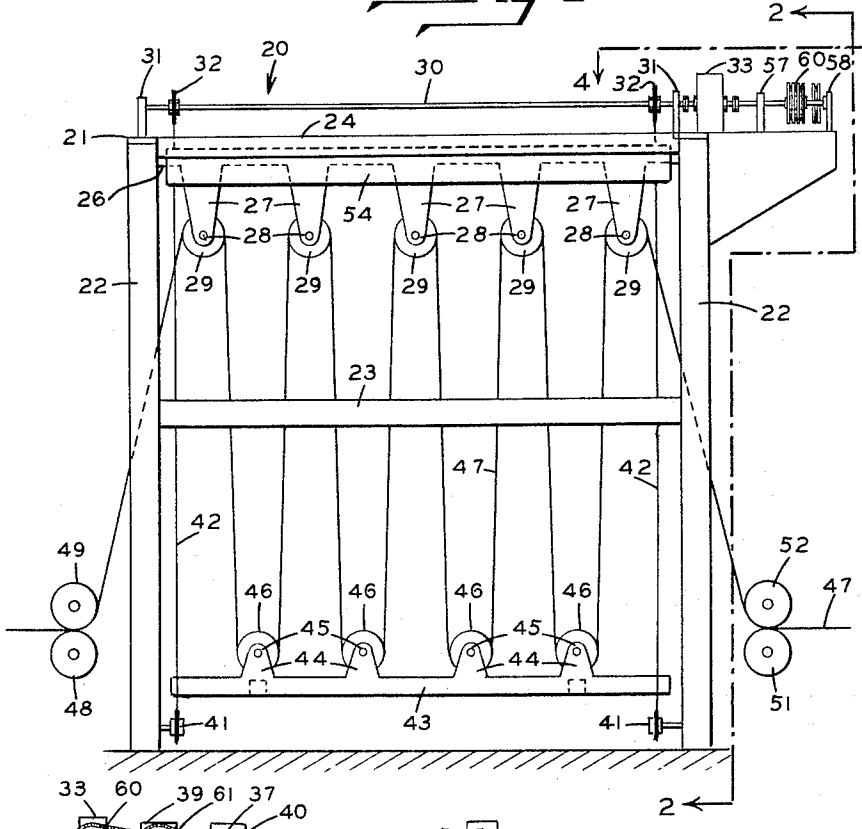
Oct. 11, 1966 C. L. HORNBERGER 3,278,100

WEB ACCUMULATOR INCLUDING MEANS FOR MODIFYING TENSION IN WEB PASSING THERETHROUGH

Filed March 20, 1964 5 Sheets-Sheet 1

Fig. 1



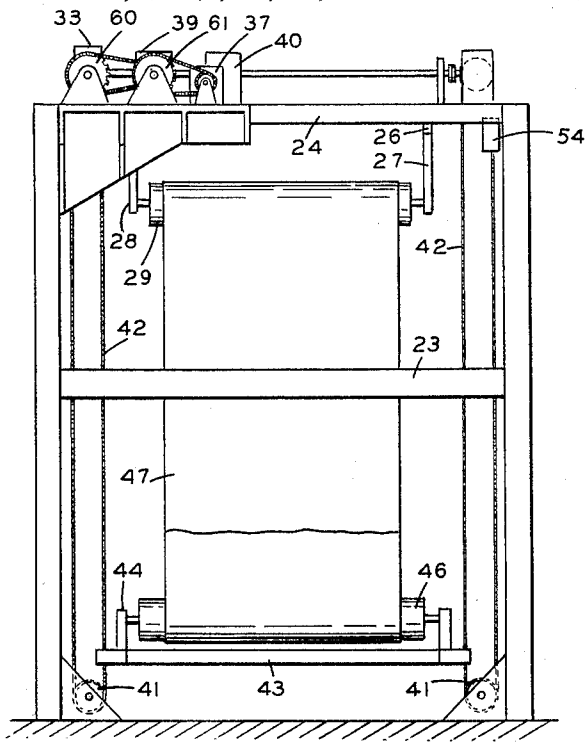


Fig. 2

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WEB ACCUMULATOR INCLUDING MEANS FOR MODIFYING TENSION IN WEB PASSING THERETHROUGH

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Fig. 3

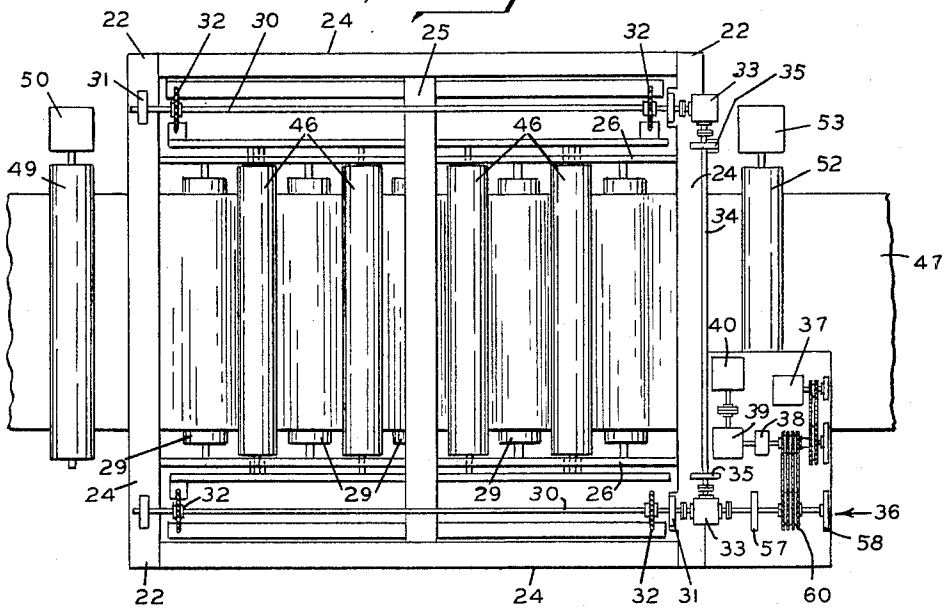
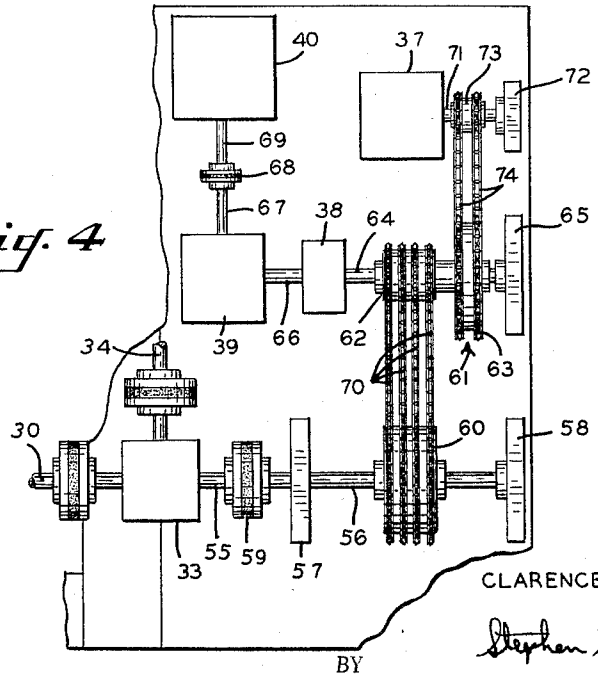


Fig. 4



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WEB ACCUMULATOR INCLUDING MEANS FOR MODIFYING TENSION IN WEB PASSING THERETHROUGH

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Fig. 5

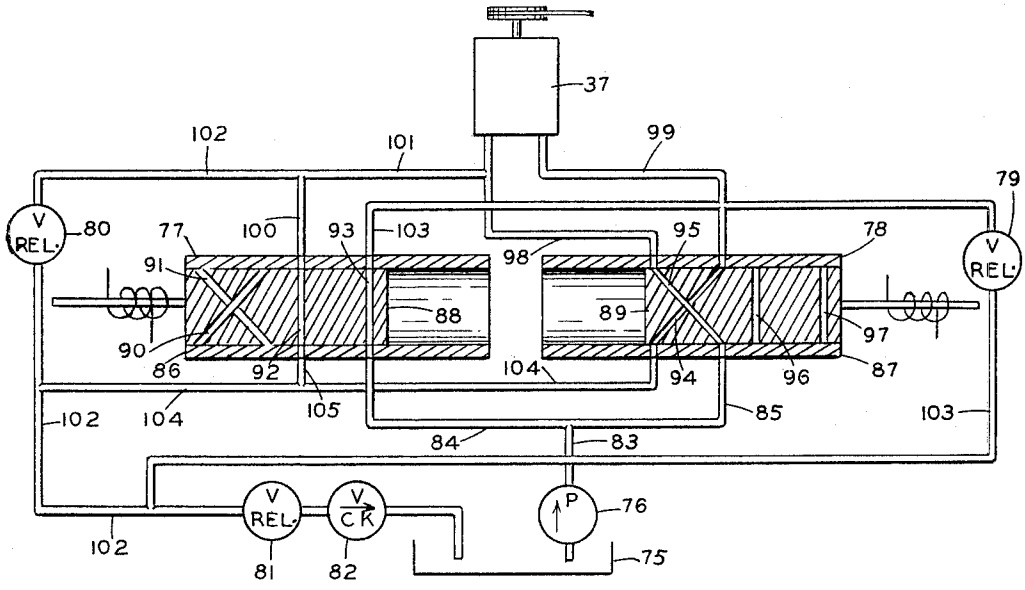
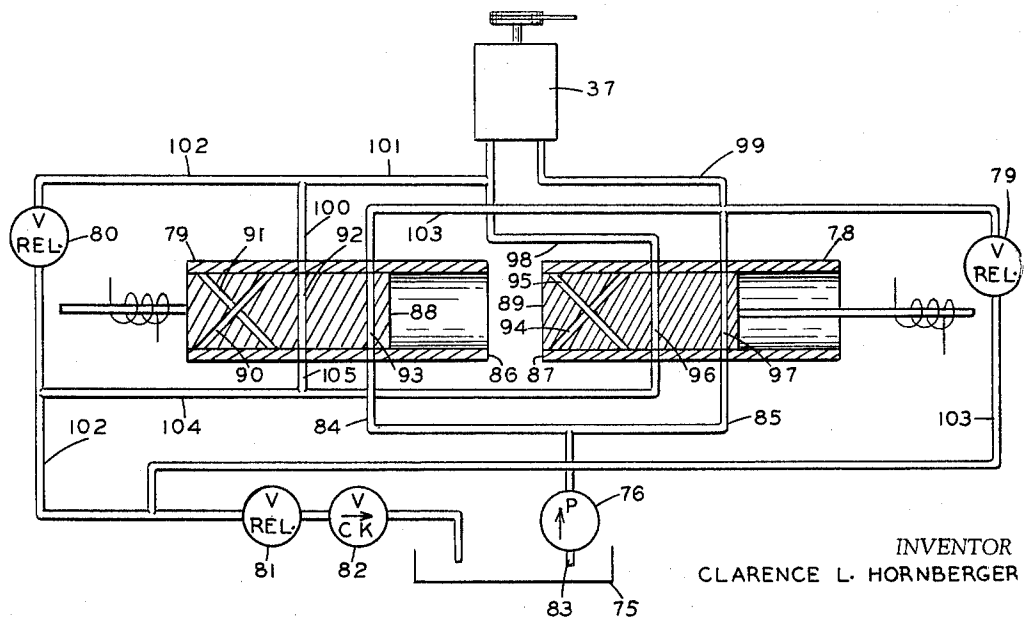


Fig. 6



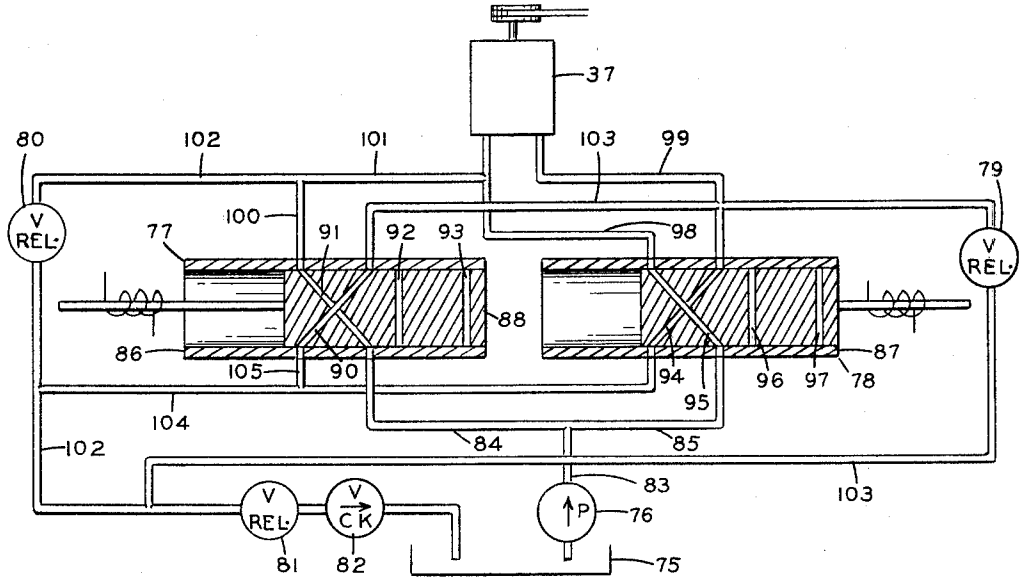
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WEB ACCUMULATOR INCLUDING MEANS FOR MODIFYING TENSION
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Fig. 7

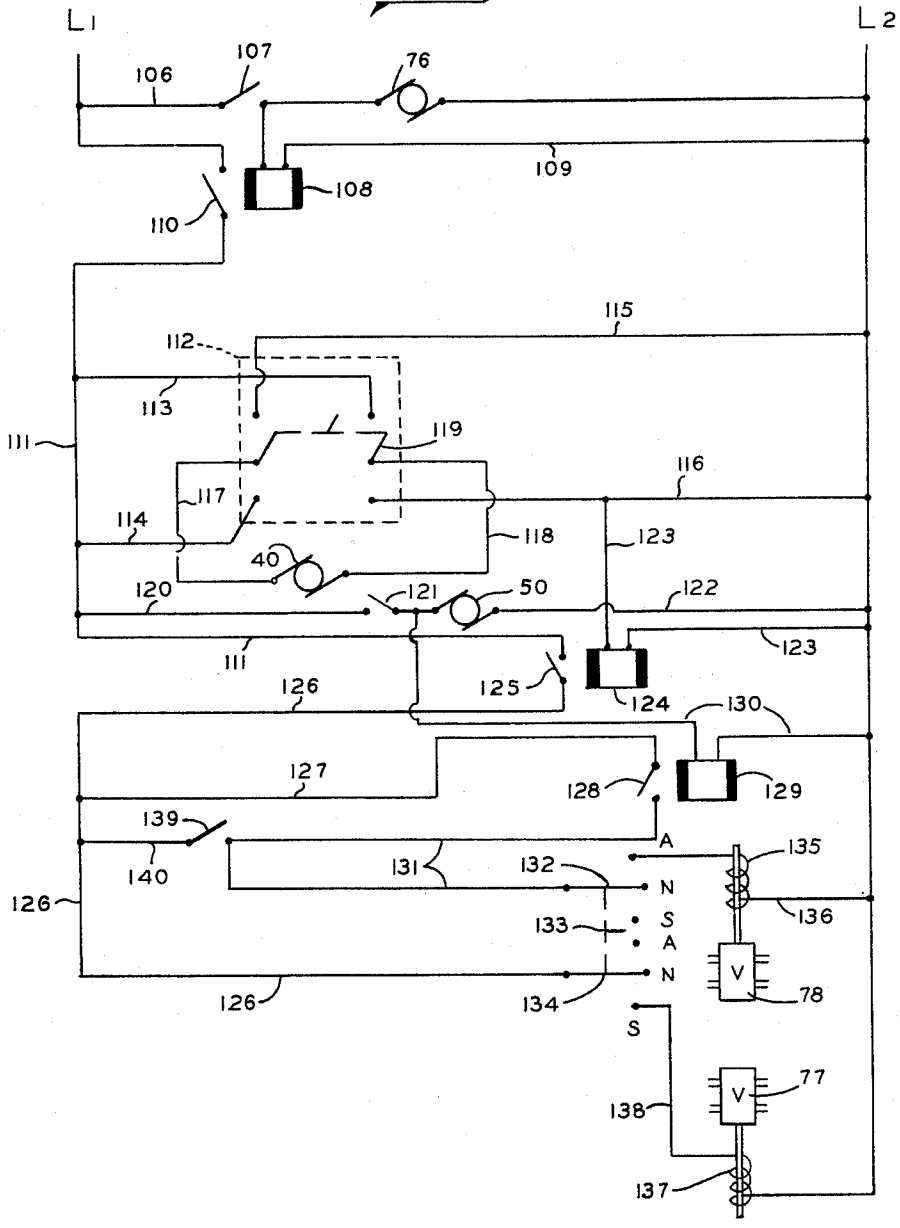


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Fig. 8



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United States Patent Office 3,278,100 Patented Oct. 11, 1966

3,278,100

WEB ACCUMULATOR INCLUDING MEANS FOR MODIFYING TENSION IN WEB PASSING THERETHROUGH

Clarence L. Hornberger, Lancaster, Pa., assignor to Armstrong Cork Company, Lancaster, Pa., a corporation of Pennsylvania

Filed Mar. 20, 1964, Ser. No. 353,325
7 Claims. (Cl. 226—189)

This invention relates to a web accumulator or looper and more specifically to a drive mechanism therefor. Web accumulators or loopers are used in the processing of sheet material of substantial length to store or accumulate said material between continuous and intermittent operations. The stored or accumulated material provides a source of continuous supply for each operation. Therefore, the material can be smoothly processed through each operation without substantial adverse effect by an prior or subsequent operation regardless of type, be it continuous or intermittent. For example, the sheet material at the inlet end of an accumulator which has a full supply of such material may be stopped while accumulated sheet material may be continuously withdrawn from the outlet end of the accumulator until the supply of material within the accumulator has been exhausted. Similarly, if an accumulator has a small quantity of stored material, movement of the material at the outlet end of the accumulator may be stopped while material is continuously fed into the accumulator until its storage capacity is entirely utilized.

Various types of accumulators are known. Basically, each accumulator consists of at least two substantially parallel frames wherein each frame contains a plurality of spaced, freely rotatable, substantially parallel rollers mounted in a plane parallel to the plane of the frame. The frames are usually positioned so that each roller of one frame is parallel to each roller of the other frame. The material passes alternately over the rollers of each frame, thereby forming loops therebetween.

The frames are mounted in a support assembly to allow relative movement of one or both with respect to the other. This is usually accomplished by a cable and pulley or chain and sprocket arrangement attached to one frame while the other frame remains fixed in the support assembly. One end of each chain or cable is attached to the movable frame while the other end, after passing over a sprocket or pulley, is attached to a counterweight having a weight which is usually less than that of the movable frame. The partially counter-balanced movable frame usually has sufficient weight to bias movement thereof away from the fixed or stationary frame in an effort to keep the material in a taut condition throughout the accumulator at all times. The bias of the frame should not be so great, however, as to cause a rupture in the sheet material. The movable frame is meant to be supported in a floating manner by the sheet material and to be free to move relative to the other frame in response to changes in the amount of sheet material in the accumulator. Where the material infeed exceeds the outfeed to the accumulator, the biasing weight of the movable frame will cause an increasing amount of material to be pulled into the accumulator, with a resultant lengthening of the material loops and movement of the movable frame away from the fixed frame. Should the material outfeed exceed the material infeed, the force of the material on the movable frame will exceed the bias thereof, and the movable frame will be pulled in a direction toward the fixed frame as the length of the loops and, therefore, the amount of material in the accumulator decreases. In some accumulators all frames are

movable with respect to each other as shown in U.S. Patent 2,242,751, for example.

In U.S. Patent 2,631,847 there is disclosed an accumulator drive, mechanism having a one-way, over-riding clutch connecting the prime mover, a motor driven speed reducer, to the sprocket shaft of a movable roller frame of carriage.

The primary drive motor in this patent is connected to the high speed shaft of a speed reducer. The speed reducer has a low speed shaft which is connected to one side of the one-way, over-riding clutch. The speed reducer is chosen so that rotation of the high speed shaft will cause the low speed shaft to rotate but also so that the internal friction of the elements of the speed reducer will be sufficient to substantially prevent the low speed shaft from driving the high speed shaft to an appreciable degree. The opposite side of the one-way clutch, being connected to the sprocket shaft of the movable frame, will, therefore, allow movement of this frame only to the extent allowed by the one-way clutch, the speed reducer, and the motor.

In the normal operation of the device of U.S. Patent 2,631,847 described above, the primary motor normally is rotated in a direction which will allow the movable frame to move away from the fixed frame at a safe rate of speed. As long as the movable frame sprocket shaft does not try to override the speed reducer output shaft, the over-riding feature of the clutch will allow said movable frame to "float" or to move in response to differences in material infeed and outfeed.

As will be apparent, the one-way clutch and speed reducer provide a safety feature. Should the sheet of material break in the accumulator, the bias of the movable frame suddenly causes it to try to move away from the fixed frame, which in turn causes the sprocket shaft to try to override the speed reducer output shaft. Such action will cause the one-way clutch to lock. Since the speed reducer cannot be driven substantially by its output shaft, the movable frame will move away from the fixed frame only as fast as the primary motor will allow the output shaft of the speed reducer to rotate. The entire structure is thereby protected from damage due to a "run away" movable frame caused by a material break. However, the one-way, over-riding clutch feature of this drive mechanism will still allow the desired "floating" action of the movable frame to keep the material in a taut condition in the accumulator. In addition, the primary motor may be reversed wherein the clutch will lock and the movable bed may be positively moved toward the fixed bed for threading and other purposes.

It will be noted that the above-noted U.S. Patent 2,631,847 discloses that the counterweights may be varied depending upon the type of material being processed. It has been found, however, that manually changing the amount of counterweight is a difficult and time consuming operation due to the size and weight of the elements involved. For example, when heavy gauge, fibrous materials were processed, heavy weights had to be added to the movable frame while the amount of counterweight had to be decreased. This added weight was required to provide enough force to cause the material to bend around the rollers to thereby keep the material in a taut condition in the accumulator. This taut condition is necessary to prevent fouling of the material. If too much weight is added, however, the support structure, chains, bearings, sprockets, clutch, speed reducer, and motor become overloaded. Thus, there are practical limits to the amount of weight which may be added. Conversely, in cases where light gauge materials were used, more counterweight was required to prevent the weight of the movable frame from tearing the sheet material.

An object of the present invention is to provide a drive mechanism for an accumulator which may vary the effective force exerted by the movable frame on the sheet material to keep the sheet material in the accumulator in a taut condition.

A further object of the present invention is to provide a drive mechanism for an accumulator which will substantially eliminate the necessity of manually adjusting weights on a movable roller frame, the possibility of damaging the accumulator due to such weight adustment, and other disadvantages of the prior art devices.

Further objects of the present invention will be readily apparent from the detailed discussion of the device noted below with reference to the drawings wherein:

FIG. 1 shows a side view in elevation of a web accumulator and drive therefor according to the invention;

FIG. 2 shows an end view in elevation of the web accumulator shown in FIG. 1 taken on line 2—2 thereof;

FIG. 3 shows a plan view of the accumulator shown in FIG. 1;

FIG. 4 shows an enlarged plan view of the drive mechanism of the web accumulator of FIG. 1 taken on line 4—4 thereof;

FIGS. 5 to 7 show hydraulic circuit diagrams which may be used to control the hydraulic booster motor associated with the drive mechanism of the accumulator of FIG. 1; and

FIG. 8 shows an electrical circuit diagram which may be used to control the drive mechanism of the accumulator of FIG. 1.

Referring now to FIG. 1, there is shown a web accumulator **20** having an upright grid-like support structure **21**. The support structure **21** includes four corner posts **22**, four intermediate horizontal beams **23** interconnecting the corner posts **22**, four upper horizontal beams **24** interconnecting the upper portions of the corner posts **22**, and a lateral beam **25**. A pair of spaced, substantially parallel roller support plates **26** are permanently fixed to and suspended from the upper portion of the grid structure **21**. Each plate **26** has a plurality of depending legs **27**. The lower portion of each leg **27** houses a bearing **28**, the axis of which is substantially normal to the plate **26** and which is aligned with a corresponding bearing **28** on the opposite plate **26**. A plurality of rollers **29** are arranged in spaced, substantially parallel relationship with their axes being substantially normal to plates **26** and mounted in the bearings **28** in each depending leg **27**.

A pair of spaced, parallel shafts **30** are mounted in bearings **31** on either side of the upper surface of the grid **21** along beams **24** and parallel to plates **26**. A pair of spaced, chain sprockets **32** are secured to each shaft **30** near the respective ends thereof. A miter gear unit **33** is connected to the corresponding end of each shaft **30**. A lateral shaft **34** mounted in bearings **35** interconnects the miter gear units **33**. One of the miter gear units **33** has an outwardly extending drive shaft which is connected through a suitable bearing, sprocket, and chain drive arrangement, generally shown at **36**, to a conventional hydraulic motor **37**, one-way clutch **38**, speed reducer **39**, and primary motor **40**. This drive arrangement will be explained in detail below with specific reference to FIG. 4.

As best seen in FIGS. 1 and 2, a sprocket **41** is attached to a lower portion of each of the corner posts **22** directly below and in the plane of a corresponding sprocket **32**. A continuous chain **42** extends around each pair of corresponding, vertically aligned, co-planar sprockets. When so located, each chain **42** has two legs wherein one leg of each chain faces the interior of the grid structure **21** and the other leg faces the exterior thereof.

A substantially horizontal frame **43** is located inside the grid structure and has each of its four corners attached to the inner leg of the nearest chain. The frame **43** has a plurality of spaced, horizontally and vertically

aligned, upwardly extending projections **44** on either side thereof. The projections **44** on each side of the frame lie in vertical planes which are parallel to each other and to the planes of the plates **26**. However, the vertical planes of the projections **44** on either side of the frame **43** are located exteriorly of the planes of the plates **26**. Thus, the distance between opposed projections **44** on frame **43** is greater than the distance between opposed legs **27** of plates **26**. Each projection **44** is provided with a bearing **45**. A plurality of spaced, parallel, horizontal rollers **46** are mounted in bearings **45** in projections **44**. The rollers **46** are parallel to but horizontally offset from rollers **29**. The space between each of the rollers **46** on frame **43** and rollers **29** on plates **26** is sufficient to allow the rollers **46** to pass upwardly through the spaces between rollers **29** to a point where the lowest portion of each roller **46** lies above the uppermost portion of each roller **29** when the frame **43** is in its uppermost position. In this position the sheet material **47** may be easily threaded through the accumulator **20** by passing said material over rollers **29** and under rollers **46**. Loops of material will be formed when frame **43** moves to a lower position where the rollers **46** have moved downwardly through the spaces between rollers **29**.

The material **47** may be fed to the accumulator **20** by infeeder pinch rolls **48** and **49** which are rotated by variable speed motor **50**. Similarly, the material **47** may be withdrawn from the accumulator **20** by pinch rolls **51** and **52** which are rotated by variable speed motor **53**.

An elongated substantially horizontal counterweight **54** is associated with each sprocket shaft and extends parallel thereto within the grid structure **21**. Each counterweight **54** is attached near its respective ends to the outer leg of each of the chains **42** of the associated sprocket shaft **30**. The counterweights **54** are positioned on the chains **42** so that they are at their uppermost positions when the movable roller frame **43** is in its lowermost position as shown in FIGS. 1 to 3, for example. It will be apparent that the frame **43** and associated counterweights **54** will move in opposite directions in adjacent vertical planes as the chains **42** move around their sprockets **32** and **41**.

Referring now to FIG. 4, there is shown the details of the drive arrangement. Shafts **30** and **34** are connected to miter gear units **33** by means of suitable shaft couplings. One of the miter gear units **33** has drive shaft **55** extending outwardly therefrom. A shaft **56**, supported by bearings **57** and **58**, is co-axially connected to shaft **55** by coupling **59**. Sprocket **60** is mounted on shaft **56** between bearings **57** and **58**. A sprocket assembly **61** having a small sprocket **62** co-planar with sprocket **60** and connected to a large sprocket **63** is mounted on shaft **64**. Shaft **64** is parallel to shaft **56** and has its outer end mounted in bearing **65** with its inner end connected to one half of the one-way clutch **38**. The other half of one-way clutch **38** is connected to the output shaft **66** of speed reducer **39**, the input shaft **67** of which is connected through coupling **68** to shaft **69** of primary motor **40**. Chains **70** interconnect sprocket **60** and small sprocket **62**. Hydraulic motor **37** has an outwardly extending shaft **71** which is parallel to shaft **64**. The outer end of shaft **71** is mounted in bearing **72**. A sprocket **73** is mounted on shaft **71** co-planar with sprocket **63**. Chains **74** interconnect sprockets **63** and **73**.

Referring now to FIG. 5, there is shown a basic hydraulic control circuit for the hydraulic motor **37**. This circuit includes a sump **75**, a conventional hydraulic pump **76**, two conventional solenoid operated valves **77** and **78** in their de-energized positions, three adjustable, pressure relief valves **79**, **80**, and **81**, a check valve **82** (which may be omitted if desired), and suitable connecting conduits to be described in detail below.

A conduit **83** leads out of a hydraulic fluid sump or reservoir **75**. Pump **76** is mounted in conduit **83**. Conduit **83** connects with conduits **84** and **85**, each of which terminates in a port in valve bodies **86** and **87** of valves

77 and 78, respectively. Valves 77 and 78 have movable valve cores 88 and 89, respectively. Valve core 88 is provided with conduits 90, 91, 92, and 93. Valve core 89 is provided with conduits 94, 95, 96, and 97. Conduits 98 and 99 extend through valve body 87 to hydraulic motor 37. Conduit 100 extends through valve body 86 to conduits 101 and 102. Conduit 101 connects with conduit 98. Conduit 102 contains pressure relief valves 80 and 81, check valve 82, and leads to sump 75. Conduit 103 extends through valve body 86, communicates with conduit 99, contains pressure relief valve 79, and communicates with conduit 102 at a point between pressure relief valves 80 and 81. Conduit 104 extends through valve body 87 to conduit 102 at a point between valve 80 and the juncture of conduits 102 and 103. Conduit 105 extends through valve body 86 to conduit 104. Valves 79, 80, and 81 are adjustable and may be set at any desired working pressures as long as the pressure required to open valve 81 is less than that of either of the valves 79 and 80.

As mentioned above, solenoid controlled valves 77 and 78 are shown in FIG. 5 in their de-energized positions. In this case it will be apparent that the pressure fluid supplied by pump 76 will be applied equally to both sides of the hydraulic motor 37 through conduits 83, 84, 93, 103, 99 and 83, 85, 95, 98. It will be noted that the pressure fluid supplied by pump 76 may short circuit the motor 37 by flowing through conduits 98, 101, 100, 92, 105, 104, 102 and 103, 99, 94, 104, 102, to sump 75. Thus, the pressure in the system will be approximately that corresponding to the setting of valve 81. The circuit shown in FIG. 5, therefore, represents a neutral condition wherein the hydraulic motor 37 will not apply any force to the sprocket 63 or to the movable frame 43. The motor 37 in this case is free to move in either direction in response to movement of sprocket 63 and chains 74.

In FIG. 6, there is shown the same hydraulic circuit shown in FIG. 5 except that the solenoid controlling valve 78 has been energized to change the connections between certain conduits. It will be noted that with the valves 77 and 78 positioned as shown in FIG. 6, the pressure fluid supplied by the pump 76 is applied only to one side of the motor 37 through conduits 83, 84, 93, 103, 99 and 83, 85, 97, 99. The pressure of the fluid supply to motor 37 in conduit 99 is greater than that of fluid return from motor 37 in conduits 98 and 101, since the pressure exerted by the pump 76 on the hydraulic fluid and the pressure settings of the relief valves 79 and 80 are greater than that pressure setting of relief valve 81. A force will, therefore, be applied by fluid motor 37 through shaft 71, sprocket 73, and chains 74 to sprockets 63 and 62, chains 70, sprocket 60, shafts 55 and 56, miter gear units 33, shafts 30, sprockets 32, and chains 42, which force will act against and thereby decrease the balancing effect of the counterweights 54. Thus, the effective weight and therefore the effective force of movable frame 43 on the material 47 is increased. The arrangement shown in FIG. 6 amounts to an "add" condition wherein the force normally exerted on the material by the frame 43 is effectively supplemented or increased. This condition is necessary where materials of relatively thick gauge or those having high resistance to bending are run through the accumulator to keep said materials in a taut condition therein. It is to be noted that the change in the amount of force applied is variable in relation to the variation in pressure settings of the adjustable valves 79, 80, and 81. It has been found that better accumulator operation is obtained if the fluid pressure applied to motor 37 is insufficient for motor 37 by itself to cause movement of the movable frame 43. It is conceivable, however, that under certain circumstances a fluid pressure which will cause such movement might be desirable.

FIG. 7 shows a circuit wherein the solenoid controlling valve 77 is energized and the solenoid controlling valve 78 is de-energized. In this case, it is apparent that

the pressure fluid supplied by pump 76 is applied only to the side of the hydraulic motor 37 opposite to that shown in FIG. 6. In FIG. 7, the pump 76 is connected to motor 37 through conduits 83, 84, 91, 100, 101, 98 and 83, 85, 95, 98. A pressure differential is therefore created between the fluid supply in conduit 98 to motor 37 and the return from said motor 37 in conduit 99, since the pressure exerted by pump 76 on the hydraulic fluid and the pressure settings of relief valves 79 and 80 are greater than that pressure setting of relief valve 81. Since the high pressure fluid is applied in the circuit of FIG. 7 to the side of the motor opposite to that shown in FIG. 6, the force on the sprockets, chains, shafts, etc. resulting from the circuit of FIG. 7 will act in the opposite direction to that force mentioned with regard to FIG. 6. This force acting as a result of the circuit of FIG. 7 will then tend to increase the balancing effect of the counterweights 54, thereby decreasing the effect of the weight and therefore the force exerted by the movable frame on the material 47. This arrangement is called a "subtract" condition in which the force normally exerted on the material 47 is counteracted or decreased. Such a condition is necessary in the case of highly flexible or thin gauge materials to prevent tearing thereof in the accumulator. As mentioned above, this force is variable, and best results are obtained if the force exerted by motor 37 is insufficient to cause movement of the movable frame 43.

Referring now to FIG. 8, there is shown an electrical control circuit for hydraulic supply pump 76, primary drive motor 40, and hydraulic control valves 77 and 78. Electrical conductors L_1 and L_2 are connected to a suitable source of power, not shown. Conductor 106 connects conductor L_1 to main control switch 107. When closed, switch 107 completes a circuit through a conductor connecting the motor of the hydraulic supply pump 76 to conductor L_2. Closure of switch 107 also energizes relay 108 in conductor 109. Relay 108 closes normally-open switch 110 to provide power to the rest of the circuit including the primary motor 40. Thus, motor 40 may not be operated until power is supplied to the motor of pump 76.

Conductor 111 is connected to switch 110. A conventional double pole, double-throw switch 112 has the correspondingly opposite terminal of each of the outer pairs of terminals connected by conductors 113 and 114 to conductor 111. The other terminal of each of the outer pairs is connected to conductor L_2 by conductors 115 and 116. The intermediate pair of terminals of switch 112 are connected to motor 40 by conductors 117 and 118 in such a manner that when switch blade 119, which is permanently connected to conductors 117 and 118, contacts conductors 114 and 116, the motor 40 rotates in a direction which will allow the movable frame 43 to move away from or toward the fixed rollers 29 in a floating manner in accordance with the operation of the speed reducer and clutch which has been previously explained. When switch blade 119 contacts conductors 113 and 115, motor 40 will be driven in the opposite direction in which the clutch 38 will lock and the movable frame 43 will be positively raised.

Conductor 120 connects switch 121 to conductor 111. Conductor 122 connects switch 121 and infeed pinch roll motor 50 to conductor L_2. Conductors 123 connect relay 124 to conductors 116 and L_2. Relay 124 controls normally-open switch 125. When closed, switch 125 connects conductors 111 and 126. Conductor 127 connects conductor 126 and normally-open switch 128. Switch 128 is controlled by relay 129 which is connected to conductors 122 and L_2 by conductors 130. Conductor 131 leads from switch 128 to blade 132 of manually controlled, three-way selector switch 133. Conductor 126 extends from switch 125 to blade 134 of selector switch 133. Both blades 132 and 134 of switch 133 will be simultaneously moved to one of three different contact

positions marked A, N, and S. Solenoid 135 which controls movement of valve 78 is connected by conductor 136 to the A contact position of blade 132 and to L_2. Solenoid 137 which controls movement of valve 77 is connected by conductor 138 to the S contact position of blade 134 and to L_2. The "add" position of valves 77 and 78 shown in FIG. 6 may occur when the switch 133 and blades 132 and 134 are located in the A contact position. When the blades 132 and 134 are in the N contact position, a neutral position of the valves 77 and 78 shown in FIG. 5 occurs. When blades 132 and 134 are in contact position S, a "subtract" position of the valves 77 and 78 as shown in FIG. 7 may occur. Switch 139 is connected to conductor 126 by conductor 140 and when closed will connect conductors 126 and 131.

As stated above, power cannot be applied to the primary motor 40 or to the solenoid controlled valves 77 and 78 unless it is first applied to the motor of the hydraulic pump 76. The relationship of the switch 112 and the positions of blade 119 with regard to the direction of rotation of motor 40 as well as the effect thereof on frame movement have been previously explained. It will be apparent that neither of the hydraulic valves 77 or 78 may be energized unless blade 119 is in contact with conductors 114 and 116, primary motor 40 is running to allow the movable frame to "float" or to move downwardly at a controlled rate, and relay 124 is energized. Thus, no additive or subtractive force may be applied to the movable frame 43 when switch blade 119 contacts conductors 113 and 115, and frame 43 is being raised positively by motor 40 through locked clutch 38. No additive or subtractive force may be applied to the movable frame when the selector switch 133 is in the N or neutral position. In each case neither of the solenoids 135 or 137 are energized, and therefore, valves 77 and 78 remain in the neutral positions shown in FIG. 5. The effect of the weight or force of the frame 43 on the material 47 remains unchanged.

When it is deemed to be necessary to provide additional force on the material, the selector switch 133 is moved so that its blades 132 and 134 are in the A contact position. It is to be noted that valve 78 may not assume its "add" position as shown in FIG. 6 unless infeeder switch 121 is closed to cause infeeder motor 50 to run, relay 129 to be energized, and switch 128 to be closed. The condition of these elements will then complete a circuit through conductor 131, switch blade 132 (when in contact with position A) to solenoid 135 which is then energized to move valve 78 to the position shown in FIG. 6. If desired, however, the effect of switch 121, relay 129, and switch 128 on valve 78 may be eliminated by closing switch 139. In any event, when blade 134 of selector switch 133 is in the A position, no circuit is completed to solenoid 137, and valve 77 remains in its de-energized condition. With the solenoid of valve 78 energized and the solenoid of valve 77 de-energized, the circuit and "add" condition of FIG. 6 are obtained. In this condition, the supplementary, additive, or increased effective force is applied constantly to the material in the accumulator regardless of the direction of movement of frame 43 caused solely by changes in the length of material in the accumulator as long as the motor 40 is rotating to allow the frame 43 to move in a "floating" manner or in a downward direction at a controlled rate due to the over-riding action of the clutch 38.

When it is desired to decrease the effective force applied to the material, the selector switch 133 is moved so that blades 132 and 134 are in contact positions S. In this case, solenoid 135 cannot be energized due to the lack of a completed circuit thereto, and valve 78 remains in its de-energized condition. However, solenoid 137 will be energized due to the completed circuit through conductor 126, blade 134, and conductors 138 and L_2. Valve 77 will then be moved to the position shown in FIG. 7, and the resultant circuit shown therein will provide the "subtract" or decreased force condition on the material 47. This decreased force condition will remain in effect regardless of the direction of movement of frame 43 caused solely by changes in the length of material in the accumulator as long as motor 40 is energized to rotate in the direction in which the over-riding action of the clutch will allow the "floating" and controlled movement of the frame 43 in response to changes in length of said material.

Thus, the device of the present invention provides means to quickly and easily adjust the effective force applied by a movable roller frame on various types of sheet material passing through an accumulator to keep said material in a taut condition while avoiding tearing thereof.

It is to be understood that the invention is not limited to the particular electrical and hydraulic circuitry, valve arrangement, number of valves, power transmission apparatus including shafts, couplings, chains, sprockets, gear units, etc., size, shape, relative position and direction of motion of the accumulator frames, size and shape of the accumulator and relative location of all the elements shown and described. The details of these elements and arrangements may be varied, and equivalent elements may be substituted therefor.

Various modifications will occur to those skilled in the art without departing from the scope of the claims.

I claim:

1. A drive mechanism comprising primary drive means, means to be driven in two directions, transmission means to drivingly connect said primary drive means and said means to be driven, said transmission means including coupling means connected to said primary drive means, said coupling means being of the type which may be driven by said primary drive means but which is substantially incapable of driving said primary drive means to an appreciable extent, and clutch means connecting said coupling means and said driven means, said clutch means allowing said coupling means, when said coupling means is moving in one direction, to override said driven means in said direction while allowing said driven means to move freely in the other direction but providing a substantially positive connection between said driven means and said coupling means should said driven means try to override said coupling means in said one direction, said clutch means also providing a positive connection between said coupling means and said driven means when said coupling means is moving in the other direction, and means associated with said transmission means to apply a force to be transmitted selectively in either direction to said driven means.

2. A drive mechanism according to claim 1 including control means for said drive mechanism.

3. An accumulator comprising at least two roller frames, support means for said roller frames including means for movably mounting at least one of said roller frames whereby said movably mounted frame may be moved toward and away from at least one of the other of said roller frames, bias means to urge said movably mounted roller frame away from said other frame, primary drive means, transmission means, including coupling means connected to said primary drive means, said coupling means being capable of being driven by said primary drive means but being substantially incapable of driving said primary drive means to an appreciable extent, said transmission means further including clutch means connecting said coupling means to said movable mounting means to allow said coupling means when said coupling means is moving in one direction to override said movable mounting means in said direction while allowing said movable mounting means to move freely in the other direction but providing a sub-

stantially positive connection between said coupling means and said movable mounting means should said movable mounting means tend to override said coupling means in said one direction, said clutch means also providing a positive connection between said coupling means and said movable mounting means when said coupling means is moving in the other direction, and means associated with said transmission means to apply a force selectively in either direction to said movable mounting means.

4. An accumulator according to claim **3** wherein said coupling means include speed reducer means.

5. An accumulator according to claim **4** further comprising control means for said selective force-applying means.

6. A drive mechanism according to claim **1** in which said selective force-applying means is hydraulic means.

7. An accumulator according to claim **5** in which said selective force-applying means is hydraulic means.

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