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[54] **APPARATUS FOR WASHING FABRIC**

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[52] **U.S. Cl.** ..... **68/22 R,** 68/44, 68/158, 68/177

[51] **Int. Cl.**.... **B05c 3/134,** B05c 3/136, B05c 3/138

[58] **Field of Search** ..... 68/19.1, 22 R, 43, 44, 68/158, 177, 178, 181 R

[56] **References Cited**

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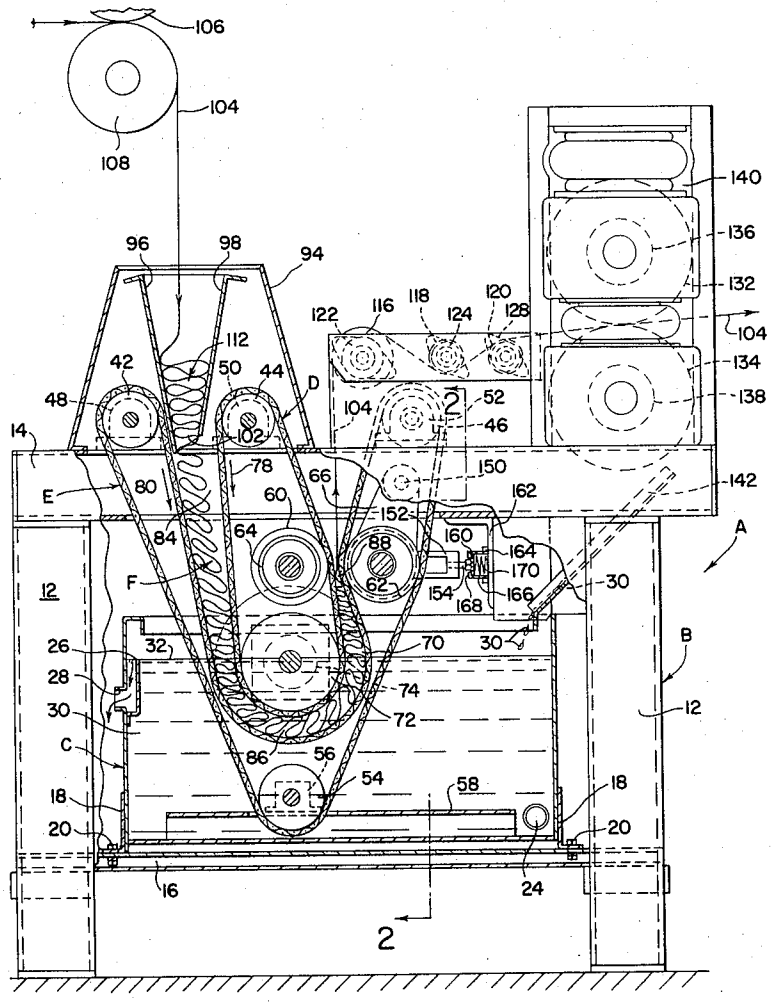
[57] **ABSTRACT**

A flat web of fabric is folded and overlapped into a fabric pack between a pair of perforate belts. The belts carry the fabric pack in a generally U-shaped conveying path. At the bottom arcuate portion of the conveying path, the fabric pack goes through a washing tank and is squeezed between the belts. The fabric pack passes out of the tank and goes between squeeze rolls which force washing liquid through and from the fabric pack. The fabric pack is then pulled from its folded and overlapped condition for passage through exit squeeze means as a flat web of fabric.

10 Claims, 2 Drawing Figures



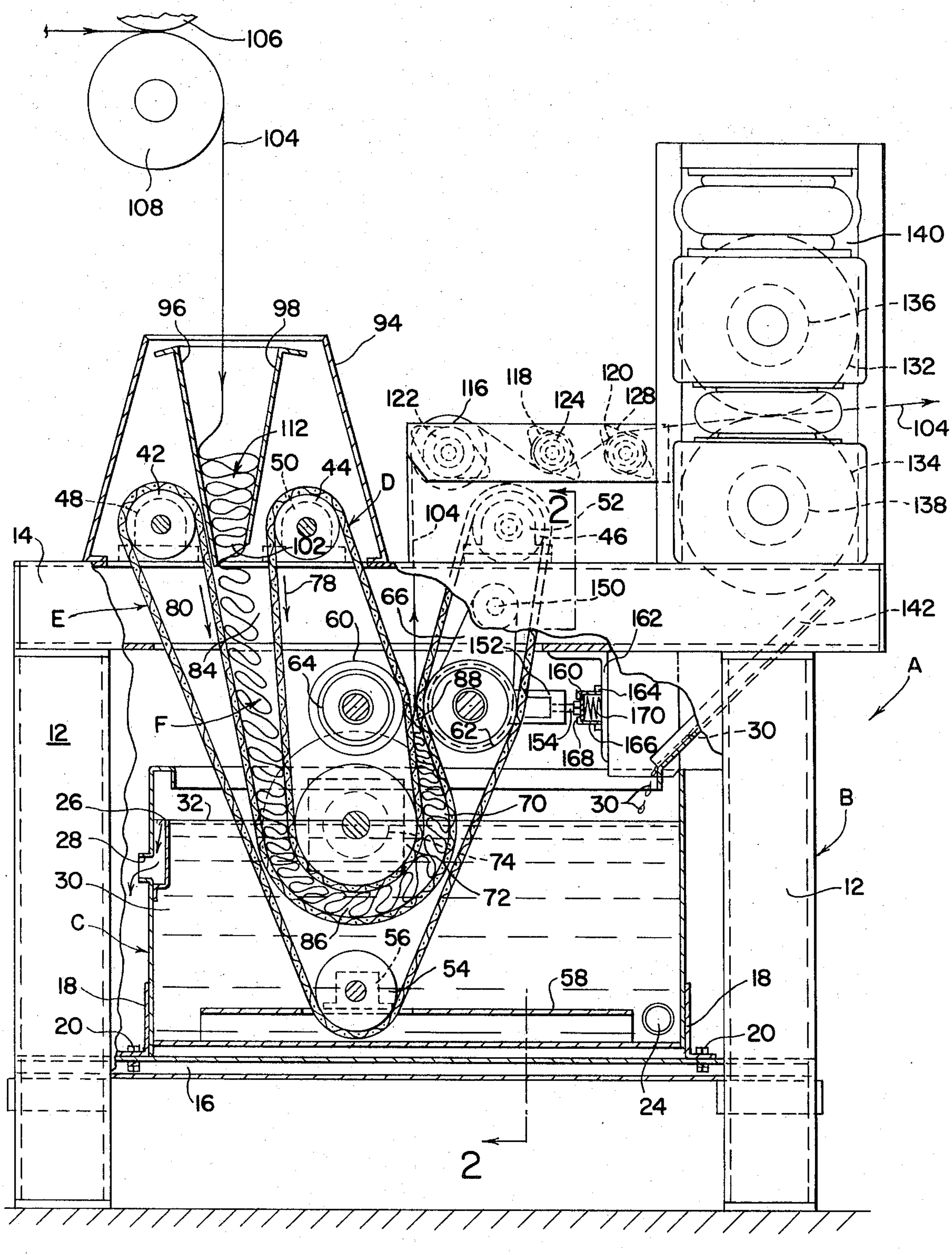

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FIG. 1

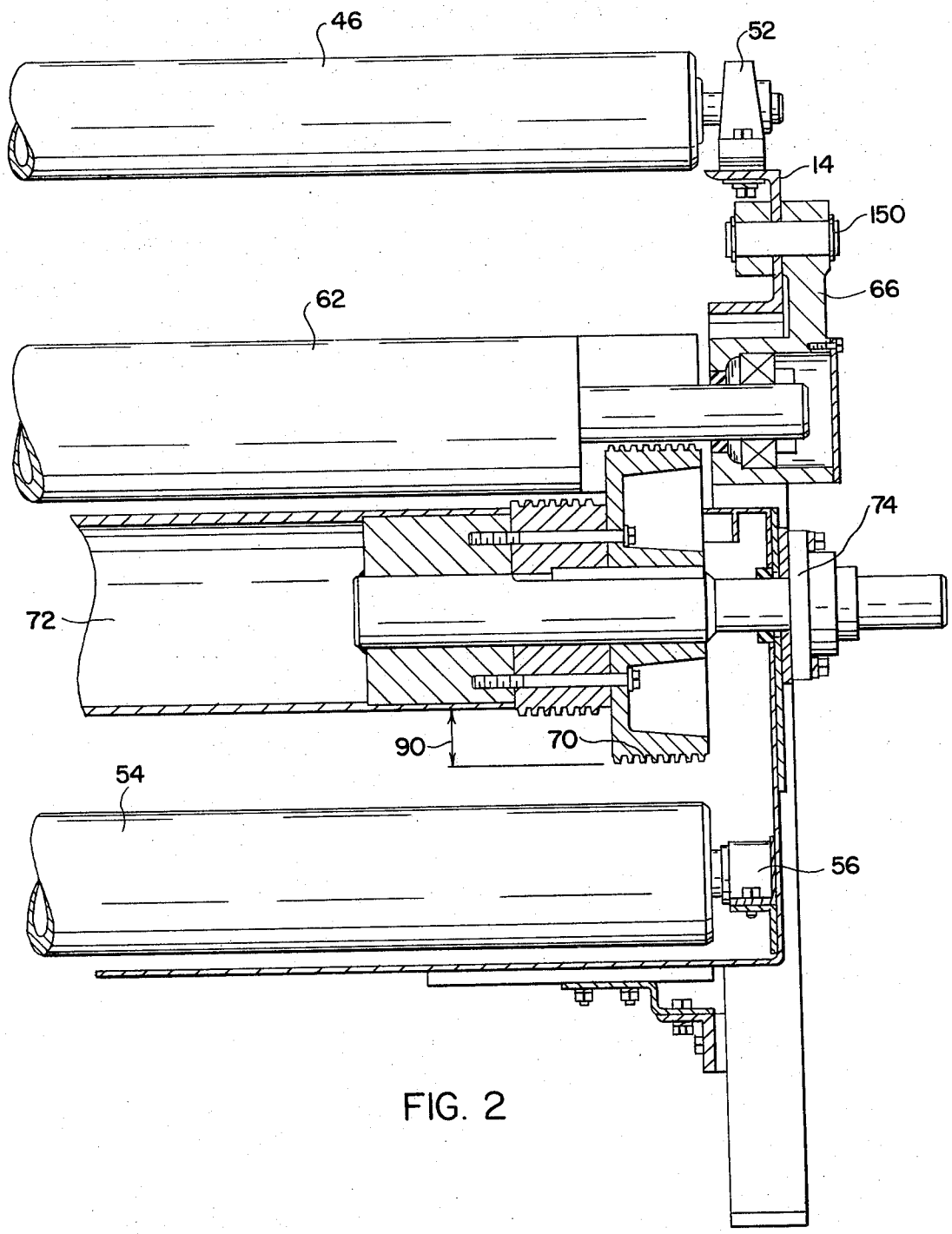

FIG. 2

APPARATUS FOR WASHING FABRIC

BACKGROUND OF THE INVENTION

This application pertains to the art of treating fabric, and more particularly to washing of fabric. The invention is particularly applicable to washing of fabric and will be described with particular reference thereto. However, it will be appreciated that the invention has broader applications and may be used for other fabric treatments.

Flat open width fabric web is commonly washed by threading it over and under rolls. The fabric is under tension and various devices have been used to improve the washing effect. Such devices includes sprays, suction pumps, squeeze rolls, vacuum slots and similar arrangements requiring substantially additional energy.

Effective washing requires a certain soaking time to loosen chemicals and dirt. It is also desirable that the washing liquid be squeezed through the fabric in order to remove chemicals and dirt from the fabric. Previous arrangements are reasonably effective at moderate fabric speeds but lose efficiency as the speed increases. Efficient processing requires speeds up to around 200 yards per minute. Therefore, the dwell or soaking time of the fabric in the washing liquid is greatly reduced.

When fabric of appreciable thickness is passed through the nip of squeeze rolls, the rolls form a water barrier and force the excess water through and out of the fabric. This creates an effective water exchange. With fabric of average weight, not having appreciable thickness, the excess water escapes without good mechanical flushing action through the fabric.

It would be desirable to have an arrangement for washing average weight fabric at high speed while increasing the residence time of the fabric within the washing tank. It would also be desirable to provide an improved arrangement for obtaining good flushing action of the washing liquid through the fabric.

SUMMARY OF THE INVENTION

Apparatus for washing fabric includes a tank for holding washing liquid up to a predetermined level. A pair of continuous belts extend around a plurality of rolls. The belts are spaced-apart on opposite sides of a substantially U-shaped fabric conveying path. The fabric conveying path includes a downwardly extending entrance path portion, an arcuate path portion within the washing tank beneath the predetermined level, and an upwardly extending exit path portion. The entrance path portion converges in a direction toward the arcuate path portion. The exit path portion terminates between a pair of squeeze rolls located above the predetermined level and whereat the pair of belts are positioned substantially closer together than at any other place along the fabric conveying path. Delivery means is provided for delivering flat open width fabric between the belts in the entrance path portion as a folded and overlapped fabric pack. The fabric pack is squeezed between the belts and washed in the washing liquid as it travels through the arcuate portion of the fabric conveying path. The fabric pack is squeezed between the squeeze rolls to force washing liquid through the overlapped and folded fabric pack. Exit squeezer means is provided for pulling the fabric pack back into a continuous open width flat web. The delivery means and the exit squeezer means are driven at substantially the same speed. The belts move the fabric pack

through the fabric conveying path at a substantially lower speed. Therefore, the fabric pack travels through the washing liquid in a washing tank at a much lower velocity than the flat open width fabric web moves through the delivery means and the exit squeezer means. This provides a longer soaking time of the fabric pack within the washing tank. Having the fabric in a folded and overlapped fabric pack also increases its thickness so that good mechanical flushing action takes place as the fabric pack passes through the squeeze rolls.

In accordance with a preferred arrangement, fresh washing liquid is fed into the bottom of the washing tank, and dirty washing liquid is withdrawn from the upper portion of the washing tank. Therefore, the fabric pack is squeezed between the belts and washed in relatively clear liquid in the lower portion of the washing tank. The dirty washing liquid falls back into the top portion of the washing tank from the squeeze rolls. The dirty washing liquid overflows from the washing tank through a dirty water outlet.

In a preferred arrangement, at least one of the squeeze rolls is adjustable toward and away from the other of the squeeze rolls for adjusting the distance between the squeeze rolls.

In accordance with another arrangement, yieldable biasing means is provided for yieldably biasing one of the squeeze rolls toward the other squeeze roll. The yieldable roll may yield to limit the amount of force applied to the fabric pack so that crease lines will not be permanently formed in the fabric pack.

It is a principal object of the present invention to provide an improved apparatus for washing fabric.

It is another object of the present invention to provide an apparatus for washing fabric in a manner which increases the soaking time while maintaining high processing speeds.

It is a further object of the present invention to provide a fabric washing apparatus which improves flushing action through average weight fabrics.

BRIEF DESCRIPTION OF THE DRAWING

The invention may take form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawing which forms a part hereof.

FIG. 1 is a side elevational view of an improved fabric washing apparatus constructed in accordance with the present invention and with portions cut away for clarity of illustration; and,

FIG. 2 is a cross-sectional elevational view looking generally in the direction of arrows 2—2 of FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, wherein the showings are for purposes of illustrating a preferred embodiment of the invention only and not for purposes of limiting same, FIG. 1 shows a fabric washing apparatus A constructed in accordance with the present invention. Apparatus A has a supporting frame B which includes a plurality of structural members bolted, welded or otherwise secured together. Frame B includes a plurality of upright legs 12 supporting upper horizontal structural members 14 and lower horizontal structural members 16.

An open top rectangular washing tank C is mounted on lower structural members **16** as by brackets **18**, and bolt and nut assemblies **20**. Washing tank C has a clean washing liquid inlet **24** in the bottom portion thereof. Washing tank C has an overflow weir **26** leading to a dirty water outlet **28** in the top portion thereof. This maintains washing liquid **30** within washing tank C at predetermined level **32**.

A plurality of belt support rolls **42, 44** and **46** are rotatably mounted in suitable bearing assemblies **48, 50** and **52** secured to upper structural members **14**. A lower belt support roll **54** is rotatably mounted to a bearing assembly **56** secured to a structural member **58** within the bottom portion of washing tank C. A pair of squeeze rolls **60** and **62** are rotatably mounted in suitable bearing assemblies **64** and **66** secured to structural members **14**. Edge rolls **70** and roll **72** are mounted on a common shaft rotatably mounted to bearing assemblies **74** secured to the opposite sidewalls of washing tank C. The lower half of edge rolls **70**, and of roll **72**, are immersed in washing liquid **30** below predetermined level **32**. A continuous perforate belt D is movably supported by rolls **44, 60** and **72** for movement in the direction of arrow **78**. Another continuous perforate belt E is supported by rolls **42, 54, 62, 46** and edge rolls **70** for movement in the direction of arrow **80**.

As shown in FIG. **1**, belts D and E are spaced-apart on opposite sides of a substantially U-shaped fabric conveying path F. Fabric conveying path F includes downwardly extending path portion **84** merging into an arcuate path portion **86** which in turn merges into an upwardly extending exit path portion **88**. Belts D and E converge toward one another so that entrance path portion **84** converges or becomes narrower toward arcuate portion **86**. Arcuate portion **86** is located within washing liquid **30** beneath predetermined level **32**. Exit path portion **88** terminates between squeeze rolls **60** and **62** whereat belts D and E are positioned closer together than at any other place in the defined fabric conveying path.

As shown in FIG. **2**, edge rolls **70** are at the ends of roll **72** to provide a spacing distance **90** between the outer peripheral surfaces of edge rolls **70** and the outer peripheral surface of roll **72**. Space **90** is common with arcuate path portion **86**. Perforate belts D and E may be made of any suitable material. In one arrangement, belts D and E are woven from stainless steel wire.

Support members as at **94** secured to the top of structural members **14** support inclined flat plates **96** and **98** having an elongated bottom opening **102** therebetween and positioned above belt E at entrance path portion **84**. A flat open web fabric **104** is delivered by delivery means defined by driven rolls **106** and **108**. Fabric **104** strikes plates **96** and **98**, and becomes folded and overlapped in the manner shown to form a fabric pack generally indicated by numeral **112**. The folded and overlapped fabric pack drops through opening **102** onto belt E in entrance path portion **84**. Fabric pack **112** is then progressively squeezed between belts D and E as it is conveyed down entrance path portion **84** toward washing liquid **30**. As fabric pack **112** moves through washing liquid **30**, it is squeezed between belts D and E in arcuate path portion **86** so that it is thoroughly soaked and has washing liquid forced therethrough. Fabric pack **112** then moves up exit path portion **88** until it is squeezed betweeen rolls **60** and **62**. This squeezing action forces the washing liquid through and from the fabric pack to provide very efficient washing action. The expelled liquid falls back down into washing tank C.

A plurality of spaced-apart exit rolls **116, 118** and **120** are rotatably mounted in bearing assemblies **122, 124** and **126** secured to a structural member **128**. Fabric **104** is threaded over and under rolls **116, 118** and **120** in the manner shown in FIG. **1**. Fabric **104** then passes in a flat open web condition between exit squeeze means defined by upper and lower exit squeeze rolls **132** and **134** rotatably mounted in bearing assemblies **136** and **138** mounted to windows of upright frame members **140**. Liquid expressed from fabric **104** as it passes through exit squeeze rolls **132** and **134** falls into inclined drain plate **142** which drains back into the upper portion of washing tank C.

Delivery rolls **106** and **108**, and exit squeeze rolls **132** and **134**, are rotatably driven so that flat open web fabric **104** is delivered to U-shaped fabric conveying path F at the same speed at flat open web fabric **104** is pulled from the path by squeeze rolls **132** and **134**. The rolls may be driven by electric motors or chain drives. One or both of belts D and E may be driven for movement in the direction of arrows **78** and **80**. When only one belt is driven, the other belt will move due to fabric pack **112** effectively connecting the belts in the fabric conveying path. Any one or more of the defined belt support rolls may be rotatably driven by electric motors or chain drives.

Fabric pack **112** moves through fabric conveying path F at a substantially slower speed than flat open web fabric **104** is delivered to the conveying path and pulled therefrom. Therefore, this provides a high residence time of fabric pack **112** within washing liquid **30**. The greater thickness of fabric pack **112**, provided by folding and overlapping, also enhances the squeezing action between squeeze rolls **60** and **62** for obtaining good flushing action of washing liquid flowing through the fabric pack. Fabric pack **112** is pulled back into a flat open web condition **104** by squeeze rolls **132** and **134**.

In a preferred arrangement, at least one of squeeze rolls **60** and **62** is adjustably mounted for adjustable movement toward and away from the other roll. At least one of rolls **60** and **62** is also yieldably biased toward the other roll. In one arrangement, bearing assembly **66** for squeeze roll **62** is pivotably mounted to frame member **14** by pivot pin **150**. Bearing assembly **66** can then swing about pin **150** for moving roll **62** toward and away from squeeze roll **60**. Bearing assembly **66** includes a projecting portion **152** in FIG. **1** having a bolt **154** threaded thereto. Bolt **154** is adapted to bear against a stop **160** secured to a frame member **162** fixed to the bottom of structural member **14**. Frame member **162** may have a nut **164** welded thereto. A cylindrical sleeve member **166** may be threaded onto nut **164**. Sleeve member **166** has an inturned flange **168**. A coil spring **170** positioned within sleeve member **166** biases stop member **160** to the left in FIG. **1**. This also biases bearing assembly **66** to the left for moving roll **62** toward roll **60**. Nut **154** may be rotated relative to projecting portion **152** on bearing assembly **66** to vary the spacing between squeeze rolls **60** and **62** when bolts **152** is bearing against stop **160**. Excessive squeezing force due to additional thickness of fabric pack **112** allows bearing assembly **66** to swing for moving squeeze roll **62** away from squeeze roll **60** by the action of the

yieldable biasing means defined by spring **170.** Pneumatic or hydraulic yieldable biasing means may also be provided to perform the same function.

The apparatus and method of the present invention provides improved soaking time for a fabric pack while maintaining high processing speeds. The improved apparatus and method of the present invention also enhances the flushing action of washing liquid flowing through the fabric pack for sweeping chemicals and dirt therefrom.

Although the invention has been shown and described with respect to a preferred embodiment, it is obvious that equivalent alterations and modifications will occur to others skilled in the art upon the reading and understanding of this specification. The present invention includes all such equivalent alterations and modifications, and is limited only by the scope of the claims.

Having this defined by invention, I claim:

1. Apparatus for washing fabric comprising: a tank for holding liquid up to a predetermined level, a plurality of belt support rolls, a pair of continuous belts extending around said rolls, said belts being spaced-apart on opposite sides of a substantially U-shaped fabric conveying path, said path including a downwardly extending entrance path portion, an arcuate path portion within said tank beneath said predetermined level, and an upwardly extending exit path portion, said entrance path portion converging in a direction toward said arcuate path portion, said exit path portion terminating between a pair of squeeze rolls located above said predetermined level and whereat said belts are positioned substantially closer together than at any other place along said fabric conveying path, delivery means for delivering flat fabric between said belts in said entrance path portion as a folded and overlapped fabric pack, said fabric pack being squeezed and washed in said tank in said arcuate path portion, said fabric pack being squeezed between said squeeze rolls to force washing liquid therethrough and therefrom, and exit squeezer means for pulling said fabric pack back into a continuous flat web, said delivery and exit squeezer means being driven at substantially the same speed, and said belts being driven at a speed substantially slower than said delivery and exit squeezer means whereby said fabric pack travels through said tank at a much slower velocity than said flat fabric moves through said delivery means and said exit squeezer means.

2. The apparatus of claim **1** wherein said tank has a bottom portion and further including fresh liquid inlet means in said bottom portion, and dirty liquid outlet means in said tank at said predetermined level.

3. The apparatus of claim **2** wherein said belts comprise woven stainless steel belts.

4. The apparatus of claim **1** wherein said belts comprise woven stainless steel belts.

5. The apparatus of claim **1** and including a plurality of spaced-apart fabric conveying rolls positioned between said squeeze rolls and said exit squeezer means, said fabric being trained over and under said fabric conveying rolls.

6. The apparatus of claim **1** wherein at least one of said squeeze rolls is adjustable toward and away from the other of said squeeze rolls.

7. The apparatus of claim **1** wherein at least one of said squeeze rolls is yieldable away from the other of said squeeze rolls and yieldable biasing means for yieldably biasing said one squeeze roll toward said other squeeze roll.

8. The apparatus of claim **7** wherein at least one of said squeeze rolls is adjustable toward and away from the other of said squeeze rolls.

9. The apparatus of claim **8** wherein said tank has a bottom portion and further includes fresh liquid inlet means in said bottom portion, and dirty liquid outlet means in said tank at said predetermined level.

10. The apparatus of claim **9** wherein said belts comprise woven stainless steel belts.

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