Feb. 17, 1959 V. T. FAHRINGER 2,873,597

APPARATUS FOR SEALING A PRESSURE VESSEL

Filed Aug. 8, 1955 3 Sheets-Sheet 1

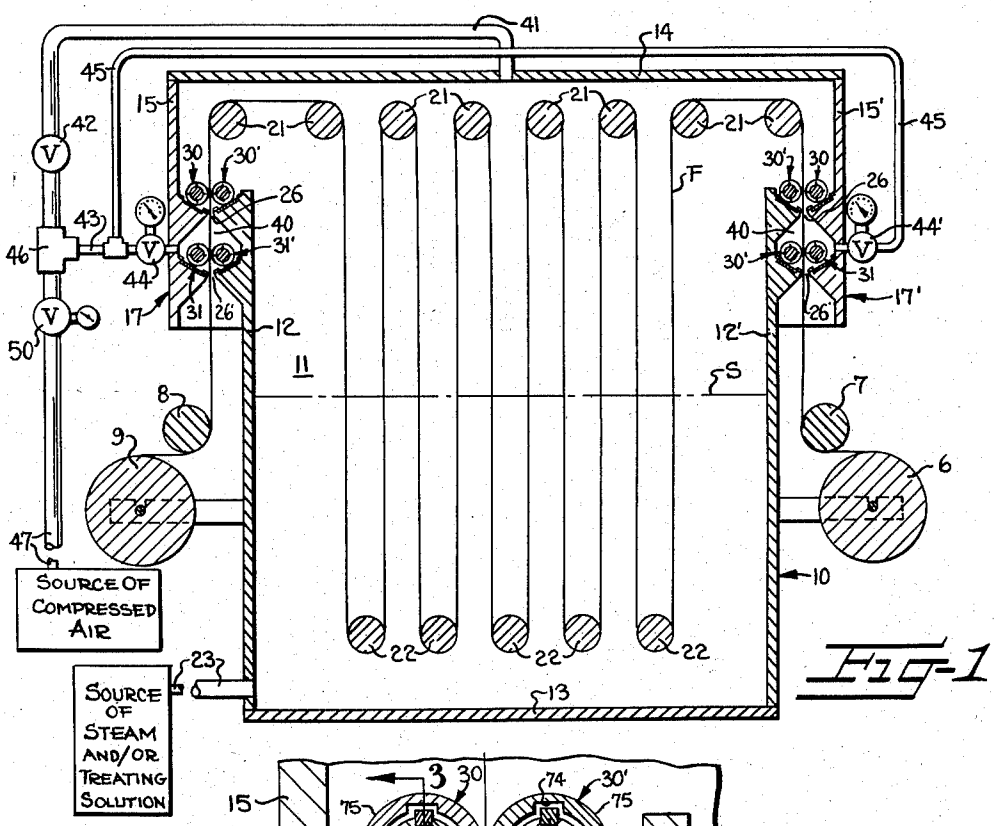

Fig-1

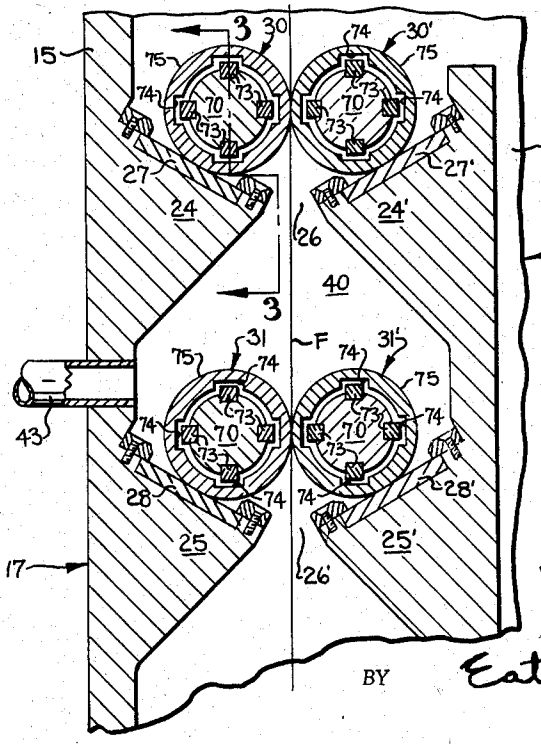

Fig-2

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Filed Aug. 8, 1955 3 Sheets-Sheet 2

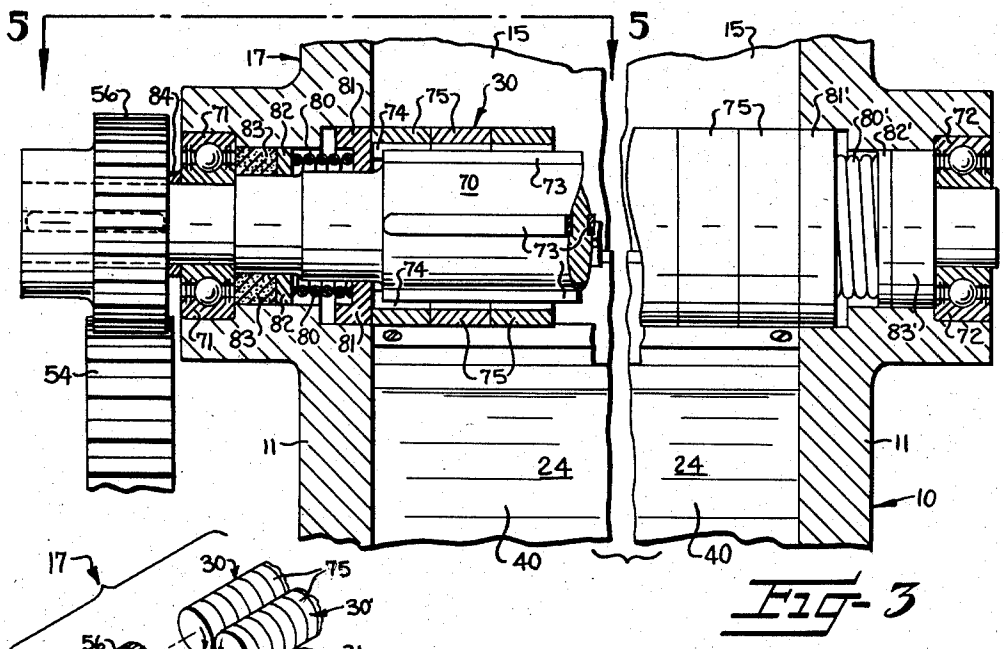

Fig- 3

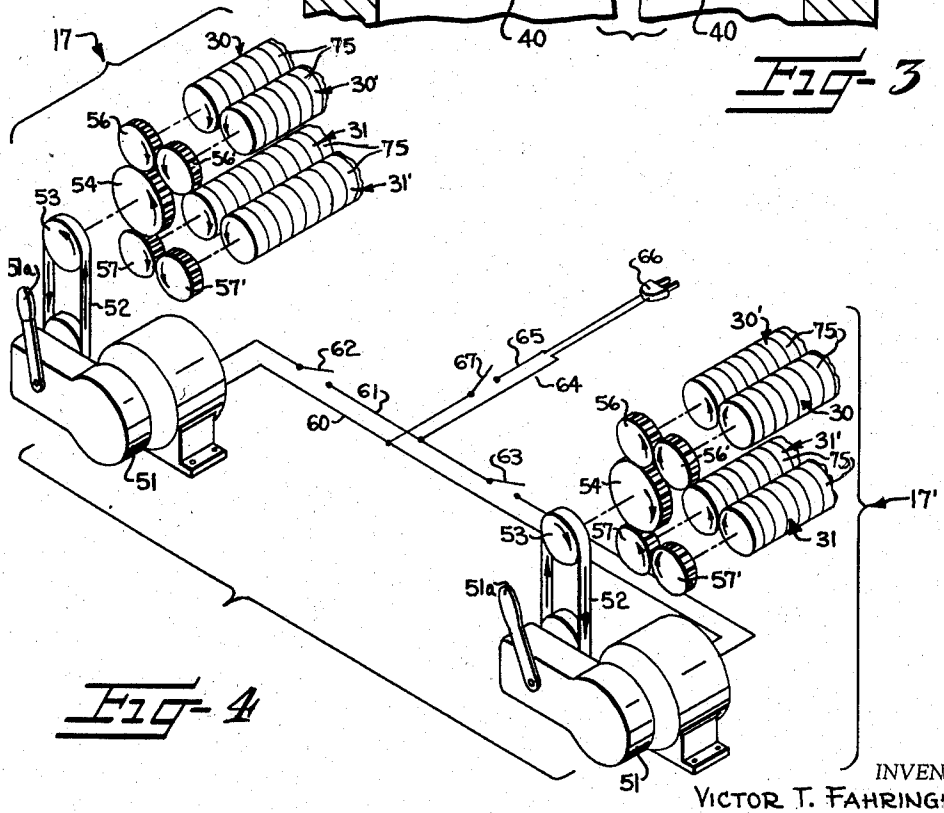

Fig- 4

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APPARATUS FOR SEALING A PRESSURE VESSEL

Filed Aug. 8, 1955 3 Sheets-Sheet 3

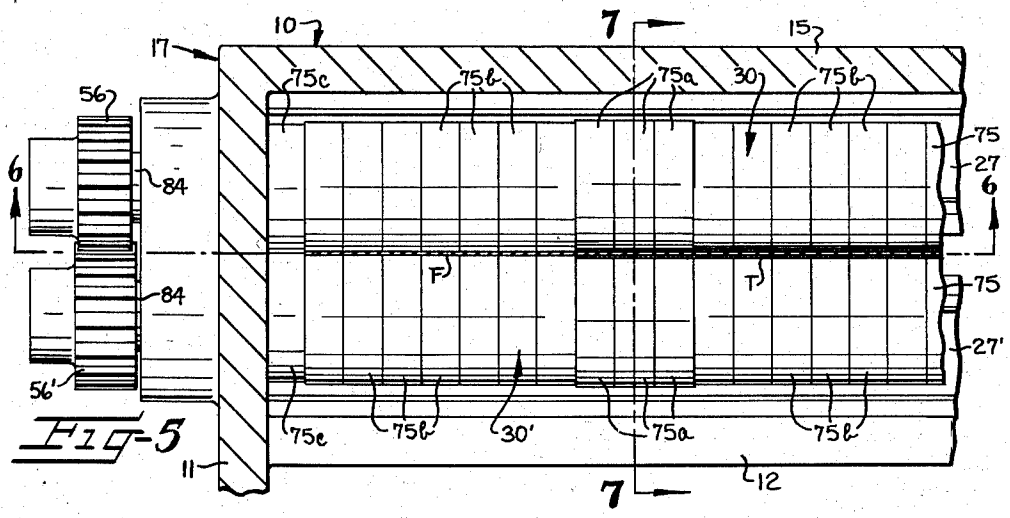

Fig-5

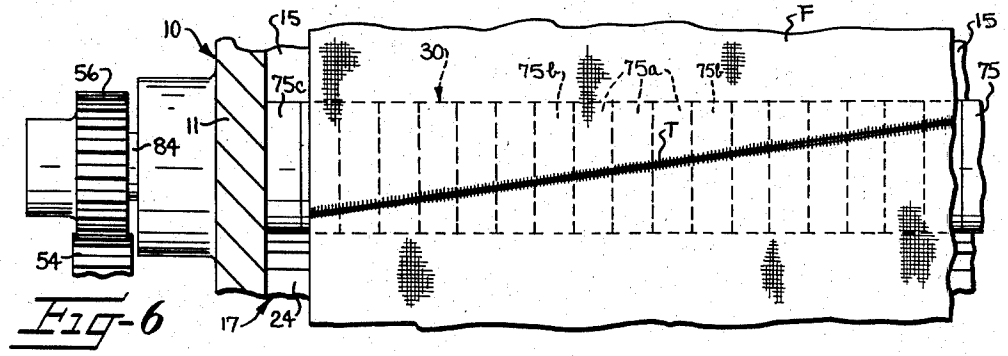

Fig-6

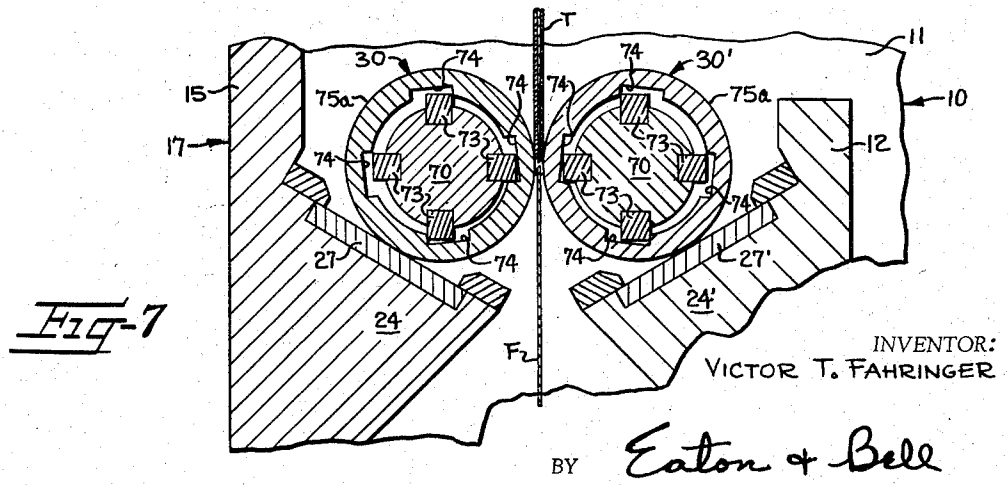

Fig-7

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2,873,597

APPARATUS FOR SEALING A PRESSURE VESSEL

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Application August 8, 1955, Serial No. 527,046

17 Claims. (Cl. 68—5)

This invention relates to pressure seals and, more especially, to an improved pressure seal for preventing the escapement of relatively high pressure from within a pressure tank or vessel at the points at which web or strand material is introduced into and/or withdrawn from the pressure tank or vessel. The present invention shall be hereinafter described as though it involves the processing of web material or fabric although it should be distinctly understood that the principles of the present invention shall readily apply to the processing of single strands or a plurality of strands or the processing of any type of material wherein it is desirable to maintain a high pressure within a vessel and to prevent the escapement of the same when the material enters and leaves the same.

In treating textile material, especially fabric made from synthetic polyamide, polyester and acrylonitrile yarns such as nylon, "Dacron," Orlon" and the like for the purposes of dyeing, desizing, boiling off, decatizing and other processes, it is highly desirable that the fabric be immersed in the treating solution while the treating solution is maintained at a relatively high temperature; substantially higher than the boiling point of water under atmospheric pressure. Accordingly, it is necessary to maintain the treating solution at a relatively high pressure.

It is therefore an object of this invention to provide an improved pressure seal or valve construction which permits the introduction and withdrawal of fabric into and out of the pressure tank or vessel through corresponding openings or slots formed in the wall of the vessel and wherein the improved pressure seal or valve is positioned adjacent each of said openings and the fabric passes through the pressure seal. The pressure sealing valve is so arranged that the greater the pressure within the pressure tank or vessel, the greater the sealing effect produced by the improved pressure sealing valve to prevent escapement of the pressure from within the pressure tank.

It is also an object of this invention to provide an improved pressure seal for a pressurized vessel having openings therein wherein members having convex surfaces are confined adjacent said openings to form a Venturi through which the material is passed and wherein said members are relatively movable to substantially close the Venturi upon pressure of said vessel flowing therethrough.

It is another object of this invention to provide an improved pressure sealing valve of the character described comprising a vessel having a lid with the side portions or flanges of said lid spaced from the sides of the body of said vessel to provide openings or slots therebetween communicating with the interior of the vessel to permit fabric to pass therethrough and wherein the slots or openings are defined by downwardly converging sloping shoulder portions which support pairs of opposed sealing rollers to maintain the pressure in the vessel as the fabric passes through the openings or slots.

A further object of the invention is to provide each of the pressure sealing rollers in the form of a plurality

of juxtapositioned rings with key-ways formed on their inner surfaces for being positively rotated by a common shaft loosely encircled by the rings. The shaft has longitudinally positioned keys formed thereon to loosely engage the key-ways of the rings to drive the same while permitting each of the rings to have a floating axis.

A further object of the invention is to provide a pressure vessel having pairs of alined slots or openings at opposite ends thereof to permit the passing of fabric therethrough with a small compartment defined between each of said pairs of openings or slots, pairs of sealing rollers positioned to seal each of the alined slots at the sides of the vessel and a passageway or pipe arrangement leading from a top wall of the pressure vessel into the compartment formed between the alined openings with an adjustable pressure reducing valve therein to maintain a differential pressure between the pressure in the vessel and the pressure in the compartment to reduce the nip pressure and bearing load on the cloth passing between the pair of sealing rollers. Also, a piping arrangement is provided to permit high pressure air from an outside source to enter the compartments between the pairs of sealing rollers in lieu of using the pressure from the vessel itself to maintain a differential pressure between the compartment and the vessel. This latter arrangement permits only compressed air to seep through the bottom pair of sealing rollers at each end and thereby prevents the loss of pressure in the vessel that ordinarily might seep out.

A further object of the invention is to provide sealing rollers each comprising a plurality of juxtapositioned substantially co-axial rings driven by a common shaft in such a manner that only those rings in contact with a fabric passing therethrough will move apart from each other. Also, the passing of a biased seam in a fabric through rollers of this type will force further apart or away from each other only those rings upon each of the rollers in contact with the seam at the nip of the rollers to thereby prevent the escapement of pressure between these rollers not in contact with the biased seam which has not been possible heretofore when solid rollers were employed.

This application is a continuation-in-part of my copending applications entitled, Method and Apparatus for Treating Web and/or Strand Material, Serial Number 424,855, filed on April 22, 1954 and Pressure Sealing Valve for Web or Strand Passageways and Method, Serial Number 424,869, filed April 22, 1954.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is a schematic view showing the apparatus for carrying out the steps of the improved method of treating textile material in web or strand form;

Figure 2 is a greatly enlarged view of the pairs or sets of sealing rollers shown in the left-hand portion of Figure 1;

Figure 3 is an enlarged substantially vertical section taken on line 3—3 of Figure 2 showing the manner in which the sealing rollers are mounted;

Figure 4 is a schematic view showing the drive means for the pairs of sealing rollers at opposite sides of the pressure vessel;

Figure 5 is a sectional plan view taken substantially along line 5—5 of Figure 3 and showing the relative positions of the juxtapositioned rings of each sealing roller when a fabric of less width than the rollers and having a biased seam is passing therebetween;

Figure 6 is a vertical sectional view taken on line 6—6 in Figure 5 and showing a narrow fabric with a biased seam passing across the nip of the sealing rollers;

Figure 7 is a vertical section taken along line 7—7 in Figure 5 showing the relative position of the rings of each sealing roller with respect to their shaft when a biased seam of a fabric is passing between the rollers.

Referring more specifically to the drawings, particularly Figure 1, the apparatus for carrying out an improved method of sealing a pressure vessel is illustrated somewhat schematically. The pressure vessel is shown in the form of a substantially rectangular tank broadly designated at **10** and which comprises spaced side walls **11**, only one of which is shown, spaced end walls **12**, **12'** and a bottom wall **13**. A top wall, cover or lid **14** is suitably supported on side walls **11** in spaced relation above the end walls **12**, **12'** and has spaced end portions, walls or flanges **15**, **15'** depending therefrom and whose lower portions extend downwardly past the upper portions of opposite end walls **12**, **12'** and are spaced outwardly therefrom to accommodate the improved pressure sealing units respectively broadly designated at **17**, **17'**. These units **17**, **17'** constitute the nucleus of the present invention and will be later described in detail.

The end walls **15**, **15'** depending from the lid **14**, may be termed as auxiliary end walls and are connected to opposite end portions of the side walls **11** extending beyond the end walls **12**, **12'**. In this instance, the sealing unit **17'** is at the ingress or inlet end of the tank **10** and the sealing unit **17** is at the discharge, outlet or egress end of the tank **10** with respect to the movement of material being treated, such as fabric F.

As shown in Figure 1, the fabric F is drawn or unwound from a roll **6** and passes beneath a guide roll **7** and then upwardly through the sealing unit **17'**. The fabric F is then entrained over and under upper and lower sets of substantially parallel spaced idler rolls **21** and **22**, respectively, as the material is drawn through the pressure vessel or tank **10** and during the course of which the fabric F is immersed in a suitable treating solution S. The idler rolls **21**, **22** may be suitably journaled in the side walls **11**.

It will be noted that the uppermost left-hand idler roll **21** in Figure 1 is disposed above the sealing unit **17** and the material or fabric F passes downwardly from this roll through the sealing unit **17** and thence, beneath a guide roll **8** from whence it passes to a take-up roll indicated at **9**. The take-up roll **9** may be driven by any suitable means, not shown.

A pipe or conduit **23** is connected adjacent the bottom of the vessel **10** to permit the entrance of live steam or treating solution under pressure from an outside source, not shown, into the pressure vessel **10** to maintain a constant pressure in the vessel **10** and to also maintain the desired amount of solution S in the vessel **10**. Since the pressure sealing unit **17** is illustrated more in detail than the unit **17'** and both units are substantially identical, except being opposite hand, only the pressure sealing unit **17** will be described in detail and like parts associated with the unit **17'** will bear the same reference characters.

The proximal overlapping portions of the walls **12**, **15** are provided with respective pairs of vertically spaced projections or substantially triangularly-shaped shoulder portions **24**, **25** and **24'**, **25'** whose proximal corners or ends are spaced from each other to provide respective substantially vertically alined passageways, apertures or slots **26**, **26'** therebetween which are of sufficient width to permit the fabric F to pass freely therebetween. It will be noted in Figures 2 and 7 that the upper surfaces of the substantially triangular-shaped shoulder portions **24**, **25**, **24'**, **25'** converge downwardly from the respective walls **15**, **12** and have respective inclined bearing plates **27**, **28**, **27'**, **28'** suitably secured thereto which bearing plates may be made from graphite or any other suitable material, such as nylon or Teflon, to minimize friction and to provide a tight seal between each of the

bearing plates and each of the sealing rollers positioned to be rotated thereon as will be presently described.

Upper and lower complementary pairs or sets of normally contacting sealing rollers or pressure rollers **30**, **30'** and **31**, **31'** rest upon the respective pairs of inclined bearing plates **27**, **27'** and **28**, **28'** so the rollers **30**, **30'** and **31**, **31'** normally tend to contact each other due to gravity and pressure. The upper triangularly-shaped shoulder portions **24**, **24'** are so formed in order to provide an auxiliary pressure compartment **40** in which the lower set of sealing rollers **31**, **31'** is loosely positioned. It should be noted that compartment **40** is thus formed between the upper and lower sets of pressure rollers.

Referring again to Figure 1, means are shown for directing fluid pressure into the chambers or compartments **40** of the pressure sealing units **17**, **17'**. To this end, a pipe, conduit or passageway is connected at one end thereof to the top or lid **14** of the vessel **10** and normally directs fluid pressure through a manually operable valve **42** into a pipe, conduit or passageway **43** and through a pressure reducing valve **44** into the compartment **40** of unit **17** for maintaining a differential pressure between the compartment **40** of unit **17** and the pressure vessel **10**.

A pipe, conduit, or passageway **45** has one end communicatively connected to a medial portion of the pipe **43** and its other end is communicatively connected to the compartment **40** of unit **17'** on the right-hand side of the vessel **10** to also maintain a differential pressure between the compartment **40** of unit **17'** and the pressure vessel **10**. A suitable pressure reducing valve **44'** is also provided to control the pressure in the compartment **40** of sealing unit **17'** in a manner similar to that in which the pressure reducing valve **44** functions at the other side of the vessel.

It will be noted that the manually operable valve **42** is interposed in the pipe, conduit or passageway **41** and suitably connected with the pipes **41** and **43**, as by a pipe T **46**, is a pipe or conduit **47** which leads from a suitable source of compressed air, not shown, and has a suitable manually operable valve **50** interposed therein. The valve **42** is closed whenever valve **50** is open and, conversely, the valve **50** is closed whenever the valve **42** is open. Thus, when the valve **42** is open, pressure is directed from the pressure vessel or tank **10** into the two compartments **40**, the amount of pressure in the compartments **40** being determined by the adjustment of the pressure regulating valves **44** and **44'**. On the other hand, when the valve **50** is open and valve **42** is closed, pressure is maintained in the two compartments **40** by compressed air entering through the pipe **47**.

In either event, it is apparent that any desired pressure may be maintained in each of the compartments **40** to maintain a predetermined pressure differential between the compartments **40** and the vessel **10**. The desired pressure may normally be maintained in the chambers **40** when valve **42** is open, with satisfactory results. However, it is sometimes more desirable to use compressed air for maintaining the desired differential pressure between the compartments **40** and the tank **10** in order to absolutely prevent the leakage or escapement of steam or vapors from within the vessel **10** through the passageway **26'**. In this instance, the valve **42** would be closed and the valve **50** would be opened and the reducing valves **44**, **44'** would be so adjusted as to maintain only a relatively slight differential pressure between the pressure in the compartments **40** and the pressure in the vessel **10** which would permit only the compressed air and not the steam or hot vapors in the vessel **10** from escaping or seeping through between the nips of the lower sets of sealing rollers **31**, **31'**.

By controlling the differential pressure between the compartments **40** and the pressure in the vessel **10**, this correspondingly controls the squeezing pressure upon the

fabric F and the pressure upon the sealing rollers on their respective bearing plates. For example, if the pressure in the vessel **10** is twenty pounds and the pressure reducing valves **44, 44'** are so adjusted as to reduce the pressure to ten pounds in the two compartments **40**, the lower and upper sets of sealing rollers will have a squeezing pressure of ten pounds per square inch as opposed to twenty pounds per square inch against the upper pairs of pressure rollers **30, 30'** if this differential were not controlled. Controlling of the pressure in the compartments **40** by the pressure reducing valves **44, 44'** also prevents pressure that might seep through the upper pair of sealing rollers into the corresponding compartment **40** from increasing or building up therein and damaging the fabric by creating an excess squeezing pressure on the fabric by the corresponding lower pair of sealing rollers.

Referring to Figure 4, there is illustrated, schematically, means for driving the upper and lower sets of pressure sealing rollers associated with the pressure sealing units **17, 17'** so the pressure sealing rollers associated with unit **17** may be driven at speeds independent of the speeds at which the pressure sealing rollers of unit **17'** are driven and vice versa. Since the driving means for the rollers of the pressure sealing unit **17'** is shown as being substantially identical to the driving means associated with the pressure sealing unit **17**, like reference characters shall apply to the driving means associated with each of the pressure sealing units **17, 17'**.

The pressure sealing rollers of each pressure sealing unit **17, 17'** are driven by a manually adjustable variable speed power unit **51** having a manually movable control lever **51*a*** which controls the output speed of the corresponding unit **51** for driving an endless belt **52**. Endless belt **52** drives a pulley **53** which, in turn, drives an intermediate gear **54**. The intermediate gear **54** meshes with a pair of relatively smaller gears **56, 57** which, in turn, mesh with respective gears or pinions **56', 57'**. The gears **56, 57, 56', 57'** drive the cores or shafts, to be later described, of the respective pressure sealing rollers **30, 31, 30', 31'** for the purpose of minimizing the friction on the fabric F passing through the nips thereof.

Opposite ends of conductors **60, 61** are connected to the two speed variable speed units **51**, a pair of manually operable switches **62, 63** being interposed in the conductor **61** on opposite sides of a conductor **64**, the conductor **64** being connected to a medial portion of conductor **61**. One end of a conductor **65** is also connected to a medial portion of conductor **60** and the other ends of the conductors **64, 65** are connected to a plug **66** adapted to be connected to a suitable source of electrical energy, not shown. A manually operable master switch **67** is interposed in the conductor **65**.

It is thus seen that, when all the switches **62, 63, 67** are closed, both of the power units or variable speed units **50** are energized. The position of the switches **62, 63** in the conductor **61** permits the variable speed units **50** to be operated independently of each other or simultaneously depending upon whether the switches are in open or closed position. It is apparent that the switches **62, 63, 67** may be positioned on a suitable panel to be readily accessible to the operator, as desired.

The independently adjustable variable speed units **50** are provided for the pressure sealing units **17, 17'** to permit adjustment of the speed of the sealing rollers associated with the sealing unit **17'** at the ingress end of the tank or vessel in accordance with the desired speed at which the fabric F enters the vessel and to adjust the speed of the sealing rollers associated with the pressure sealing unit **17** at the egress end of the tank or vessel to compensate for the reduced speed of the fabric due to shrinkage or tightening of the fabric as it passes through the treating solution S in the vessel **10**.

The construction of the sealing rollers **30, 30', 31, 31'** are all the same and therefore a description of only one of these sealing rollers, namely, sealing roller **30** as shown in Figures 2 and 3, will be described in detail. The sealing roller **30** is provided with a shaft **70** having reduced end portions rotatably mounted in bearings **71** and **72** positioned in the respective vessel side walls **11**. A washer **84** is provided to space the corresponding gear **56** from the bearing **71**. The end of the shaft in engagement with the bearing **71** has the gear **56** secured thereto for being rotated by the same through the gear **54**. A plurality of circularly spaced, longitudinally extending projections or keys **73**, as clearly shown in Figures 2 and 7, are provided on the shaft **70** for engaging shoulder portions defined by recessed portions or key-ways **74** formed on the inner surfaces of a plurality of co-axial juxtapositioned rings **75** forming the periphery of the sealing roller **30**.

It will be observed in Figures 2 and 7 that the inside diameter of the rings **75** is substantially greater than the outside diameter of the shaft **70** and that the outer surfaces of the keys **73** define a circle of lesser diameter than a circle defined by the bottoms of the key-ways **74** to thus permit relative movement between the rings **75** and the shaft **70** for reasons to be later explained. The key-ways **74** are also substantially wider than the corresponding keys **73**. Although keys **73** and key-ways **74** are shown, it is apparent that any suitable complementary, loosely interengaging means may be provided between shaft **70** and each ring **75**.

In order to maintain the plurality of rings **75** in juxtaposition, springs **80, 80'** (Figure 3) are provided at opposite ends of the shaft **70** with their proximal surfaces engaging respective cup washers **81, 81'** which exert an inward pressure on the end rings **75**. The outer ends of the springs **80, 80'** rest against circular washers **82, 82'** which abut packing glands or sealing rings **83, 83'**, respectively.

In Figures 5, 6 and 7, there is illustrated the main advantage of these juxtapositioned rings **75** for sealing the inlet and outlet slots or openings of the pressure vessel **10** over the type of sealing rollers heretofore employed wherein the sealing rollers have had a solid continuous peripheral surface. In these views there is illustrated a fabric F of a narrower width than the width of the surface of the sealing rollers formed by the plurality of rings **75**. In order to clarify the function of certain of the rings **75** in Figure 5, these rings are identified by the additional numerals **75*a*, 75*b*, 75*c***.

The fabric F is shown in Figures 5 and 6 as also having a biased seam or thickened portion T therein, passing between the nip of rollers **30, 30'**. As will be observed, particularly in Figure 5, the portions of the biased seam T that are engaged by the rings **75*a*** of rollers **30, 30'** cause the rings **75*a*** to move a greater distance outwardly from each other than the portions of the biased seam that are not at the nip of the rings **75*b***. Since this fabric is of narrower width than the length of the rollers formed by the plurality of rings **75**, the rings **75*c*** at the ends of the sealing rollers **30, 30'** will have their surfaces contacting each other and are, therefore, shown in a more inward position than the rings **75*b*** in contact with opposed surfaces of the fabric and the rings **75*a*** in contact with portions of the biased seam of the fabric.

This particular arrangement, as will be appreciated, permits the fabric F to pass into and out of the pressure vessel **10** without permitting the pressure to escape therefrom between the sealing rollers **30**, as has been the case heretofore when similar rollers were formed as solid rollers. As illustrated in Figure 7, there will always be at least two of the longitudinal keys **73** provided on the shafts **70** of adjacent pairs of rollers in driving engagement with the shoulders of key-ways **74** formed in the inner surfaces of the rings **75** so the sealing rollers **30, 30'** will always be positively driven by the corresponding shafts **70** as a fabric passes therebetween to

reduce the friction on the fabric. It will also be noted that the lower portions of the rings 75 will always be in engagement with their respective bearing plates 26, 26', 27, 27' due to gravitational forces and the pressure inside the vessel 10 to maintain a tight seal.

Accordingly, there has been disclosed an improved apparatus for and method of sealing the inlet and outlet ends of a pressure vessel while permitting the continuous passage therethrough of material, such as fabric, and wherein novel means and a method are disclosed for controlling the squeezing pressure on the fabric at the nip of the sealing rolls so as not to damage the same.

Although the invention is disclosed as particularly applicable for the treating of fabrics or continuous strands of material in a pressure vessel, it is to be distinctly understood that the invention is applicable to any type of process wherein any type of material enters and leaves a pressure vessel whether in a continuous path such as the fabric illustrated or at given intervals in segmental form.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. In an apparatus for treating material having a pressure vessel provided with vertically arranged ingress and egress openings for the material to pass therethrough and means for maintaining a pressure in the vessel above atmospheric pressure; sealing means provided adjacent the ingress and egress openings of the vessel for engaging opposed surfaces of the material passing therethrough and to prevent the escapement of pressure from the vessel comprising opposed abutments provided on opposite sides of each of the openings, said abutments having downwardly sloping converging upper surface portions, bearing plates positioned on said upper surface portions, a pair of normally contacting sealing rollers positioned on said bearing plates and extending across the opening, means for rotating each of said rollers of said pair of rollers in opposite directions, each of said rollers comprising a shaft, a plurality of longitudinally extending keys provided on said shaft, a plurality of juxtapositioned rings surrounding said shaft, each ring having a plurality of key-ways formed in the inner surface thereof to receive said keys, the diameter of a circle formed by the bottoms of said key-ways being larger than the diameter of a circle formed by the outer surfaces of said keys on said shaft whereby said sealing rollers are positioned to be rotated by said shaft with a loose driving action to permit the rings of each of said sealing rollers to freely move toward and away from each other dependent upon the thickness of the material passing therebetween.

2. In an apparatus for treating material having a pressure vessel provided with ingress and egress openings for the material to pass therethrough and means for maintaining a pressure in the vessel above atmospheric pressure; sealing means provided adjacent the ingress and egress openings of the vessel for engaging opposed surfaces of the material passing therethrough and to prevent the escapement of pressure from the vessel comprising a pair of normally contacting sealing rollers positioned adjacent each of said openings in said vessel and extending across the opening, means for driving said sealing rollers in unison to permit material to pass therebetween, means provided adjacent said openings for engaging peripheral portions of said sealing rollers, said engaging means contacting the vessel adjacent each opening to form a seal between the vessel and each of said peripheral portions, each of said sealing rollers comprising a plurality of juxtapositioned rings forming its periphery, means for loosely driving in unison each of said rings on said rollers whereby each of said rings is permitted to move independently inwardly or outwardly dependent upon the thickness of the material passing between each of said pairs of rollers.

3. A device according to claim 2 wherein each of said rings is provided with a plurality of recessed portions on its inner surface defining shoulder portions and said means for loosely rotating said rings comprises a shaft, a plurality of longitudinally extending keys secured to said shaft for contacting said shoulder portions formed on the inner surfaces of said rings, the diameter of said shaft being less than the inner diameter of each of said rings, and the diameter of a circle formed by said keys on said shaft being less than the diameter of a circle formed by said recessed portions on the inner surfaces of said ring whereby material passing between said rollers will move the rings of each roller away from the rings of the other roller a distance dependent on the thickness of the material passing between the nip portions of said pairs of rollers.

4. A device according to claim 3 wherein means are provided for maintaining the rings in juxtaposition and comprises resilient means at opposed opposite end portions of said shaft and surrounding said shaft and exerting an inward pressure to maintain the rings in contact with each other.

5. Apparatus for treating material comprising a pressure vessel having ingress and egress openings, means for maintaining a pressure in said pressure vessel substantially above atmospheric pressure, sealing means provided adjacent the ingress and egress openings of the pressure vessel for engaging opposed surfaces of the material passing therethrough and to prevent the escapement of pressure from the vessel, said sealing means comprising spaced pairs of sealing rollers at each vessel opening, each of said rollers having a plurality of juxtapositioned relatively movable rings defining its peripheral surface, a pressure compartment between said pairs of rollers at the ingress and egress openings, and means for maintaining a pressure in each of said pressure compartments above atmospheric pressure but below the pressure in the pressure vessel, each pair of sealing rollers extending across the respective opening of the vessel.

6. Apparatus according to claim 5 wherein the means for maintaining a pressure in each of said pressure compartments substantially above atmospheric pressure and below the pressure in the pressure vessel comprises means for transmitting the pressure in the pressure vessel into the pressure compartments, and valve means interposed in said transmitting means to control the amount of pressure entering said compartments and to maintain the pressure in the compartments below the pressure in the pressure vessel.

7. Apparatus according to claim 5 wherein the means for maintaining a pressure in each of said pressure compartments substantially above atmospheric pressure and below the pressure in the pressure vessel comprises means for directing an outside source of high pressure into the pressure compartments, and valve means to control the amount of pressure entering said compartments from said source and to maintain the pressure in the compartments below the pressure in the pressure vessel.

8. Apparatus according to claim 5 wherein means are provided for rotating the sealing rollers as material passes in contact therebetween and each of said rings are movable transversely of its axis of rotation.

9. Apparatus according to claim 8 wherein the means for rotating the sealing rollers comprises means for rotating the pairs of sealing rollers at the ingress and egress openings at variable speeds relative to each other to compensate for any shrinkage of the material passing through the pressure vessel, and switch means are provided for independently controlling the rotation of each pair of sealing rollers.

10. Apparatus according to claim 5 wherein each sealing roller comprises a rotatable shaft having a plurality of projections extending from its surface, said rings en-

circling said shaft, resilient means for maintaining the rings in contact with each other, each of said rings having a plurality of recessed portions on their inner surface to receive the corresponding shaft projections, said recessed portions defining shoulder portions which are engaged by the shaft projections upon rotation of the shaft, the diameter of said shaft being less than the inner diameter of each of said rings, and said projections on said shaft defining a circle having a smaller diameter than the diameter of a circle formed by the recessed portions of the rings whereby the rings are permitted to be rotated eccentrically by the shaft in a floating manner.

11. In an apparatus for treating material having a pressure vessel provided with inlet and outlet openings for the material to pass therethrough and means for maintaining a pressure in the vessel substantially above atmospheric pressure; sealing means for preventing the escapement of pressure from the pressure vessel while moving material into and out of the same comprising at least two pairs of rotatably mounted sealing rollers positioned at each of the inlet and outlet openings of the pressure vessel and engaging opposed surfaces of said material passing between each of said pairs of sealing rollers, each pair of sealing rollers extending across the respective opening of the vessel, a pressure compartment between each of adjacent pairs of said sealing rollers, means for maintaining a lesser pressure in said compartments than is present in said vessel whereby the material passing between each of said pairs of rollers and through each compartment will have less pressure exerted on the same by each of said pairs of sealing rollers than would be the case in the absence of said compartments, each sealing roller comprising a shaft having a plurality of projections extending from its surface, a plurality of juxtapositioned rings encircling said shaft, resilient means for maintaining the rings in contact with each other, each of said rings having a plurality of recessed portions on their inner surface to receive the corresponding shaft projections, said recessed portions defining shoulder portions which are engaged by the shaft projections upon rotation of the shaft, the diameter of said shaft being less than the inner diameter of each of said rings, and said projections on said shaft defining a circle having a smaller diameter than the diameter of a circle formed by the recessed portions of the rings whereby the rings are permitted to be rotated eccentrically by the shaft in a floating manner.

12. In an apparatus for treating material having a pressure vessel provided with at least one opening for the material to pass therethrough and means for maintaining a pressure in the vessel above atmospheric pressure; means for sealing the opening while passing the material therethrough comprising a pair of pressure sealing rollers positioned adjacent the opening for engaging opposite sides of the material as it passes through the opening, each sealing roller extending across the opening and comprising a rotatable shaft, a plurality of relatively narrow rings loosely encircling said shaft and being laterally displaceable relative to each other and transversely of the axis of said shaft, and means to substantially maintain rotation of said rings consistent with rotation of the shaft.

13. In an apparatus for treating material having a pressure vessel provided with at least one opening for the material to pass therethrough and means for maintaining a pressure in the vessel above atmospheric pressure; means for sealing the opening while passing the material therethrough comprising a pair of outwardly converging surfaces on the vessel straddling the opening, a pair of pressure sealing rollers adapted to engage opposite sides of the material and engaging said converging surfaces, each sealing roller extending across the opening and comprising a shaft and a plurality of rings loosely encircling said shaft and being relatively laterally displaceable transversely of the axis of said shaft.

14. A structure according to claim 13 wherein said shaft is a driven rotary shaft, and complementary interengaging means between the shaft and each ring whereby the rings rotate with the shaft.

15. A structure according to claim 14 wherein said complementary interengaging means includes a plurality of circularly spaced projections on the shaft and the inner surface of each ring having a recess therein for loosely receiving each of said projections.

16. A structure according to claim 15 wherein the outer surfaces of said projections collectively define a circle of lesser diameter than a circle collectively defined by the bottoms of said recesses.

17. In an apparatus for treating material having a pressure vessel provided with ingress and egress openings for the material to pass therethrough and having means for maintaining a pressure in the vessel above atmospheric pressure; sealing means provided adjacent the ingress and egress openings of the vessel for engaging opposed surfaces of the material passing therethrough and to prevent the escapement of pressure from the vessel comprising a pair of normally contacting sealing rollers positioned adjacent and extending across each of said openings in the vessel, means provided adjacent said openings for engaging peripheral portions of said sealing rollers, said engaging means contacting the vessel adjacent each opening to form a seal between the vessel and each of said peripheral portions, and each of said sealing rollers comprising a plurality of juxtapositioned movable rings forming its periphery to permit the rings to move independently of each other inwardly or outwardly dependent upon the thickness of the material passing between each of said pair of rollers.

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