Nov. 16, 1965 R. A. SHERMAN 3,218,219

WEB PRECONDITIONER

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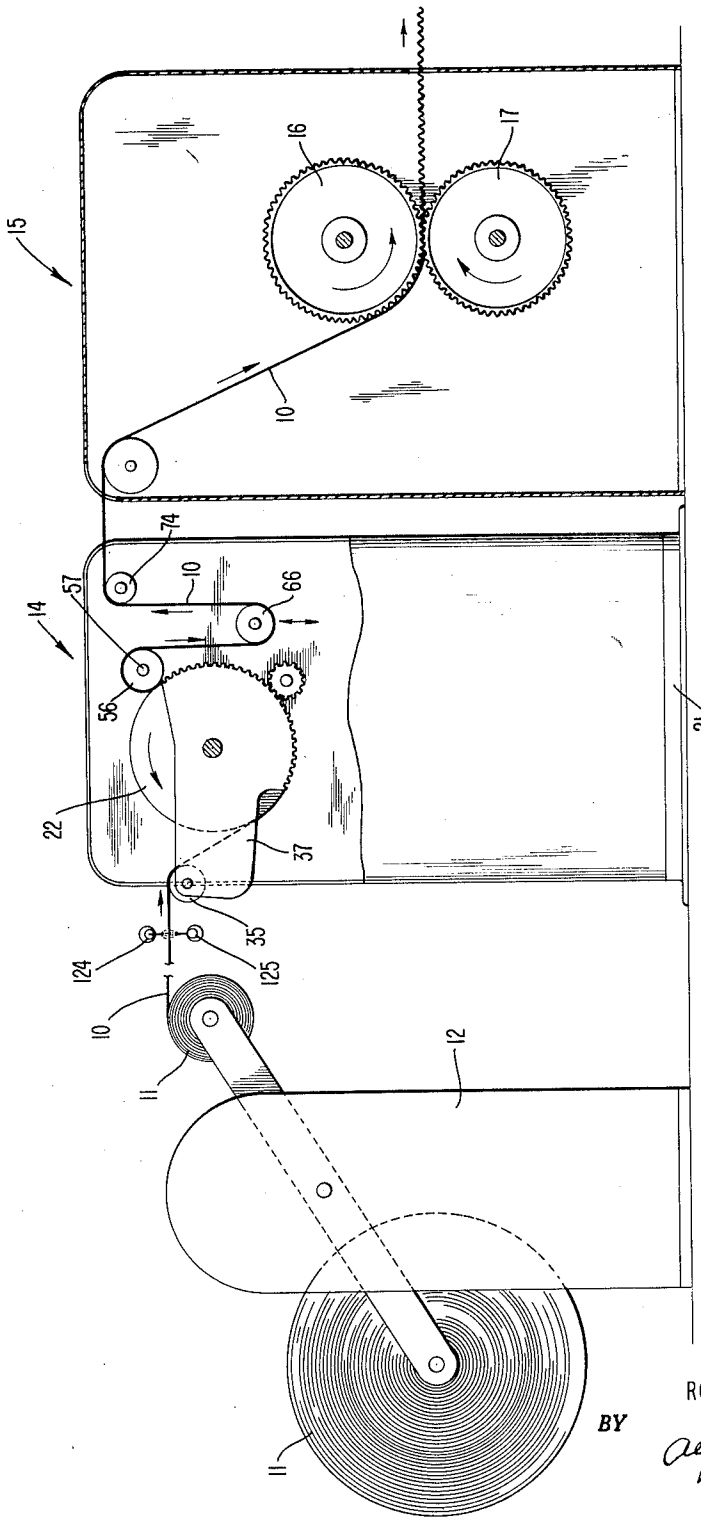

FIG. 1

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WEB PRECONDITIONER

Filed Dec. 1. 1961 7 Sheets-Sheet 2

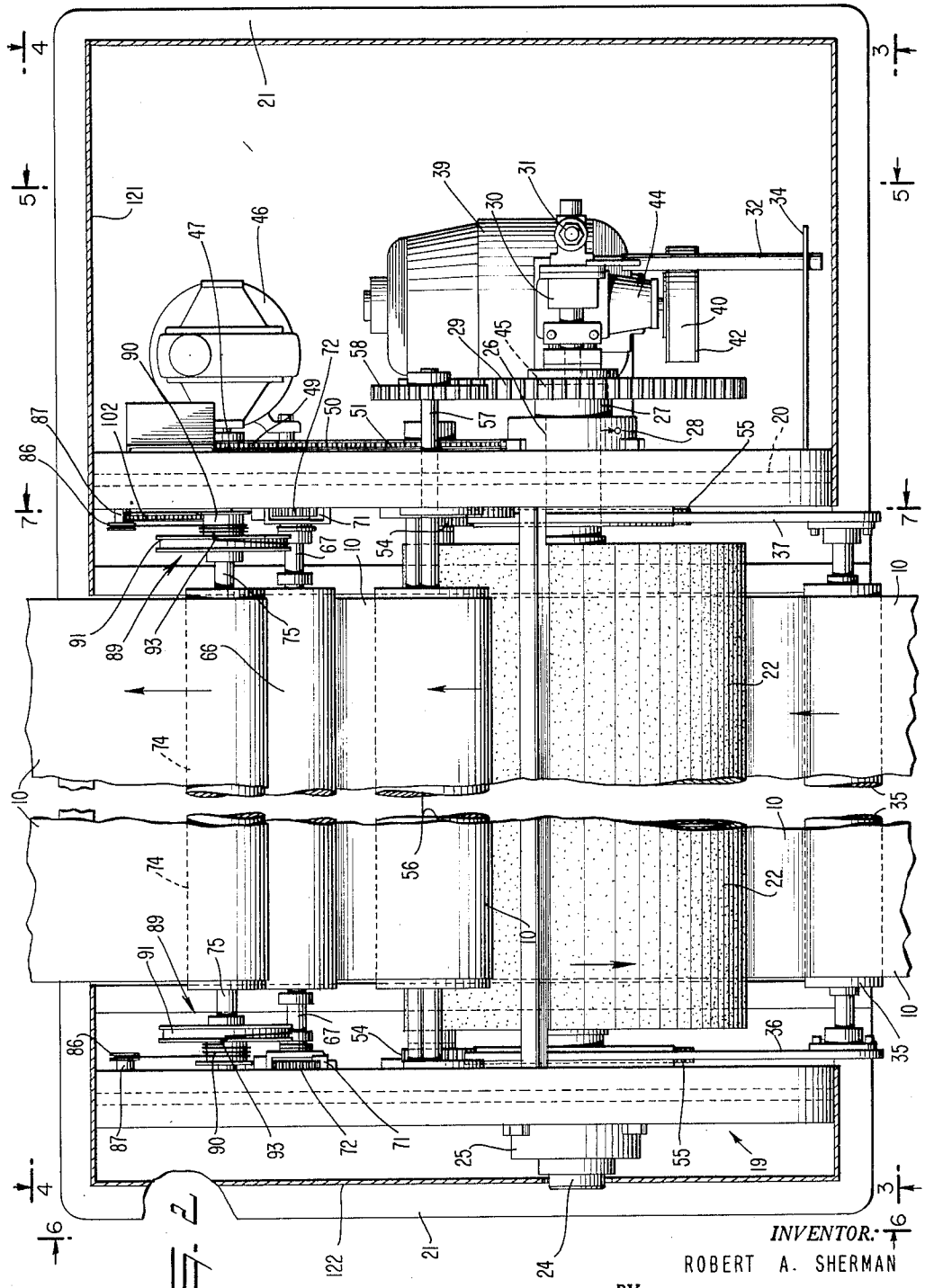

FIG. 2

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WEB PRECONDITIONER

Filed Dec. 1. 1961 7 Sheets-Sheet 3

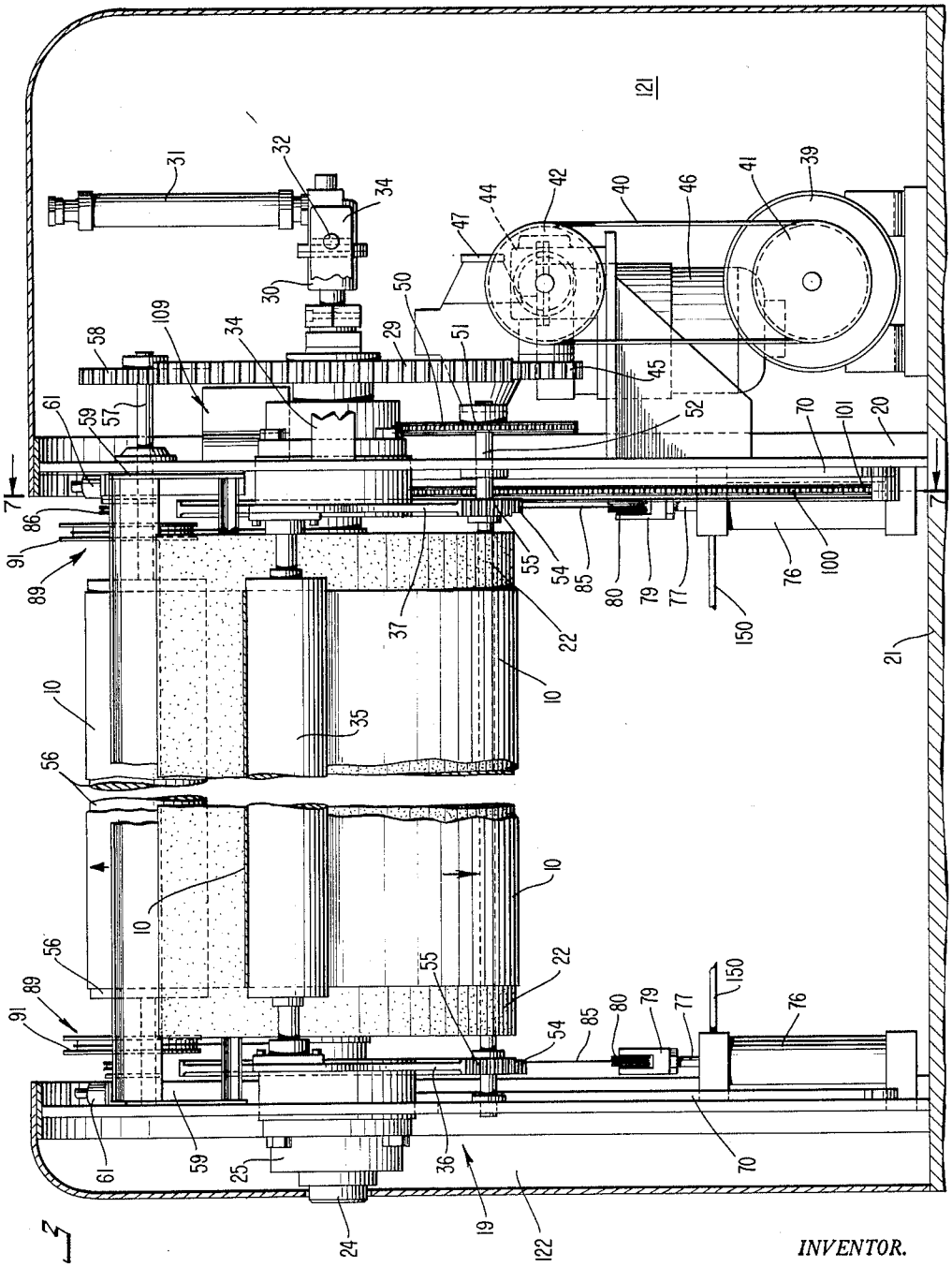

FIG. 3

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WEB PRECONDITIONER

Filed Dec. 1. 1961 7 Sheets-Sheet 4

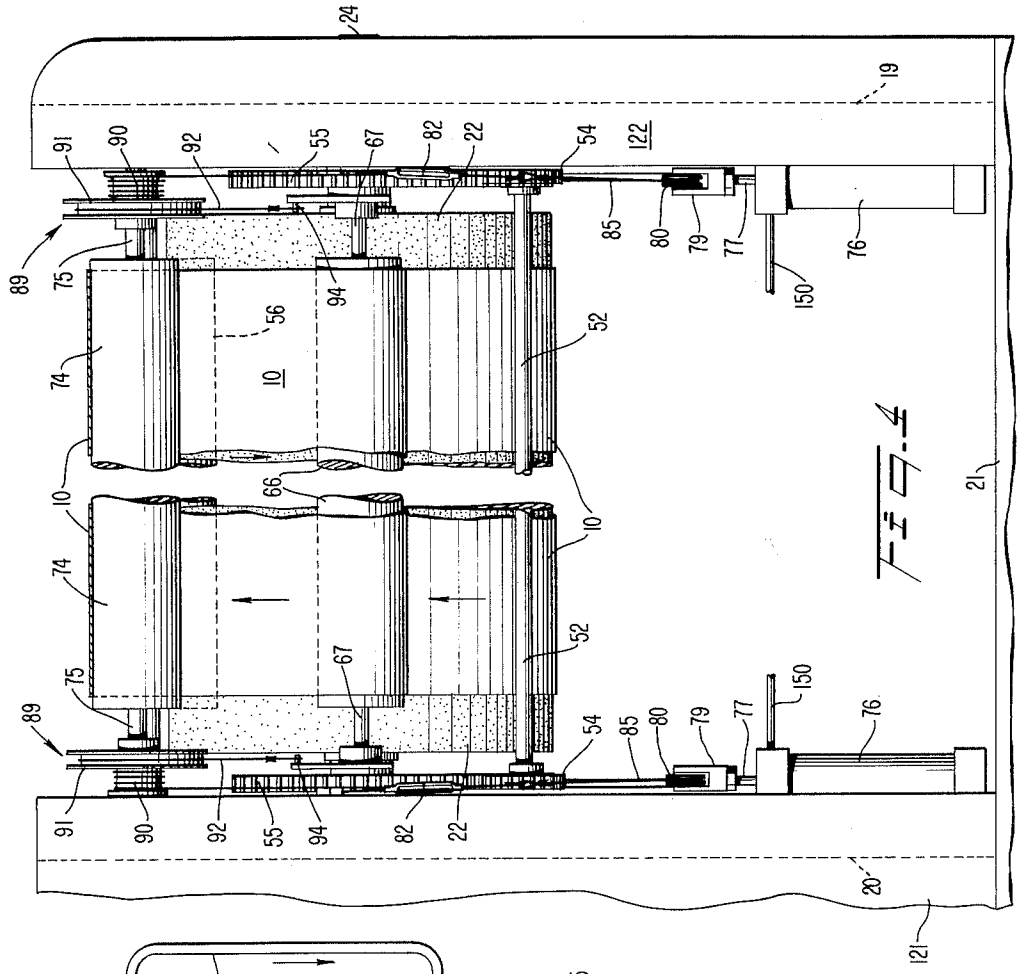

FIG. 4

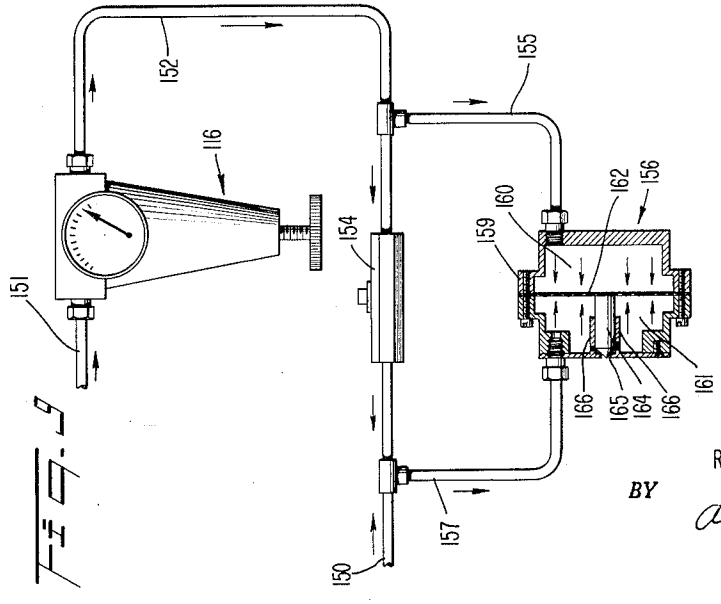

FIG. 3

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WEB PRECONDITIONER

Filed Dec. 1, 1961 7 Sheets-Sheet 5

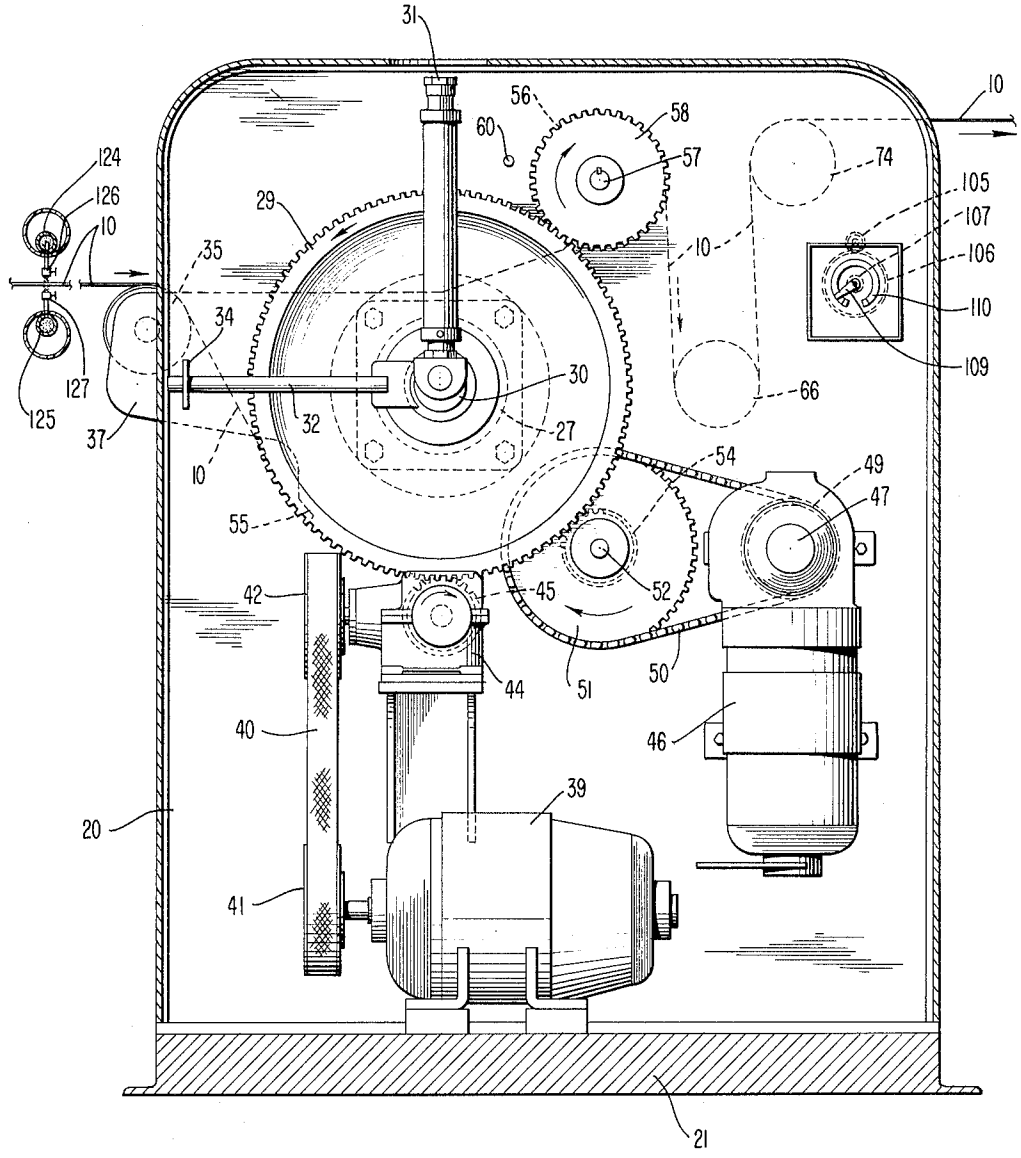

Fig. 5

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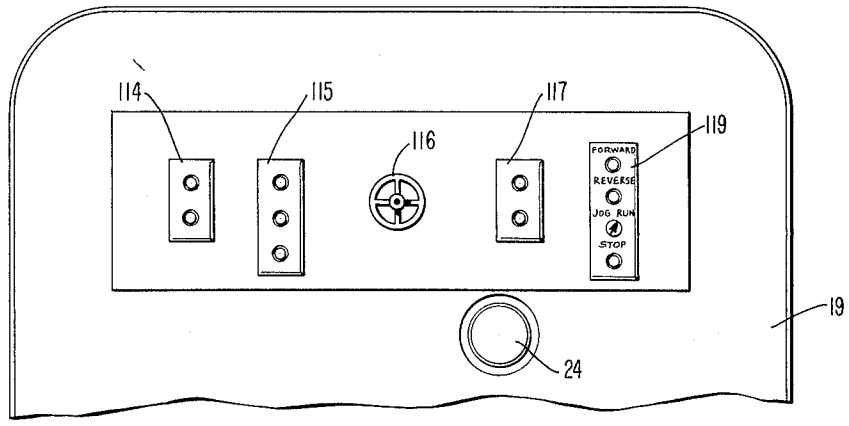
WEB PRECONDITIONER

Filed Dec. 1. 1961 7 Sheets-Sheet 6

Fig. 6



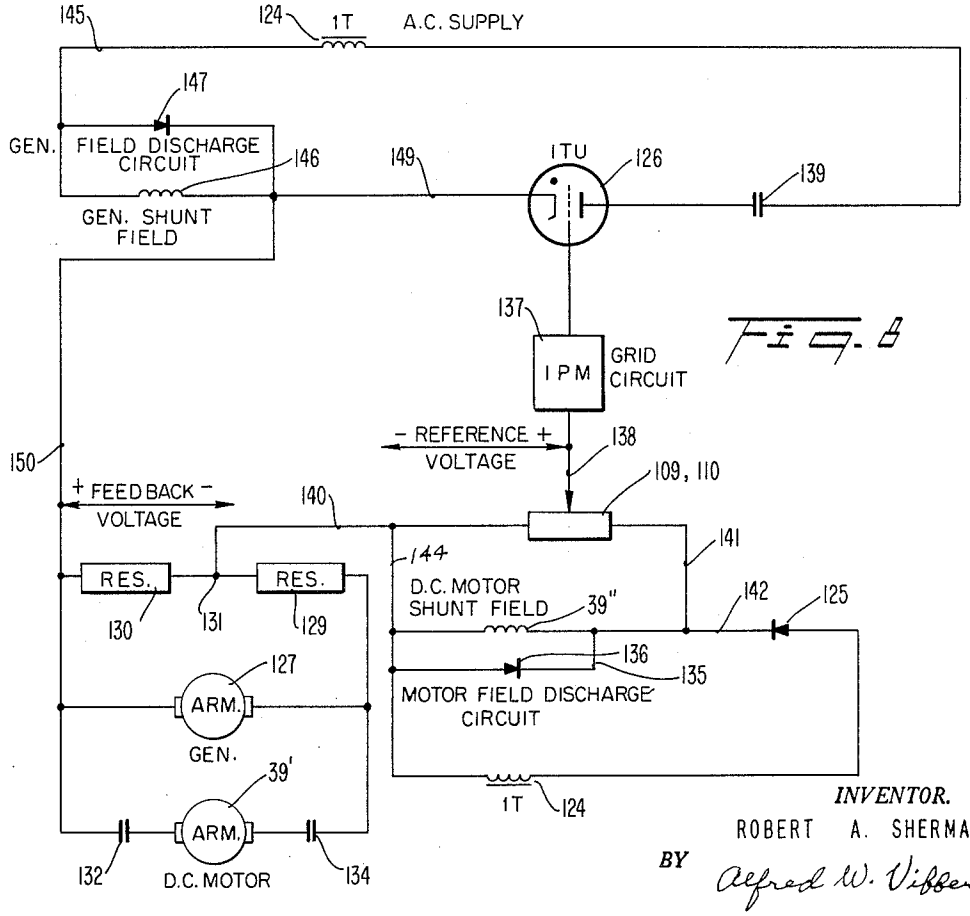


Fig. 8

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WEB PRECONDITIONER

Filed Dec. 1. 1961 7 Sheets-Sheet 7

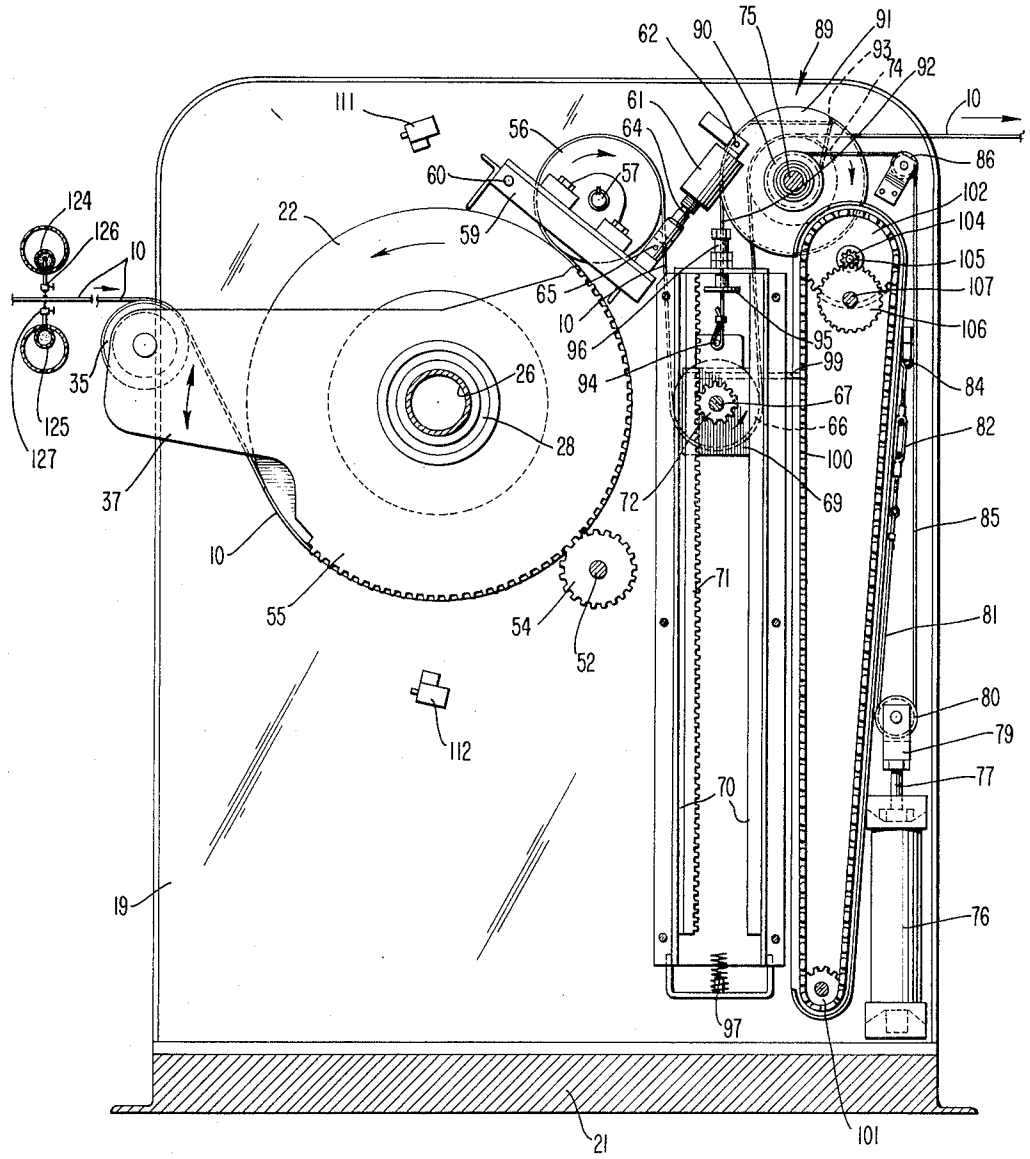

Fig. 1

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United States Patent Office 3,218,219 Patented Nov. 16, 1965

3,218,219

WEB PRECONDITIONER

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Filed Dec. 1, 1961, Ser. No. 156,420
5 Claims. (Cl. 156—587)

This invention relates to an improved web preconditioner, and more particularly relates to a preconditioner for a web of paper or paperboard.

The invention has among its objects the provision of an improved web preconditioner of the type indicated.

A further object of the invention resides in the provision of an improved web preconditioner having positive web gripping and forwarding means.

Another object of the invention lies in the provision of an improved web preconditioner of the type indicated immediately above in combination with mechanism receiving the preconditioned web, such latter mechanism having means for positively gripping and forwarding the web, such combination further including means for controlling the tension in the web between the two web-forwarding means.

Yet another object of the invention is the provision of novel means for controlling the tension of a web between two spaced mechanisms for positively gripping and forwarding the web.

A still further object of the invention lies in the provision of a novel dancer roll for detecting changes in tension in the web of material, and of a novel mechanism connecting the dancer roll to means for controlling the speed of at least one of the web-forwarding means.

Still other objects of the invention lie in the provision of a novel mechanism for selectively varying the effective force with which the dancer roll engages the web, and of a novel pinch or presser roll arrangement cooperating with the drum of the preconditioner, such arrangement including novel means for selectively removing the pinch roll from cooperation with the drum.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

FIG. 1 is a view in elevation on a small scale of a web supply stand, a web preconditioner, and a web corrugator as installed in a production line, the mechanisms being somewhat schematically shown;

FIG. 2 is a view in plan of a web preconditioner in accordance with the present invention, a central portion of the preconditioner being shown broken away for economy of space in illustration;

FIG. 3 is a view in front elevation of the web preconditioner shown in FIG. 2;

FIG. 4 is a view in rear elevation of such web preconditioner;

FIG. 5 is a view in end elevation of the preconditioner shown, the view showing a first, or driving, end of the preconditioner;

FIG. 6 is a fragmentary view in end elevation of the other end of the preconditioner, the view showing somewhat schematically a control panel for the apparatus;

FIG. 7 is a view in vertical transverse section through the preconditioner, the section being taken along the line 7—7 of FIGS. 2, 3, and 4;

FIG. 8 is a somewhat schematic wiring diagram illustrating the manner of control of the speed of the motor driving the drum of the web preconditioner; and

FIG. 9 is a somewhat schematic diagram of the air supply system for the fluid motors powering the dancer roller counterbalancing mechanism.

The embodiment of web-treating apparatus shown is particularly adapted for the preconditioning of a paper or paperboard web which is to be corrugated to form the intermediate layer of a composite paperboard having a corrugated intermediate layer. When treated by the corrugator, not only must the web of paper be in such condition as to be satisfactorily corrugated or fluted, but it must be in condition so that it can be almost immediately thereafter satisfactorily adhesively bonded to the two outer flat covering layers of paper or paperboard. The web preconditioner of the invention is particularly adapted to be employed in the production line as indicated in FIG. 1. In such figure a web of paper **10** is shown as being fed from a supply roll **11** mounted on a supply roll stand generally designated **12**. The web **10** is fed forwardly into a preconditioner, generally designated **14**, in which it is heated and has its moisture content adjusted so as to be in optimum condition for being first corrugated and then adhesively laminated, as above explained. From the preconditioner the now conditioned web is fed into a corrugator 145 where it runs between two mating fluted rolls **16** and **17** so as to be corrugated thereby. From the corrugator the corrugated web passes in a forward direction to a paperboard laminating mechanism, not shown.

It is preferred that the corrugating rolls **16** and **17** be run at constant speed in order that the corrugated web be as uniform as possible and so that the webs to be laminated may be run at constant speed through the laminating station. In the apparatus shown the novel web preconditioner **14** employs the driven web-engaging drum thereof as one element of a pinch roll set, there being another pinch roll element which may be selectively advanced into cooperation with the drum or retracted therefrom. Thus the drum and the movable pinch roll, on the other hand, and the corrugator rolls on the other, form positive web-engaging forwarding means which determine the speed of the web at their respective locations. The corrugating operation is preferably carried out with the web material approaching the corrugating rolls held under substantially uniform tension. To accomplish this, with the novel preconditioner of the invention, there is employed a web storage-providing means between the preconditioner and the corrugator, such storage means maintaining the length of web therein, as well as approaching the corrugator under substantially uniform tension. Such web storage means and tension control governs peripheral speed at which the drum of the preconditioner is driven, whereby to maintain the length of web in the storage means within predetermined desired limits.

Turning now to FIGS. 2–7, inclusive, it will be seen that the preconditioner **14** has two parallel vertically disposed end frames **19** and **20**, such end frames being spaced a distance somewhat exceeding the width of the web material to be treated. The end frame members are secured to a flat horizontal base **21** as shown in FIGS. 3 and 4. A circular cylindrical drum **22**, adapted to be heated by the introduction of steam therewithin, is journalled between end frame members **19** and **20** as shown. The end of drum **22** at the frame member **19** is provided with an axially projecting stub shaft **24** which is journalled in a bearing **25** secured to frame member **19**. At its other end the drum **22** is provided with an axially disposed outwardly projecting hollow shaft **26** which is journalled in a sleeve **27**. The bearing sleeve **27**, in turn, is journalled in a bearing **28** which is directly supported by frame member **20**. A large circular driving gear **29** is

fixed to hollow shaft 26 adjacent the outer end of the latter; gear 29 and thus drum 22 are driven at a selectively variable speed by a motor 39 in a manner to be explained hereinafter.

At its outer end the hollow shaft 26 is provided with a rotatable steam gland or joint 30 into which steam is introduced under pressure through a steam supply pipe 31 from a steam source, not shown. The rotatable joint 30 is held from rotation with the shaft 26 by means of a retaining arm 32, the outer end of which is permitted some degree of movement with respect to the arm-retaining brace 34 affixed to the frame member 20.

Upon entering the preconditioner 14, the web 10 passes over an idle guide roll 35 which is journalled on the outer ends of similar spaced parallel arms 36 and 37 which are mounted for rotational adjustment about the axis of drum 22. As particularly shown in FIG. 2, the arm 36 has its central or root portion journalled in a suitable bearing mounted upon the frame member 19, arm 36 being positioned between frame member 19 and drum 22. Arm 37, which is similarly positioned at the other end of the drum, is fixedly attached to the inner end of the sleeve 27.

Drum 22 is driven by motor 39 in the following manner. A belt such as a "timing" belt 40 is entrained over a driving pulley 41 on the shaft of motor 39 and a driven pulley 42 on the input shaft of a speed reducer 44 of the gear type. A pinion 45 fixed to the output shaft of speed reducer 44 meshes with the large drum-driving gear 29.

The angular position of the arms 36 and 37, and thus the degree of wrap-around of the web 10 on drum 22, is adjusted in the following manner. Affixed to the outer face of frame member 20 is a vertically disposed gearmotor 46 having a horizontal output shaft 47. A chain 50 is entrained about a sprocket 49 affixed to shaft 47 and a second, larger sprocket 51 affixed to a horizontal shaft 52 having its opposite ends journalled in frame members 19 and 20, respectively. Similar pinions 54 are affixed to shaft 52 immediately inwardly of the frame members 19 and 20. Pinions 54 mesh with gear segments 55 which are disposed on the root portions of arms 36 and 37 generally opposite the position of idle guide roll 35. Gearmotor 46 is of the reversing type. It will be apparent that upon running the motor 46 in the appropriate direction the entering guide roll 35 may be adjusted either clockwise or counterclockwise from the position shown, thereby adjusting, as above explained, the length of the web 10 in contact with the drum 22 as the web travels through the preconditioner.

After traveling about the drum 22, which is driven in a counterclockwise direction (FIG. 1), the web 10 passes under an elongated pinch roll 56 which is normally pressure held downwardly against the drum. Pinch roll 56 is mounted upon a shaft 57, the opposite ends of which are journalled in bearings secured to an elongated inclined frame 59. The upper end of frame 59 is pivotally secured to the frame of the conditioner by means of pivot pins, of which one is shown at 60, such pivot pins connecting the frame to the respective end frame members 19 and 20. Ordinarily the weight of the pinch roll 56 and of its frame 59 are sufficient to maintain adequate gripping engagement of the web 10 by the drum 22 and the pinch roll 56. When it is desired to remove the pinch roll from engagement with the drum, as during the stringing-up of the preconditioner, the frame 59 and the roll 56 may be pivoted upwardly counterclockwise about pivot pins 60 by means of air motors 61. Each air motor is mounted adjacent the inner face of the respective frame members 19 and 20 and is pivotally connected at its upper end to such member by a pivot pin 62. The piston rod 64 of each air motor 61 is connected by a suitable pivoted fitting 65 to the lower end of frame 59. When air under pressure is introduced into the lower end of each of motors 61, pinch roll 56 is raised; release of such air allows the pinch roll to be lowered into the operative position shown in the figures. The shaft 57 of pinch roll

56 is provided with a pinion 58 which meshes with drum driving gear 29 to drive the pinch roll in synchronism with the drum. The raising of the pinch roll by air motors 61 is insufficient to disengage gears 58 and 29.

After passing under pinch roll 56, the web 10 travels away from the drum over the pinch roll and thence downwardly in a substantially vertical run to a dancer roll generally designated 66. Such roll 66 is freely rotatably mounted upon a cross shaft 67 which is journalled at its opposite ends to similar slide devices 69. Each such slide device is accurately guided for vertical travel in a guideway 70, one such guideway being affixed to the inner face of frame member 19 and the other guideway 70 being disposed parallel to the first such guideway and affixed to the inner face of frame member 20. To insure that the two slide devices 69 shall remain in horizontal alignment at all times, provision is made for connecting the slide devices for equal vertical travel. Such means, in the embodiment shown, takes the form of a vertically disposed rack gear 71 affixed to one side of each of guideways 70. The shaft 67 carrying the dancer roll is provided at each end with a pinion 72 secured thereto, each pinion having meshing engagement with its respective rack gear 71. It will be seen that as the dancer roll 66 rises, the shaft 67 turns in one direction, and that as the dancer roll falls the shaft turns in the opposite direction. The interaction of the pinions 72 and the respective rack gears 71 insures that the dancer roll 66 remains horizontal at all times despite such vertical travel.

After traveling about the dancer roll the web 10 rises in a second generally vertical run from the bight thereof to pass over the idle exit guide roll 74. Roll 74 is provided at each end thereof with an axially projecting stub shaft 75, the outer end of each such stub shaft being journalled in bearings affixed to the respective end frame members 19 and 20.

The dancer roll 66, the shaft 67, and the slide device 69 together have a very substantial weight. Ordinarily it is preferred not to subject the web 10 to the full weight of such elements and, in any event, it is preferable to be able to adjust the tension to which the web material 10 is subjected in the variable storage loop thereof formed by the dancer roll. Accordingly, the preferred illustrative embodiment of preconditioner is provided with means whereby such tension may be varied. In the embodiment shown there are provided two generally vertically disposed reciprocable air motors 76, one such air motor being disposed immediately inwardly of and secured to each of the end frame members 19 and 20 as shown in FIG. 3. Secured to the upper end of the piston rod 77 of each motor 76 is a U-shaped fitting 79 in which there is journalled an idle pulley 80. A first run 81 of a flexible material such as a wire rope extends from a turn buckle 82 which is pivotally connected to the respective end frame member of the preconditioner at 84. It extends from this down to the pulley 80. A second run 85 of such flexible cord extends from pulley 80 upwardly to a fixed guide pulley 86 which is journalled in a fitting 87 affixed to the end frame member. From guide pulley 86 the cord is brought horizontally to the smaller step 90 of a two-step pulley 89 which is mounted for free rotation upon the respective stub shaft 75 of the guide roll 74. After being wound several times about such smaller step 90, the cord is then secured at an intermediate portion 93 thereof to the pulley 89 and is then led to the peripheral surface of the larger step 91 of the pulley 89. After making an appropriate number of turns about the larger step 91, the cord is brought downardly in a further run 92 to a fitting 94 by means of which it is attached to its respective slide device 69.

It will be seen that the described cord, and the pulleys 80 and 89 constitute a force-multiplying means between the air motors 76 and the dancer roll 66. The illustrated construction allows the air motors to be of moderate height and stroke while still adjustably counterbalancing

the dancer roll **60** throughout the entire vertical travel of the latter. It is to be understood that the dancer roll may be alternatively counterbalanced by longer stroke air motors connected directly to the ends of the dancer roll.

Adjustable stop means are provided at the upper ends of the vertical guideways **70** for the dancer roll. Such stop means take the form of a horizontal plate-like abutment **95** which is aligned with the respective slide **69**. The vertical position of abutment **95** may be adjusted by means of a vertically disposed stud **96** which carries the abutment on its lower end, the stud being threaded into a horizontal member at the upper end of the guideway. A buffer coil compression spring **97** is disposed in alignment with each of the slides **69** at the bottom of the guideway **70**, the spring cushioning the fall of the dancer roll if the web **10** of paper should break.

As above indicated, means is provided for adjusting the speed of the drum driving motor **39** in response to variations in the vertical position of dancer roll **66**, whereby to maintain the length of the loop formed by the dancer roll within predetermined limits. As shown in FIG. 7, there is a horizontal arm **99** which is affixed to and projects laterally from the slide **69** of the dancer roll which is nearer the reader in that figure. The outer end of arm **99** is secured to a link of an endless chain **100** which is entrained about a lower idle sprocket **101** and an upper drive sprocket **102**. When dancer roll **66** rises, it causes sprocket **102** to be driven in a clockwise direction, and when the dancer roll falls, it causes such sprocket to be driven in a counterclockwise direction. Sprocket **102** is affixed to a horizontal shaft **104** journalled in frame member **20**, such shaft having a pinion **105** fixedly secured thereto. Pinion **105** meshes with a larger gear **106** which is affixed to a second shaft **107** journalled in frame member **20**. As shown in FIG. 5, the shaft **107** projects outwardly through the frame member **20**, there being a movable arm **109** of a rheostat affixed to the outer end of shaft **107**. Arm **109** cooperates with the winding **110** of a rheostat, the position of arm **109** relative to the winding **110** being varied as a function of the vertical position of the dancer roll **66**. The manner in which rheostat **109, 110** adjusts the speed of drum driving motor **39** will be more fully explained in connection with the schematic wiring diagram of FIG. 8.

The control panel for the described preconditioner is shown somewhat schematically in FIG. 6. Such control panel carries a suitable switch **114** for the control of the driving motor (not shown) for the corrugator **15**. To the right of switch **114** there is a second switch **115** which provides for the control of the gearmotor **46** which adjusts the entering wrap-around guide roll **35**. Switch **115**, and the conventional unillustrated control circuit in which it is incorporated, allows the gearmotor **46** to be started and stopped and to be run so as to adjust roll **35** either clockwise or counterclockwise about the drum **12**. Such control circuit also includes relays controlled by upper and lower limit switches **111** and **112** (FIG. 7) whereby adjustment of the roll **35** may take place only between predetermined limits.

The control panel includes a control handle **116** for an adjustable fluid pressure-reducing valve which is interposed in the air supply line leading to the upper ends of the two counterbalancing air motors **76**. By suitable adjustment of such valve by handle **116** the piston rod **77** of such motors may be thrust downwardly with a desired force, thereby, in effect, to lighten the effective weight of the dancer roll. The construction of the pressure-reducing valve and of the air supply system is such that the upper end of each of motors **76** remains subjected to the same predetermined fluid pressure, once the valve has been adjusted, throughout the range of vertical travel of the pistons and piston rods of the motors.

In FIG. 9 there is somewhat schematically shown an air supply system for the air motors powering the dancer roll counterbalancing mechanism. The system of FIG. 9 has an air inlet pipe **151**, through which air under pressure flows from a suitable compressed air supply. The supply may include an air filter and a lubricator, neither of which is shown, in the supply line in advance of pipe **151**. Pipe **151** leads to the above-described pressure reducing and regulating valve **116**, air under the desired adjusted pressure leaving valve **116** through pipe **152**.

Pipe **152** leads to a check valve **154**, which allows air to pass therethrough to the left into pipe **150**, but which prevents the reverse flow of air therethrough. Pipe **150** is branched at a location not shown, and leads to the upper end of each of the air motors **76**. Connected in parallel with check valve **154**, by pipes **155** and **157**, is a pressure equalizing valve **156**.

Valve **156** has a transversely split casing **159** which provides a chamber **160** therewithin in the right end of the casing, such chamber communicating with pipe **152** by way of pipe **155**, as shown. The left-hand end of casing **159** provides a chamber **161** in the left-hand end of the casing, chamber **161** communicating with pipe **150** by way of pipe **157**, as shown. Extending transversely of casing **159**, and separating chambers **160** and **161**, is a resilient diaphragm **162** made, for example, of rubber or rubber-like material which occupies the central position shown when the pressures within chambers **160** and **161** are equal. Secured to the diaphragm **162** centrally thereof and guided for axial reciprocation in fixed guide means shown schematically at **166** is a stem-like valve member **164**. The outer, left-hand end of valve member **164**, in the embodiment shown, is of conical shape, and selectively sealingly cooperates with an annular valve seat **165** in the left-hand end of the housing **159**.

The construction of the valve **156** is such that with the diaphragm **162** in the position shown the valve member **164** sealingly cooperates with valve seat **165**. If, however, the pressure in chamber **161** should exceed that in chamber **160**, the central portion of diaphragm **162** and the valve member **164** secured thereto are moved a short distance to the right, thereby allowing air to escape from chamber **161** through the then open valve **164, 165**. When a quality of pressure is again established by the chambers **160** and **161**, the diaphragm **162** resumes the position thereof shown in FIG. 9, again closing valve **164, 165**.

It will be seen that the described system for supplying air under pressure to the upper ends of air motors **76** maintains at all times within close limits the pressure which has been preselected by adjustment of valve **116**. Consequently, the effective weight of the dancer roll **66** may be suitably selected and remains constant during the operation of the preconditioner, regardless of whether the dancer roll is momentarily rising or falling.

The control panel also includes a switch **117** which controls a solenoid operated valve (not shown) for selectively subjecting the lower ends of air motors **61** to a source of pressure sufficient to lift the frame **59** and the pinch roll **56** or to disconnect the motors from such source. As above noted, the pinch roll is lifted from the drum as, for example, during the stringing of a web through the preconditioner.

Finally, the control panel includes a switch **119** for the control of the motor **39** which drives the drum **22**. Switch **119** has four operating buttons, a "forward" button, a "reverse" button, a "jog run" button, and a "stop" button. By appropriate manipulation of switch **119**, the motor **39** may be manually started and stopped, run in either direction, and may be jogged in either direction. The speed of motor **39**, under steady running conditions, is, as above noted, under the control of the dancer roll **66** operating through the rheostat **109, 110**. The manner of such speed control of motor **39** will be more readily apparent upon reference to the schematic wiring diagram of FIG. 8.

In the illustrative embodiment, the motor **39** is a part of a system known as the "Square D2 Class 8832 AS drive, Type MG10. The motor **39**, which is of the shunt field adjustable speed direct current type, is fed by a direct current generator suitably driven at constant speed. The system controls the speed of motor **39** throughout its constant torque speed range by adjusting the armature voltage of motor **39** while keeping the shunt field at full strength. The adjustable armature voltage for the motor **39** is obtained by controlling the field excitation of the direct current generator.

In the circuit shown in FIG. 8 there is provided an alternating current supply which may be in the form of a transformer **124**. Across the generator armature **127** there is connected a voltage divider having serially connected resistance **129** and **130** with a junction **131** between them. The armature **39'** of motor **39** is connected in parallel with the generator armature **127** through selectively operated contacts **132** and **134**. The junction **136** is connected to the negative side of the reference voltage generated by a grid module **137** through the rheostat **109, 110** and wire **138**. Adjustment of the rheostat **109, 110** changes such reference voltage. The voltage across resistance **130** is the feedback voltage, the feedback-reference comparison being made at the junction **131**.

The remainder of the circuit is connected as follows: One terminal of transformer **124** is connected through a half-wave diode **125** and wires **142** and **141** to the rheostat **109, 110**. The other end of transformer **124** is connected to wire **140** between junction **131** and the rhesotat. The shunt field **39''** of motor **39** is connected across wire **144** and the junction of wires **141** and **142**. A motor field discharge circuit **135**, connected in shunt with the field **39''**, has a half-wave diode rectifier **136** interposed therein.

Element **126** is a thyratron power tube having a half-wave grid by which it is controlled. Such grid is connectde, as shown, to the grid module **137**. A set of selectively closed contacts **139** is interposed in the circuit between one plate of tube **126** and one terminal of transformer **124**. The other terminal of the transformer is connected through a wire **145** to one side of a circuit having the generator shunt field **146** and a half-wave diode rectifier **147** connected in parallel. The other end of such parallel circuit is connected by a wire **149** to the other plate of power tube **126** and through a wire **150** to one side of the parallel circuit, including the motor armature and generator armature.

In the described circuit, because of the generator armature voltage feedback, a change in generator output voltage or a change in the speed adjustment of rheostat **109, 110** will directly affect, by subtraction of voltages, the direction current bias voltage on tube **126** controlling the generator field. In this manner the generator magnetic field may be changed to give the desired value of generator armature voltage and the speed of direct current motor **139**.

It is believed that, with the above description, the manner of operation of the web preconditioner of the invention will be obvious. Associated with the preconditioner, although not shown in FIGS. 1–4, inclusive, are upper and lower steam pipes or manifolds **124** and **125**, respectively, between which the web runs as it approaches the preconditioner. Manifolds **124** and **125** are provided with a plurality of laterally spaced nozzles **126** and **127**, respectively, which direct steam onto the broad faces of the web as the web travels between such nozzles. The web **10** then enters the preconditioner over the guide roll **35** which will have been angularly adjusted about the axis of the drum in order to give the web the requisite length of travel about the drum **22** to bring its moisture content to that which is desired for its subsequent treatment by the corrugator **15**.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be especially understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art.

What is claimed is:

1. Apparatus for treating an elongated web of material, which comprises a first means for positively gripping and feeding the web forward in the direction of its length, a second means spaced forwardly of the first means for positively gripping and feeding the web in the same direction, means including a tension sensitive dancer roll for forming a salient loop in the web between the first and second feeding means, wherein the opposite runs of the loop extend vertically with the bight of the loop at the bottom thereof, and comprising means for guiding the dancer roll for vertical travel through a substantial distance in the bight of the loop, whereby the runs of the loop are subjected to tension caused by the effective weight of the dancer roll throughout a substantial range of vertical travel of the dancer roll, means for driving the first and second feeding means to forward the web, and means controlled by the position of the dancer roll to vary the relative web forwarding speeds of the first and second feeding means to maintain the length of the loop formed by the dancer roll within predetermined limits, and comprising a linking means movable vertically with the dancer roll, a fixed controller, and means drivingly connecting the linking means and the controlling means whereby the controlling means is driven in synchronism with movement of the dancer roll, wherein the linking means is an arm extending generally laterally from the dancer roll, the controlling means has a rotatable element, and comprising a chain drivingly connecting the arm and the rotatable element of the controlling means, and comprising a first, idle sprocket rotatable about a fixed axis, a second sprocket parallel with the first sprocket and spaced therefrom along the length of the guide for the dancer roll, wherein the chain is endless and is entrained about the sprockets, and comprising means drivingly connecting the second sprocket to the rotatable element of the controlling means, and means connecting the arm of the linking means to a run of the chain extending between the sprockets.

2. Apparatus for treating an elongated web of material, which comprises a first means for positively gripping and feeding the web forward in the direction of its length, a second means spaced forwardly of the first means for positively gripping and feeding the web in the same direction, means including a tension sensitive dancer roll for forming a salient loop in the web between the first and second feeding means wherein the opposite runs of the loop extend vertically with the bight of the loop at the bottom thereof, and comprising means for guiding the dancer roll for vertical travel through a substantial distance in the bight of the loop, whereby the runs of the loop are subjected to tension caused by the effective weight of the dancer roll throughout a substantial range of vertical travel of the dancer roll, means for driving the first and second feeding means to forward the web, and means controlled by the position of the dancer roll to vary the relative web forwarding speeds of the first and second feeding means to maintain the length of the loop formed by the dancer roll within predetermined limits, comprising means for changing the effective weight of the dancer roll operative upon the loop of the web, said last named means including adjustable means for counterbalancing the dancer roll in selected amounts, and wherein the counterbalancing means comprises a fluid motor, adjustable means to subject the motor to fluid under selected variable pressure, and means to connect the motor to the dancer roll so as adjustable to counterbalance the dancer

roll, and wherein the fluid motor is reciprocable, and wherein the means to connect the motor to the dancer roll comprises a flexible elongated member connected to and extending generally vertically from the dancer roll and connected to a reciprocable part of the fluid motor so as to exert a variable lifting action upon the dancer roll, and comprising a motion-multiplying and force transmitting mechanism interposed between the fluid motor and the flexible elongated member extending to the dancer roll, wherein the motion-multiplying and force transmitting mechanism comprises a multi-step pulley, the flexible elongated member extending to the dancer roll being entrained over and connected to the periphery of a larger step of the pulley, and comprising a second elongated flexible member having one end entrained over and connected to the periphery of a smaller step of the pulley, and having its other end connected to said reciprocable part of the motor.

3. Apparatus for preconditioning and corrugating an elongated web of paper material, which comprises a web preconditioner having means including a web-heating drum for positively gripping and feeding the web forward in the direction of its length, a corrugator spaced forwardly of the first means having means for positively gripping and feeding the web in the same direction, means including a tension sensitive gravity actuated dancer roll positioned adjacent the exit end of the drum for forming a salient loop held under substantially a uniform predetermined tension in the web between the drum and the corrugator, means for driving the preconditioner and the corrugator to forward and treat the web, and means controlled by the position of the dancer roll to vary the web forwarding speed of the drum of the corrugator to maintain the length of the loop formed by the dancer roll within predetermined limits, and comprising a separate variable speed motor for driving the corrugator drum, and comprising means controlled by the position of the dancer roll for varying the speed of such separate motor.

4. A web conditioner comprising a frame, a rotatable drum journalled in the frame, the web travelling in contact with the outer surface of the drum, means to heat the drum to web-treating temperature, means to drive the drum, a pinch roll rotatable on an axis parallel to the axis of the drum, and means to mount the pinch roll for selective movement into forcible engagement with a web lying on the drum and away from the drum to allow the stringing up of the web in the preconditioner wherein the mounting means for the pinch roll comprises a sub-frame in which the pinch roll is journalled, and means pivotally connecting the sub-frame to the frame, and comprising power means for moving the pinch roll and the sub-frame in at least one of the two directions toward and away from the drum, and wherein the web travels downwardly over the drum from the entrance end of conditioner and thence upwardly over the drum to a zone confronting the exit end of the conditioner, the web leaving the drum at such zone, and wherein the pinch roll is positioned at such zone of the drum and so that the web in leaving the drum passes partially around and over the pinch roll, and wherein the sub-frame is disposed at an angle to the horizontal, the pivotal connecting means connects the upper end of the sub-frame to the frame, and the power drums selectively lift the sub-frame and the pinch roll away from the drum.

5. A web conditioner comprising a frame, a rotatable drum journalled in the frame, the web travelling in contact with the outer surface of the drum, means to heat the drum to web-treating temperature, means to drive the drum, a pinch roll rotatable on an axis parallel to the axis of the drum, and means to mount the pinch roll for selective movement into forcible engagement with a web lying on the drum and away from the drum to allow the stringing up of the web in the preconditioner wherein the mounting means for the pinch roll comprises a sub-frame in which the pinch roll is journalled, and means pivotally connecting the sub-frame to the frame, and comprising power means for moving the pinch roll and the sub-frame in at least one of the two directions toward and away from the drum, and comprising means for driving the pinch roll at the same peripheral speed as the drum.

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