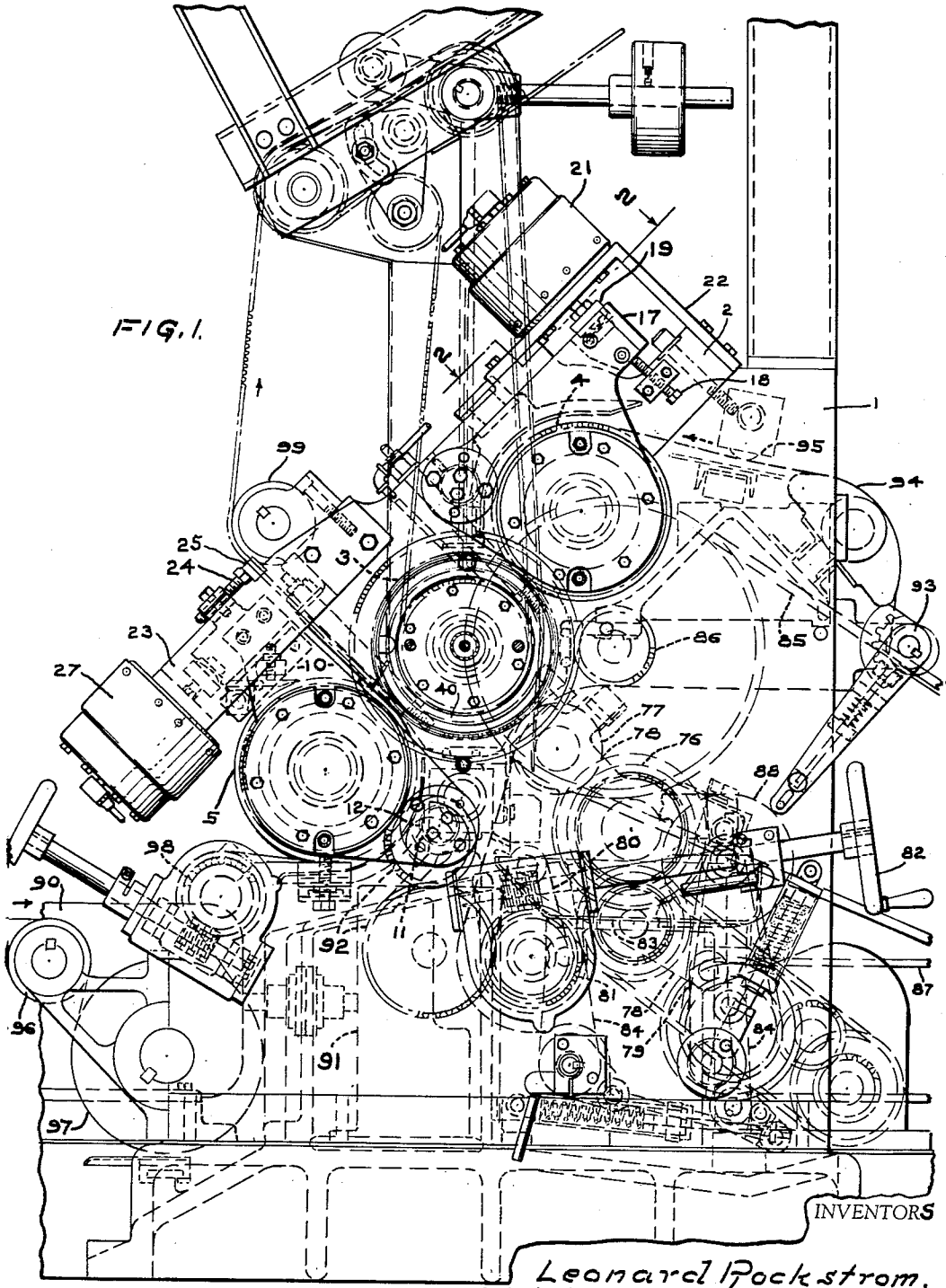
Oct. 18, 1955 L. ROCKSTROM ET AL 2,720,910

CORRUGATOR ROLL MOUNTING

Filed March 8, 1952 8 Sheets-Sheet 1

FIG. 1.



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CORRUGATOR ROLL MOUNTING

Filed March 8, 1952 8 Sheets-Sheet 2

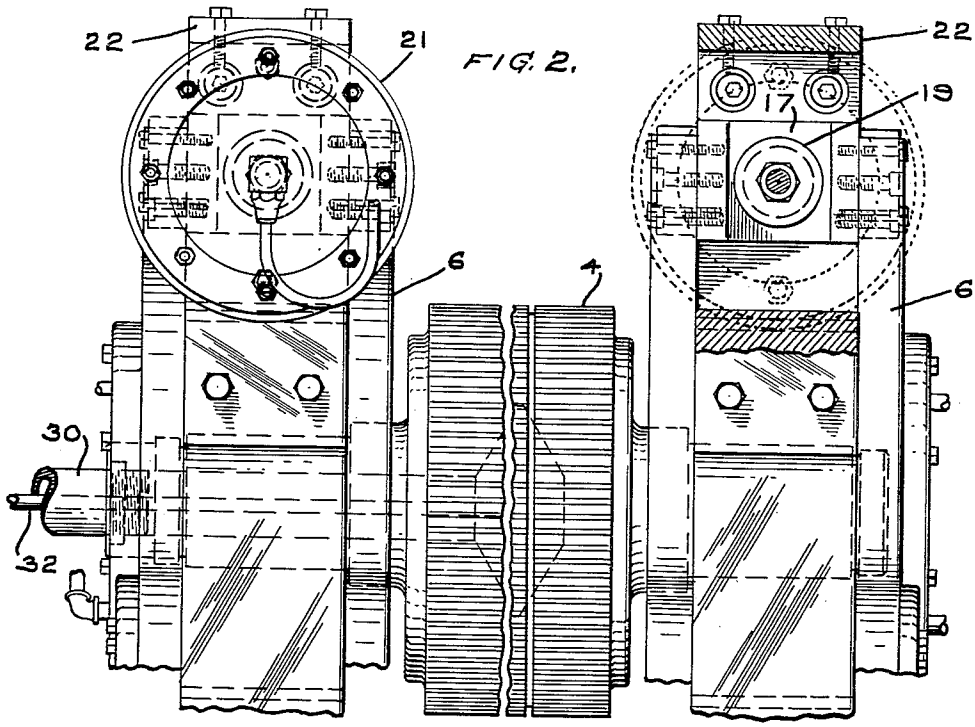


FIG. 2.

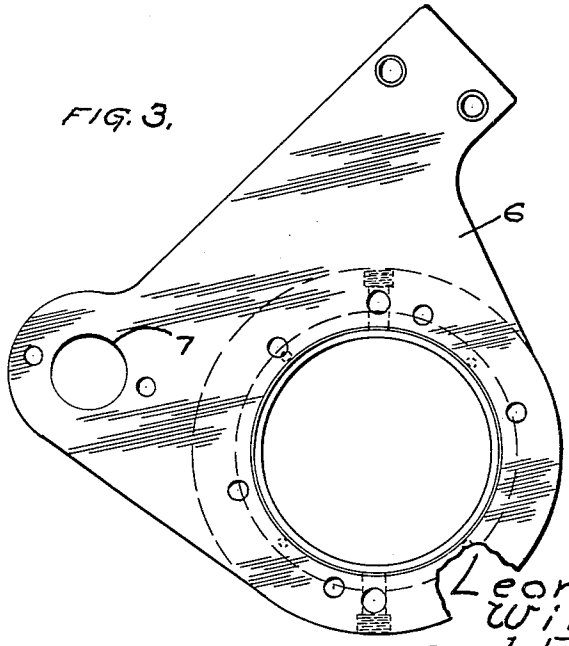


FIG. 3.

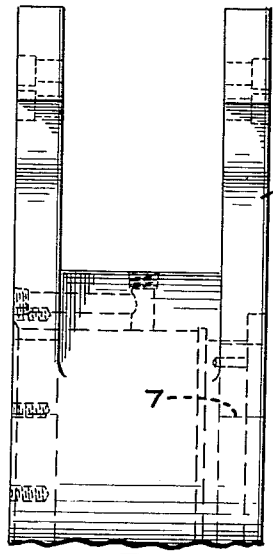


FIG. 4.

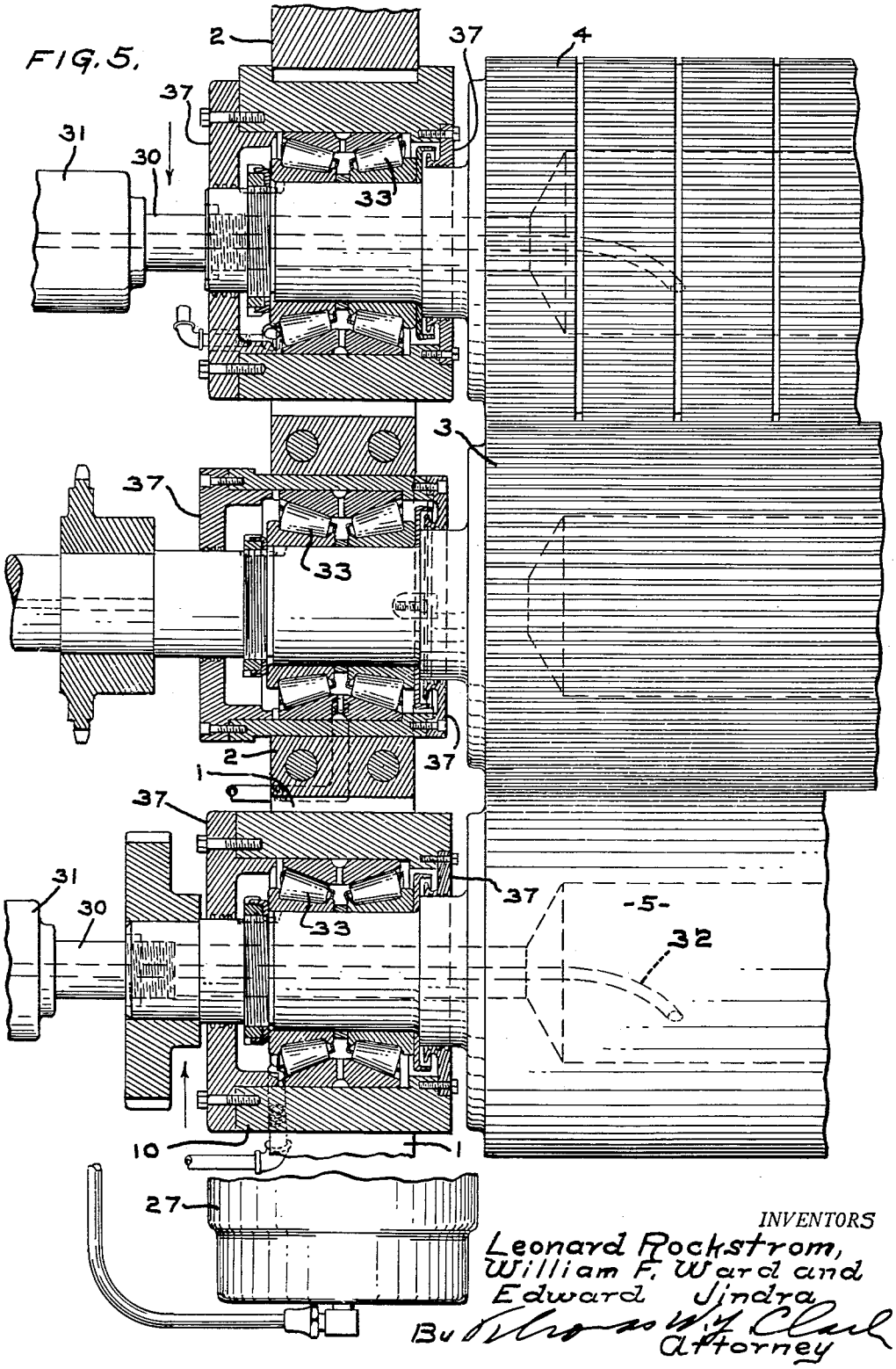
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CORRUGATOR ROLL MOUNTING

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FIG. 5.



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CORRUGATOR ROLL MOUNTING

Filed March 8, 1952 8 Sheets-Sheet 4

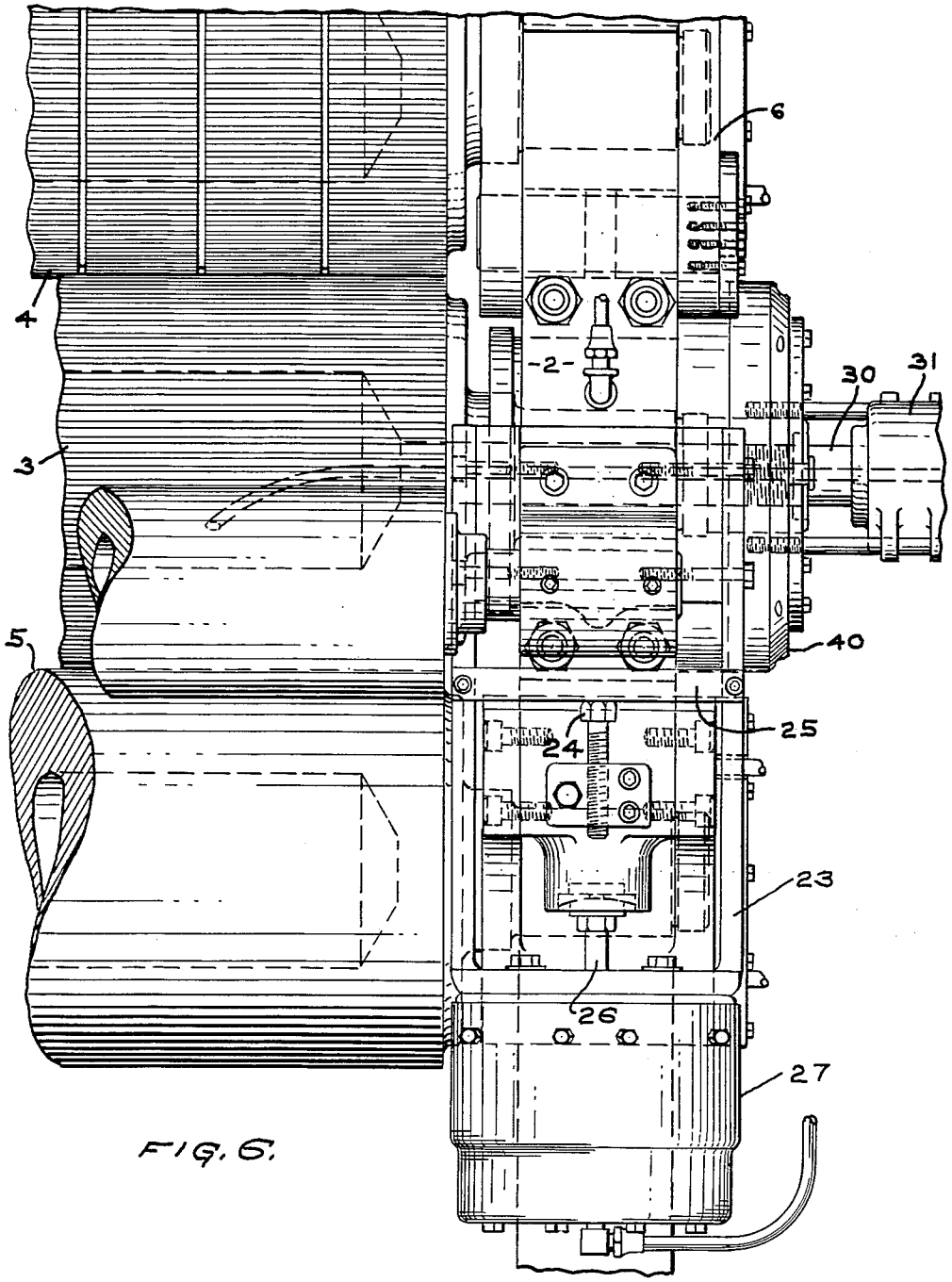


FIG. 6.

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CORRUGATOR ROLL MOUNTING

Filed March 8, 1952 8 Sheets-Sheet 6

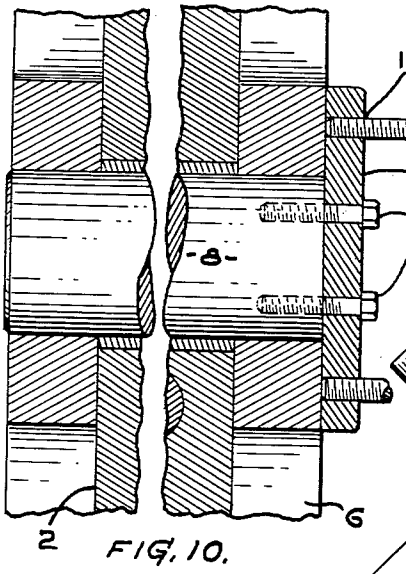


FIG. 10.



FIG. 15.

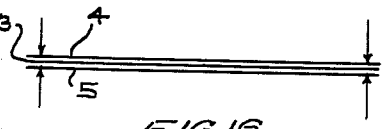


FIG. 16.

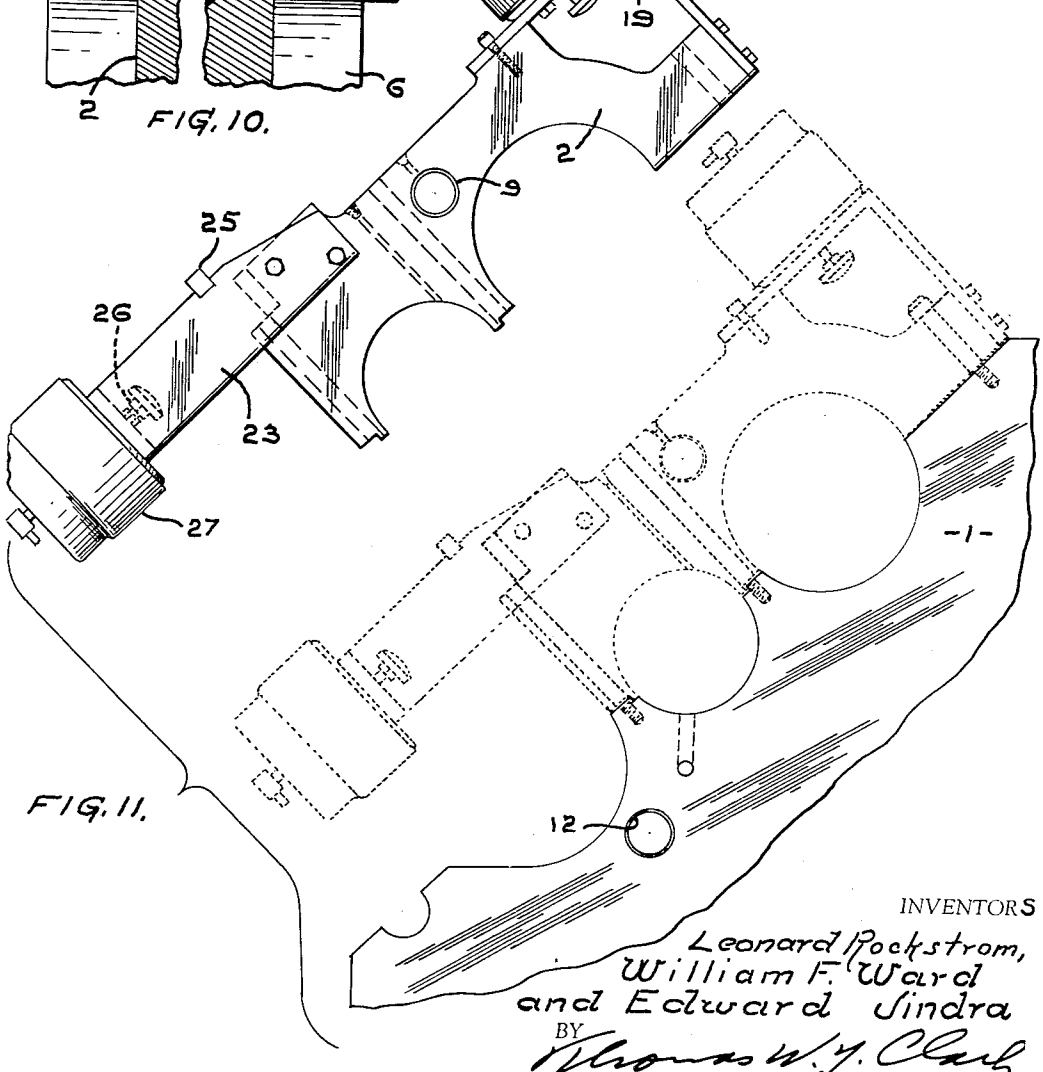


FIG. 11.

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CORRUGATOR ROLL MOUNTING

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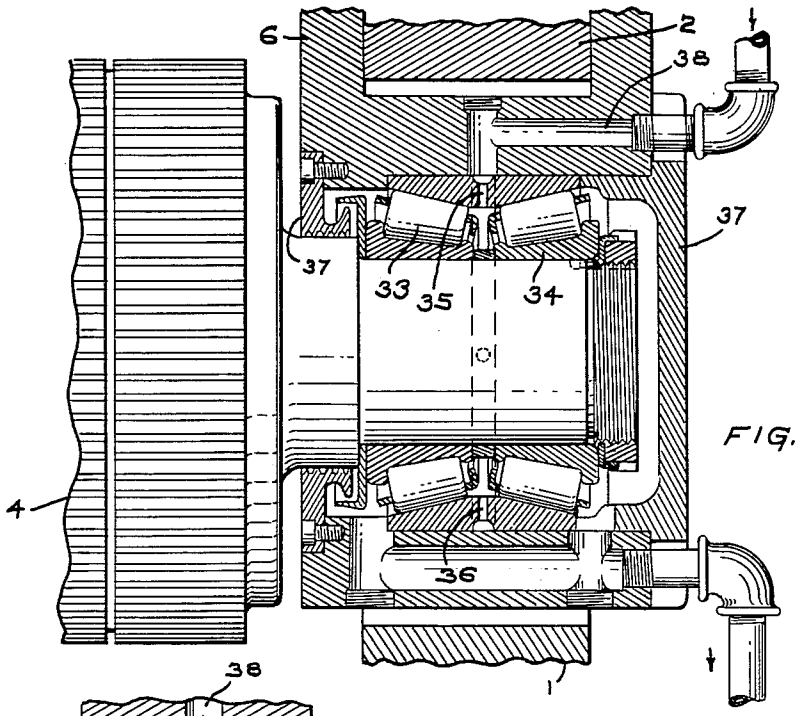


FIG. 7.

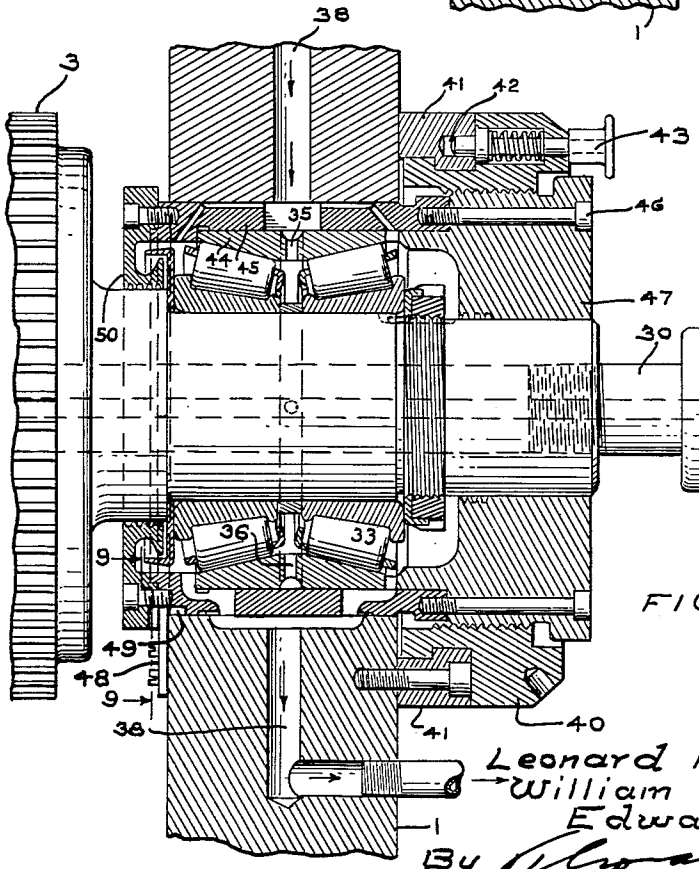


FIG. 8

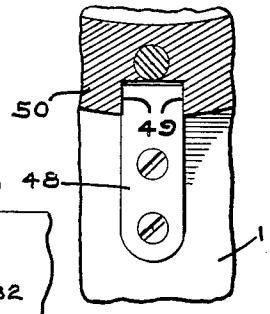


FIG. 9.

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CORRUGATOR ROLL MOUNTING

Filed March 8, 1952 8 Sheets-Sheet 7

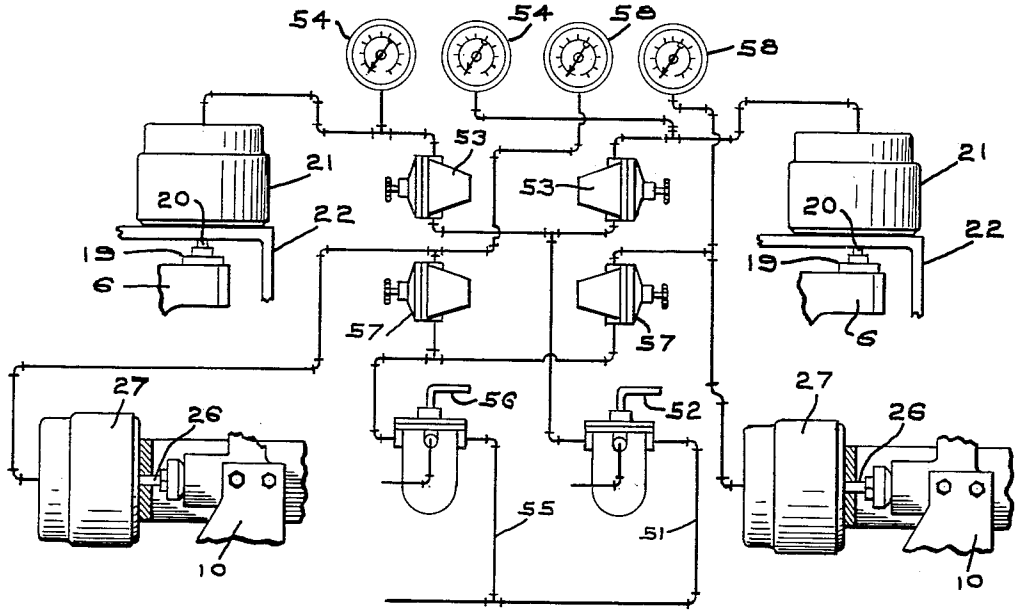


FIG. 12.

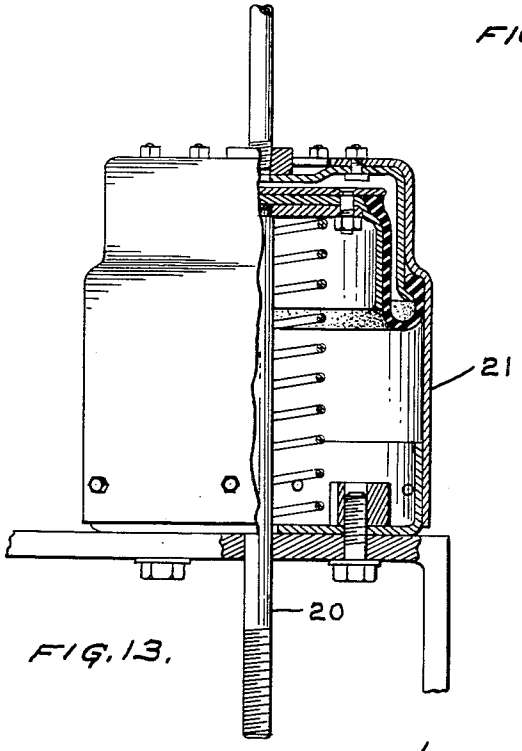


FIG. 13.

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CORRUGATOR ROLL MOUNTING

Filed March 8, 1952 8 Sheets-Sheet 8

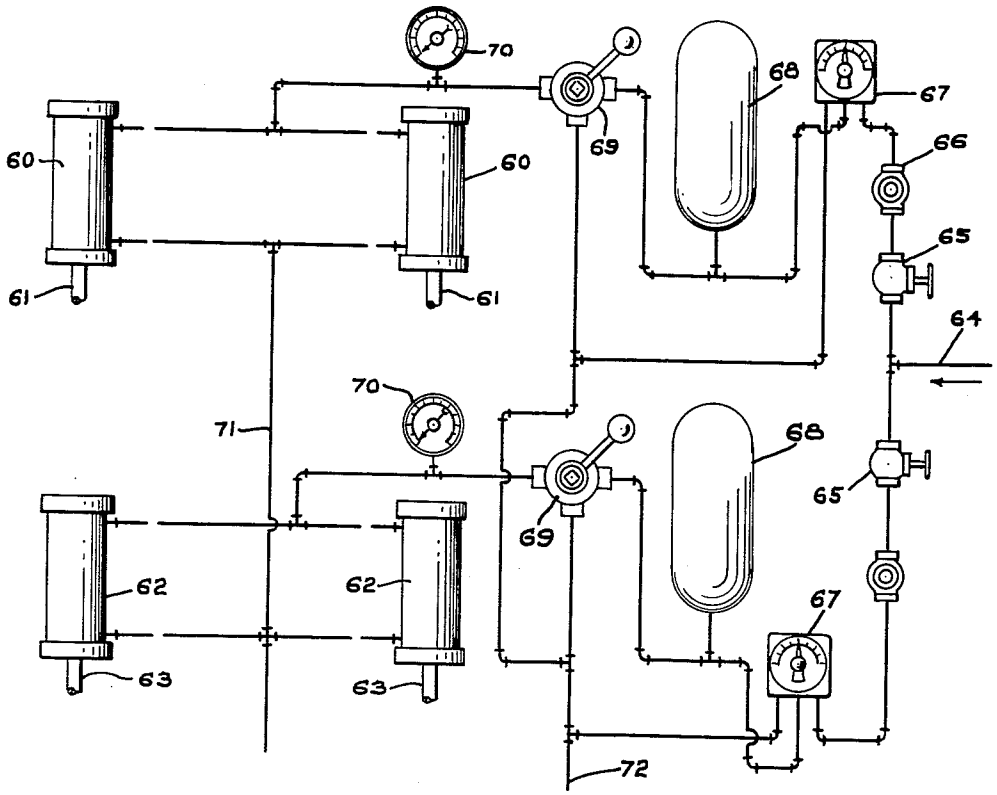


FIG. 14.

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United States Patent Office 2,720,910
Patented Oct. 18, 1955

2,720,910

CORRUGATOR ROLL MOUNTING

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Application March 8, 1952, Serial No. 275,652

13 Claims. (Cl. 154—31)

This invention relates to improvements in a corrugating machine for making single faced corrugated board from paper stock. In the making of such single faced board, paper stock is passed between two fluted or corrugated rolls, the paper having been moistened and the rolls heated and the fluted rolls are pressed together with considerable force as the paper stock passes between them to be corrugated. The corrugated paper, still on the roll, then has adhesive applied to the corrugations on the outside and another sheet called a face or liner is applied to the adhesive side of the corrugated paper, also under considerable pressure, to make what is known as single faced board.

The board as it passes between the corrugating rolls varies considerably in thickness with the quality of the stock and it also varies considerably in stiffness so that more or less pressure may be required between the rolls to give the paper the desired fluting or depth of corrugation without breaking the paper at the bends forming the corrugations. Also different widths of stock require different pressures between the rolls.

Corrugating rolls are now made so long that they almost invariably bend longitudinally under the pressure to which they are subjected. The lower roll is usually cut straight, with parallel sides and the upper roll is usually cut with a crown, or barrel shape so that when pressure is applied at the ends of the upper roll, the face of the roll in contact with the lower roll comes down parallel. If the pressure between the rolls is too little the sides of the board will not be corrugated as deeply as the center and with too much pressure the sides of the board will be corrugated more deeply than the center.

The pressure between the lower corrugating roll and the pressure roll, the pressure roll applying the liner to the corrugated board while it remains on the lower corrugating roll, after having adhesive applied to it, is also critical. This roll is also cut with a larger diameter in the center, or barrel shape and variations in the thickness of the stock have generally been provided for by mounting the pressure roll on eccentric bearings, which could be adjusted for different thicknesses of liner stock.

Although springs have sometimes been proposed to apply pressure to the pressure roll as well as the upper corrugating roll, springs lose their power to exert the same force over a period of time. Also it is nearly impossible to obtain two springs, one for each end of the roll, which will apply equal pressure to both ends of the roll and as a consequence one side of the board will often be fluted with deeper valleys than the other or one side will have the liner firmly glued to the board and not so firmly glued on the other side. Springs also have a period of vibration and that period varies with their age and use. The flutes in the corrugating rolls tend to set up a vibration between the upper corrugating roll and also the pressure roll. The springs which have heretofore been used are intended to absorb this vibration and yet maintain the rolls in fluting relation as well as liner pressure applying relation. When the corrugator has been run slowly this

vibration against the springs has not had serious consequences but as the rolls have been run faster to produce more feet of corrugated board per minute, the period of vibration of the springs has sometimes equalled the period of vibration of the rolls so that the fluting takes place erratically and also the adhesion of the liner to the corrugated board has been uneven, and quite unsatisfactory board has been turned out by these increases of speed on the old machines.

The stock for corrugating is drawn from a large supply roll and it has been the practice to draw it by the corrugating rolls themselves so that the speed of the corrugating rolls determines the speed of the unwinding from the supply rolls. Various tension applying devices have been used in an effort to regulate the tension on the stock between the supply roll and the corrugating rolls. It has been found in practice, however, that the supply roll is not always round and the tension applying devices consequently are unable to keep the tension uniform on the stock as it enters the corrugating rolls. This variation of tension has often caused the upper or movable corrugating roll to swing up and down as the tension on the stock varies and to consequently vary the depth of the corrugations in the stock as it passes between the two corrugating rolls. Sometimes this variation of tension of course is at one edge of the stock and sometimes at the other and even sometimes at the center so that the variations in the corrugations become quite marked.

One of the objects of the present invention is to so mount the upper corrugating roll that any variation of tension on the stock as it is pulled from the supply roll by the corrugating rolls will tend to draw the rolls together at all times rather than apart. Another object of the invention is to place stops to positively limit the movements of the corrugating rolls together. Another object of the invention is to mount chambers and pistons with fluid pressure applying means in the chambers to accurately apply pressure to the upper corrugating roll at each end separately and similarly to apply pressure to each end of the pressure roll as it presses the liner against the corrugating board on the lower corrugating roll. These fluid pressure chambers for each respective roll are interconnected so that the pressure can be applied equally to each end of the respective roll and gages are placed in the pressure lines so that the precise pressure on each end of each roll will always be apparent and so that it can be varied at will. Adjustable stops are also provided between the lower corrugating roll and the pressure roll, so that undue pressure can never be applied to the pressure roll.

These positive controls of the pressure between the corrugating rolls and the pressure roll and the lower corrugating roll produce much more uniform single faced board at a much greater number of feet per minute than has been possible by machines heretofore used. They also evenly distribute the wear over the length of the rolls, also the machine is out of use for adjustment for shorter periods of time.

Other objects and advantages together with other improvements in the corrugator will be apparent from the following description and the accompanying drawings forming a part hereof and in which:

Figure 1 is an elevation of the operating or right side of the machine.

Figure 2 is a front elevation partly in section on line 2—2 of Figure 1, and partly broken away of the upper or movable corrugating roll.

Figure 3 is a side elevation of the swivel arm of the upper roll.

Figure 4 is a front elevation of the swivel arm.

Figure 5 is a sectional view through the bearings of the corrugating and pressure rolls on the left or drive side.

Figure 6 is a similar view on the right or operating side.

Figure 7 is a sectional view of the right end of the upper corrugating roll and bearing.

Figure 8 is a similar view of the lower corrugating roll showing the longitudinal adjusting mechanism for this roll.

Figure 9 is a fragmentary sectional view on line 9—9 of Figure 8.

Figure 10 is a fragmentary sectional view showing the pin for mounting the swivel arm of the upper corrugating roll.

Figure 11 is a side elevation of the roll bearing cap and a fragmentary view of the adjacent part of the frame.

Figure 12 is a schematic pressure circuit diagram using pneumatic chambers.

Figure 13 is a sectional view showing one of the pneumatic chambers with its piston.

Figure 14 is a schematic diagram showing a circuit for hydraulic chambers for applying the pressure.

Figure 15 shows in diagram form the relation of the rolls before pressure is applied between them.

Figure 16 is a similar view after pressure is applied.

Similar numerals refer to similar parts throughout the several views.

The corrugator comprises a main frame **1** having on each side removable caps **2** applied on its front and in which are mounted a vertically stationary lower corrugating roll **3** and an upper vertically movable corrugating roll **4** and the vertically movable pressure roll **5**.

The upper roll **4** is mounted on two swivel arms **6** each of which is pivoted as at **7** by the pin **8** in the bearing **9** of one of the caps **2**. The pressure roll **5** is likewise mounted in two swivel arms **10** each of which is similarly pivoted at **11** in bearing **12** of the frame **1**. Each swivel pin **8** and its counterpart for arm **10**, is maintained in its bearing position by means of bolts **13** permanently attaching the pin to a cap **14** which is held on each yoked swivel arm **6** by means of bolts **15**. Cap **14** has other holes **16** therethrough which fit bolts **15** so that when these bolts **15** are removed from their holding position, to hold the pin in place in the swivel arm, these bolts **15** may be placed in holes **16** and turning them against the side of the arm pulls the pin from its bearing.

The forks of each swivel arm **6** straddle the upper ends of each bearing cap **2** and between their free ends bearing blocks **17** are placed and rest on one side against stop bolts **18** on the bearing caps **2** and they are pressed on the other side by the ends **19** of the pistons **20** mounted in chambers **21**. Chambers **21** are mounted on brackets **22** bolted to caps **2**.

The swivel arms **10** for the pressure roll **5** pass between the arms of yokes **23** attached to the lower ends of bearing caps **2**. These swivel arms have similar stop bolts **24** bearing upon stops **25** on yokes **23**. The pressure roll **5** is similarly held by pistons **26** in chambers **27** against the lower corrugating roll **3**. Figure 11 shows one bearing cap **2** with its accompanying chambers attached, both before and after the bearing cap is attached to the side of the main frame **1**.

The three rolls **4**, **3** and **5** are hollow as shown in Figures 5 and 6 and steam is admitted to these rolls through pipes **30** which rotate with the rolls and which are mounted in chambers **31** which are held stationary. Condensate is withdrawn from the rolls through pipes **32**.

The three rolls are mounted at each end in double conical roller bearings **33**, the cages **34** of which have oil inlets **35** and outlets **36** and the oil is maintained within the bearings by seals **37**. Oil is thus kept constantly circulating through openings **38** in the frames connected with the bearings around the ends of each roll. It has heretofore been customary to mount these rolls on relatively long shafts, mounting them on short shafts with constantly lubricated bearings has greatly increased the speed at which the rolls may be run and yet maintain accurate pressure between them.

The center roll may be adjusted longitudinally by means of an endwise adjustment ring **40** keyed to ring **41** mounted fast on frame **1**, ring **41** having spaced openings **42** therein at different positions of the circumference of the ring **41** to receive the spring held pin **43**. The bearing cage **44** at this end of the lower corrugating roll has a pressure fit with sleeve **45** attached by bolts **46** to bearing retainer **47**. A key **48** is attached to the frame **1** and slides in way **49** on the oil seal cap **50** bolted to the sleeve **45**. This key prevents relative rotation between the bearing retainer **47** and frame **1**.

Pressure is applied to the chambers **21** and **27** in the preferred pneumatic form by means of pressure received from a source not shown and through lines **51** where the pressure for both chambers **21** is adjusted by means of valve **52** and separately for the chambers **21** by means of valves **53**. The pressure for each chamber **21** has a separate pressure gage **54**.

For the chambers **27** air is admitted through line **55** and the initial adjustment is likewise made by a valve **56** and individual regulation for chambers **27** is made through valves **57**. These two chambers likewise have individual pressure gages **58**. Through means of these lines the pressure on each two chambers, on each roll, is adjusted together equally and if individual adjustment be required for each chamber that can be done by the separate valves.

Should it be desired to use liquid instead of air to regulate the pressures on the rolls, this can be done through means of the mechanism shown in Figure 14 in which hydraulic chambers **60** operate pistons **61** regulating the pressure on the upper corrugating roll and chambers **62** operating pistons **63** regulate the pressure on the pressure roll. Pressure is introduced to the system through line **64** and it passes through cut-off valves **65**, check valves **66**, pressure gages **67**, to air accumulators **68** and to valves **69** and from these valves the pressure goes to the top of the cylinders for both rolls to press them against the lower corrugating roll, there being a pressure gage **70** separately for each roll, a drain **71** is connected to the bottom of the pressure cylinders **60** and **62** to carry the liquid back to the source, a return line **72** likewise returns the liquid when the rolls are to be released from pressure holding position.

Although not forming a part of this invention, adhesive is supplied to the crowns of the corrugated board on roll **3** by means of a pick up roll **76** and an applicator roll **77** both of which are mounted in a frame **78** which is mounted inside the main frame **1** on two rear arms **79** and two forward arms **80**, the upper ends of arms **80** being on a shaft common with gear **81** which is rotated through means of a worm by crank **82** to swing the adhesive rolls backward out of adhesive applying position.

The glue pan **83** is likewise mounted on four arms **84** and it may likewise be swung backward by a handle, not shown.

The lower corrugating roll is driven by a motor through a belt **85**, driving a gear **86** which drives the lower roll, the upper corrugating roll is driven through the intermeshing of the corrugations with the lower roll. The glue rolls are driven from the same motor by means of belt **87** or by means of an independent motor **88**, the independent motor is so geared as to operate constantly but by means of a slip clutch not to drive while the main drive is in operation. When the main drive is cut off, the slip clutch allows the smaller motor **88** to drive the glue rolls at a slower speed. The pressure roll is driven by a separate motor **90** through a gear reduction mechanism **91** and gears **92**.

Stock to be corrugated is brought in from the back of the corrugator through tensioning mechanism **93**, over heating element **94**, steam applicator **95** to the top of the upper movable corrugator roll. The liner to be applied to the corrugated stock is brought in from the front of

the machine and passes around rolls **96, 97** and **98** to the underside of the pressure roll **5**.

After the crowns of the stock on corrugator roll **3** have received their adhesive from applicator roll **77**, the liner on pressure roll **5** is pressed firmly against the adhesive and since these rolls are all heated, the adhesive sets and the single faced corrugated board is carried out from between the lower corrugator roll **3** and the pressure roll **5** under the guide roll **99** and upwardly over the machine.

From the above detailed description it will be apparent that the pressure roll and the upper corrugating roll which are barrel shaped as shown by the indicated lines in Figure 15 are pressed so that adjacent surface lines are parallel as shown in Figure 16 by means of the pressure applying pistons and chambers and the exact pressure required for the particular stock to obtain the best corrugating effect as well as the best adhesive adhering effect may be obtained and any irregularities of the tension on the stock fed to the machine for corrugating draws the corrugating rolls together, rather than apart, but not so far together as to injure the board because of the stops **18** that limit the corrugator roll swivel in its movement downwardly.

It will be apparent that many changes may be made in the detailed construction of the corrugator of this invention without departing from the essential features thereof which are defined in the following claims.

What is claimed as new and is desired to be secured by Letters Patent is:

1. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, one roll being movable toward and from the other, a pair of spaced levers, fixed pivot means for said levers, said movable roll being journalled in said levers, pressure applying means including a fluid chamber and a fluid operated piston therein operatively attached to said movable roll, to urge it against the other roll, means to guide stock to be corrugated around the movable roll, the stock passing between the two rolls to corrugate the stock, said guiding means being positioned to bend the paper around the movable roll toward its axis away from a tangent through the axis of the fixed pivot means to the roll on the side opposite said other roll, whereby tension on the stock between the movable roll and guiding means forces the movable roll toward the other roll.

2. The machine of claim 1 including stops to limit the movement of the movable corrugating roll toward the other corrugating roll under the influence of the tension on the stock.

3. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, one roll being movable toward and from the other, a pair of spaced levers, fixed pivot means for one end of each of said levers, said movable roll being journalled in said levers intermediate the lever ends, the levers extending beyond two spaced sides of the roll, separate pressure applying means including a fluid chamber and a fluid operated piston therein operatively attached to said levers at their free ends, to urge the movable roll against the other roll, means to guide stock to be corrugated around the movable roll, the stock passing between the two rolls to corrugate the stock, said guiding means being positioned to bend the paper around the movable roll toward its axis away from a tangent through the axis of the fixed pivot means to the roll on the side opposite said other roll, whereby tension on the stock between the movable roll and guiding means forces the movable roll toward the other roll.

4. The machine of claim 3 including stops to limit the movement of the movable corrugating roll toward the other corrugating roll under the influence of the pressure applying means and the tension on the stock.

5. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, a liner applying pressure roll parallel to and adjacent one of said fluted rolls the pressure roll tending to be vibrated by the spaced crowns of the adjacent fluted roll, a pair of spaced levers, fixed pivot means for one end of said levers, said pressure roll being journalled in said levers intermediate the lever ends, the levers extending beyond both sides of the roll, separate positive pressure applying means including a fluid chamber and a fluid operated piston therein operatively attached to said levers at their free ends, whereby pressure applied to the levers urges the pressure roll toward its adjacent fluted roll and dampens the vibrating of the pressure roll, adjusting means common to said pressure applying means for balancing their pressure equally, simultaneously.

6. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, one roll being movable toward and from the other, a liner applying pressure roll parallel to and adjacent said other fluted roll in operation the movable roll and pressure roll tending to be vibrated by the spaced crowns of the adjacent fluted roll, two pairs of spaced levers, fixed pivot means for one end of said levers, said movable roll and said pressure roll each being journalled in a pair of said levers intermediate the lever ends, the levers extending beyond both sides of the rolls, separate positive pressure applying means including a fluid chamber and a fluid operated piston therein operatively attached to said levers at their free ends, whereby pressure applied to the levers urges the lever supported rolls toward said other fluted roll and dampens the vibrating of the lever supported rolls, adjusting means common to said pressure applying means for each pair of levers for balancing the pressure of each pair separately, equally, simultaneously.

7. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, a liner applying pressure roll parallel to and adjacent one of said fluted rolls the pressure roll tending to be vibrated by the spaced crowns of the adjacent fluted roll, a pair of spaced levers, fixed pivot means for one end of each of said levers, said pressure roll being journalled in said levers and spaced from said pivot means of each lever, a fluid chamber and a fluid operated piston therein operatively connected to each said lever adjacent its free end to apply pressure to said levers whereby the pressure applied to the levers urges the pressure roll toward its adjacent fluted roll and dampens the vibrating of the pressure roll, adjusting means common to said fluid chambers to adjust their pressure on said pressure roll through said levers simultaneously.

8. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, a liner applying pressure roll parallel to and adjacent one of said fluted rolls the pressure roll tending to be vibrated by the spaced crowns of the adjacent fluted roll, a pair of spaced levers, fixed pivot means for one end of each of said levers, said pressure roll being journalled in said levers and spaced from said pivot means of each lever, a fluid chamber and a fluid operated piston therein operatively connected to each said lever adjacent its free end, and supports for said chambers and pistons located on the side of the pressure roll opposite the adjacent fluted roll, adjusting means common to said fluid chambers to move the pressure roll toward the adjacent fluted roll, through said levers, simultaneously to circumferentially equalize the pressure between the pressure roll and the adjacent fluted roll.

9. A machine for making single faced corrugated board comprising a pair of parallel axis revolvable fluted rolls normally disposed to intermesh the crowns and valleys of the two rolls, a liner applying pressure roll parallel to and

adjacent one of said fluted rolls the pressure roll tending to be vibrated by the spaced crowns of the adjacent fluted roll, a pair of spaced adjustable pressure applying elements for said pressure roll, to adjust its pressure against the adjacent fluted roll, each of said adjusting elements including a fluid chamber and a fluid operated piston therein operatively connected to move the pressure roll and means connected in common to said chambers to adjust the adjusting elements simultaneously to circumferentially equalize the pressure between the pressure roll and the adjacent fluted roll.

10. A machine for making single faced corrugated board comprising a frame, a pair of meshing corrugating rolls and a liner applying pressure roll mounted in the frame, the pressure roll being adjacent one of said fluted rolls the pressure roll tending to be vibrated by the spaced crowns of the adjacent fluted roll, a pair of levers each having one end pivotally mounted in the frame and forming the support in the frame for the pressure roll, the pressure roll being journalled in the levers intermediate the ends thereof, chambers having fluid operated pistons therein mounted between the frame and the free ends of the levers and means common to the chambers to admit fluid pressure to the chambers simultaneously to force the pressure roll against its adjacent corrugating roll to circumferentially equalize the pressure between the pressure roll and the adjacent fluted roll.

11. A machine for making single faced corrugated board comprising a frame, a corrugating roll mounted in fixed position in the frame, spaced levers each pivoted at one end in the frame, a movable corrugating roll journalled in said levers, pressure applying means including a fluid chamber and a fluid operated piston therein operatively attached to said movable roll to intermesh the crowns and valleys of the two rolls, means to guide stock to be corrugated around the movable roll, means to place

the stock under tension between the guide means and rolls, said guide means being positioned to bend the paper around the movable roll toward its axis away from a tangent through the axis of the pivots of the levers in the frame to the roll on the side opposite said fixed corrugating roll, whereby the tensioned stock forces the movable roll toward the fixed position roll.

12. The machine of claim 11 including stops to limit the movement of the movable corrugating roll under the influence of the pressure applying means and the tension on the stock.

13. A machine for making single faced corrugated board comprising a frame, a pair of meshing corrugating rolls mounted in the frame, a pair of levers each having one end pivotally mounted in the frame and forming the support in the frame for one of said rolls, the lever mounted roll being journalled in the levers intermediate the ends thereof, each lever at its free end comprising a fork, one leg passing on each side of the frame, separate positive pressure applying means including a fluid chamber and a fluid operated piston therein mounted upon and extending between the said forks at their free ends and bearing against the frame to force the corrugating rolls into meshing relation.

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