon, carbon or the like, indicated at 27. The front wall portion 27 may be cemented to a backing sheet 28 of metal or the like. The portion 27 and sheet 28 are formed with registering elongated slots 27'; 28'.

A reel 29 of fabric or the like, which is to be treated within chamber C at the pressure therein has its web 30 fed between belt 17 and the low friction wall portion 27 and passed through slots 27', 28' into chest 20 and thence into chamber C. The belt 17 has a width somewhat greater than the length of registering slots 27', 28' so that its lateral marginal portions can overlap the side edges of web 30.

The web 30 is moved by the belt 17 which is driven by motor M, into chamber C. Alternatively, the web 30 may be pulled by roilers 31, 32 which are driven by suitable motor means, now shown, located outside of chest 20 and having a conventional shaft seal, not shown.

It will be apparent that the web 30 is tightly pressed against the low friction surface 27 while the same is moving through the slots 27', 28', to thereby provide an effective seal between the zones P1 and P2 of differential pressures.

The tension of belt 17 may be adjusted by adjusting slidable bearings 16 and thereby vary the position of roller shaft 13 with respect to roller shaft 14. Also, the assembly including rollers 15, 15' and belt 17 and motor M may be moved toward and away from chest 20 by positioning screws 19 and locating nuts on the outer ends thereof thus varying the arcuate extent of belt 17 which is in sealing relation to low friction surface 27.

When the difference between the pressures of zones P1, P2, is substantial, multiple seals may be used in series as shown in FIG. 3. Here, a second chest 20A, is mounted on chest 20, in communicating relation to each other. Chest 20A, includes all the elements of chest 20, including belt 17A, rollers 15A, 15'A, low friction surface 27A; and pull rollers 31A, 32A.

Thus, the web 30 first passes over low friction surface 27 of chest 20 and into said chest 20 by way of slots 27', 28'; belt 17 pressing the moving web 30 against convex low friction surface 27. The web 30 then passes from chest 20 to chest 20A which is enclosed in a rectangular frame 40 comprising a top wall 41, bottom wall 42 and side walls 43, and peripheral flanges 44, 45 which abut flange 18 and chamber wall W respectively. The web 30 then passes over low friction surface 27A of chest 20A, with pressure by belt 17A and thence by way of slots 27'A and 28'A into chamber C.

It is noted that chests 20, 20A allow for successively different pressure zones P1, P2 and P3. Suitable vacuum or pressure pumps, not shown, provide the stepped pressures P2, P3 relative to an ambient pressure P1.

It web 30 is to leave chamber C after suitable treatment thereof within the chamber; similar seals may be applied to the exit side of said chamber C.

In FIG. 4, there is shown the apparatus of the instant invention wherein the operation is of the batch type. Here a chamber C' having a top wall 50, a bottom wall 51, end walls 52, 53 and side walls 54, has a chest 55 mounted on wall 52. Chest 55 includes a top wall 56, a bottom wall 57, side walls 58, together with a concavoconvex front wall 59 formed of a curved nylon sheet. A transversely extending slot 60 in wall 59 allows for entry of web 61 into chest 55 and thence into chamber C'.

The web 61 is pressed against the convex surface of low friction wall 59 in advance of slot 60, by belt 62 entrained over rollers 63, 64, and suitably tensioned thereon. Belt 62 is driven by motor M' connected by chain 65 to roller 64 by way of a sprocket wheel 66.

The chest 55 includes a peripheral flange portion 67 which abuts and is secured to a flange portion 68 of chamber front wall 52. The web 61 thus passes from chest 55 to chamber C' which is maintained at a suitable pressure different from the ambient pressure by pumps, not shown.

The web 61 is positively advanced within chamber C' by pull rollers 69, 70; where roller 70 is driven by way of a motor 71, sprocket wheel 71A, chain 72, sprocket wheel 73 and a shaft 74 mounted in a rotary seal 75 on chamber wall 53. A bevel gear 76 on the inner end of shaft 74, meshes with a second bevel gear 77 which in turn rotates a sprocket wheel 78 connected to a sprocket wheel 79 on roller 70 by way of a chain 80.

The web 61 is thus moved onto a guide plate 81 in gathered form. It is understood that web 61 is subjected to the selected pressure within chamber C' in connection with vacuum impregnating operations, etc. In such operation, it has been found that leakage has been substantially reduced, thereby reducing operational costs to maintain a given pressure differential. Further, webs of varying widths up to the length of the slot in the chests, may be subjected to the desired treatment within the chamber.

It is understood that the material being treated may be moving between zones of varying environments, including vapor, steam, various gases, which may be at differential pressures and/or temperatures.

Further, the material being treated in accordance with the instant invention may be in the form of strands, yarns and the like as well as in sheet or web form.

We claim:

1. Apparatus for subjecting material to successive environmental conditions comprising a chamber maintained internally thereof at an environmental condition different from the environmental condition externally thereof, said chamber including a wall portion formed with an opening therein for passing said material therethrough, said wall portion being arcuate to provide a convex outer surface, means for sealing the opening in said wall portion, said sealing means comprising a flexible member for overlying and pressing said material against the convex surface portion of said wall portion, and means for tightly conforming said flexible member to said convex surface along areas of said convex surface extending from opposite sides of said opening.

2. Apparatus as in claim 1 wherein said convex surface of said wall portion includes an exposed face of low friction material.

3. Apparatus as in claim 1 wherein said flexible member comprises an endless resilient belt, said material being disposed between an inner run portion of said belt and the outer surface of said layer of low friction material.

4. Apparatus as in claim 3 and further including means for varying the effective arcuate extent of said belt run portion.

5. Apparatus as in claim 3, and further including a pair of spaced rollers, said endless belt being mounted on said rollers, and means for adjustably moving one of said rollers relative to the other roller.

6. Apparatus as in claim 5, and further including means for moving said rollers towards and away from said layer of low friction material to adjust the arcuate extent of the inner run portion of said belt.

7. Apparatus as in claim 6 and further including means for driving one of said rollers.

8. Apparatus as in claim 6 and further including means within said chamber for moving said material through said registering openings.

9. Apparatus as in claim 1, and further including second seal means mounted on said first mentioned seal means and in communicating relation thereto, whereby said web may pass through the successive seal means and said chamber.

10. Apparatus as in claim 1, wherein said low friction material is nylon.

11. A method of subjecting material to successive different environmental conditions comprising passing said material between zones of different environmental conditions, the interface of said zones being defined by a separating wall having a convex surface and a facing of low friction material on said convex surface, said wall having an opening therein, moving said material over the facing of low friction material and through said opening and resiliently pressing the moving material against said facing of low friction material.

12. A method as in claim 11, wherein said successive environmental conditions are at different pressures.

13. A method as in claim 12 wherein said material is a fabric web.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,854,222 Dated December 17, 1974

Inventor(s) Robert M. Lesh et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In item [76] "Eugene T. Woodberry, Jr." should

read -- Eugene T. Woodbery, Jr. --.

Signed and sealed this 18th day of February 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

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