

July 25, 1961

H. W. MOSER ET AL

2,993,527

DOUBLE FACER MACHINES

Filed May 14, 1958

6 Sheets-Sheet 1

FIG. 10.

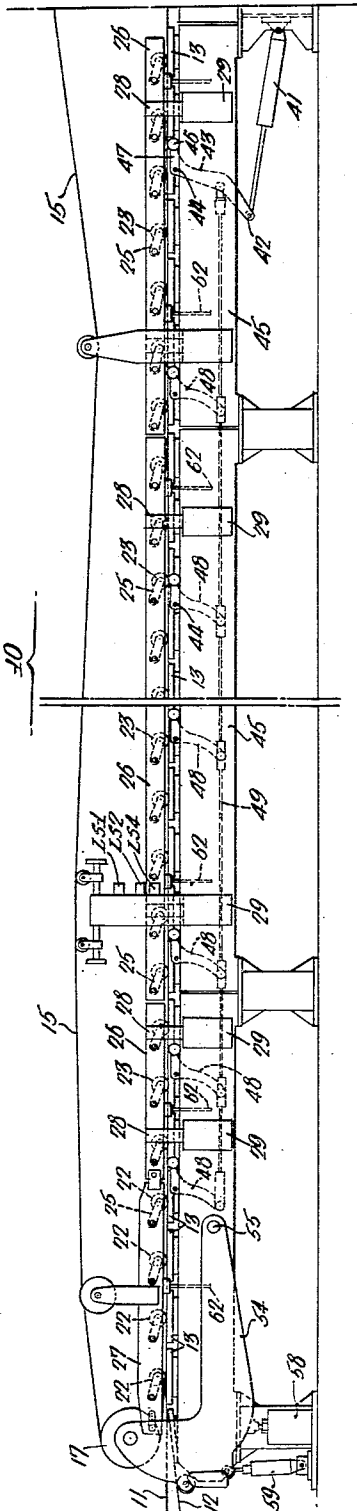
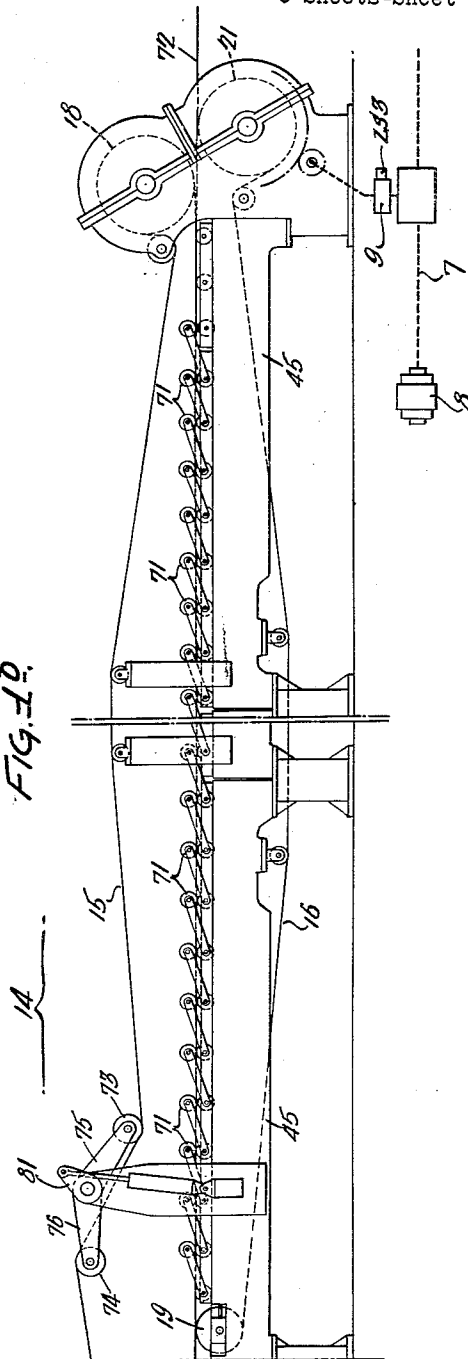


FIG. 11.



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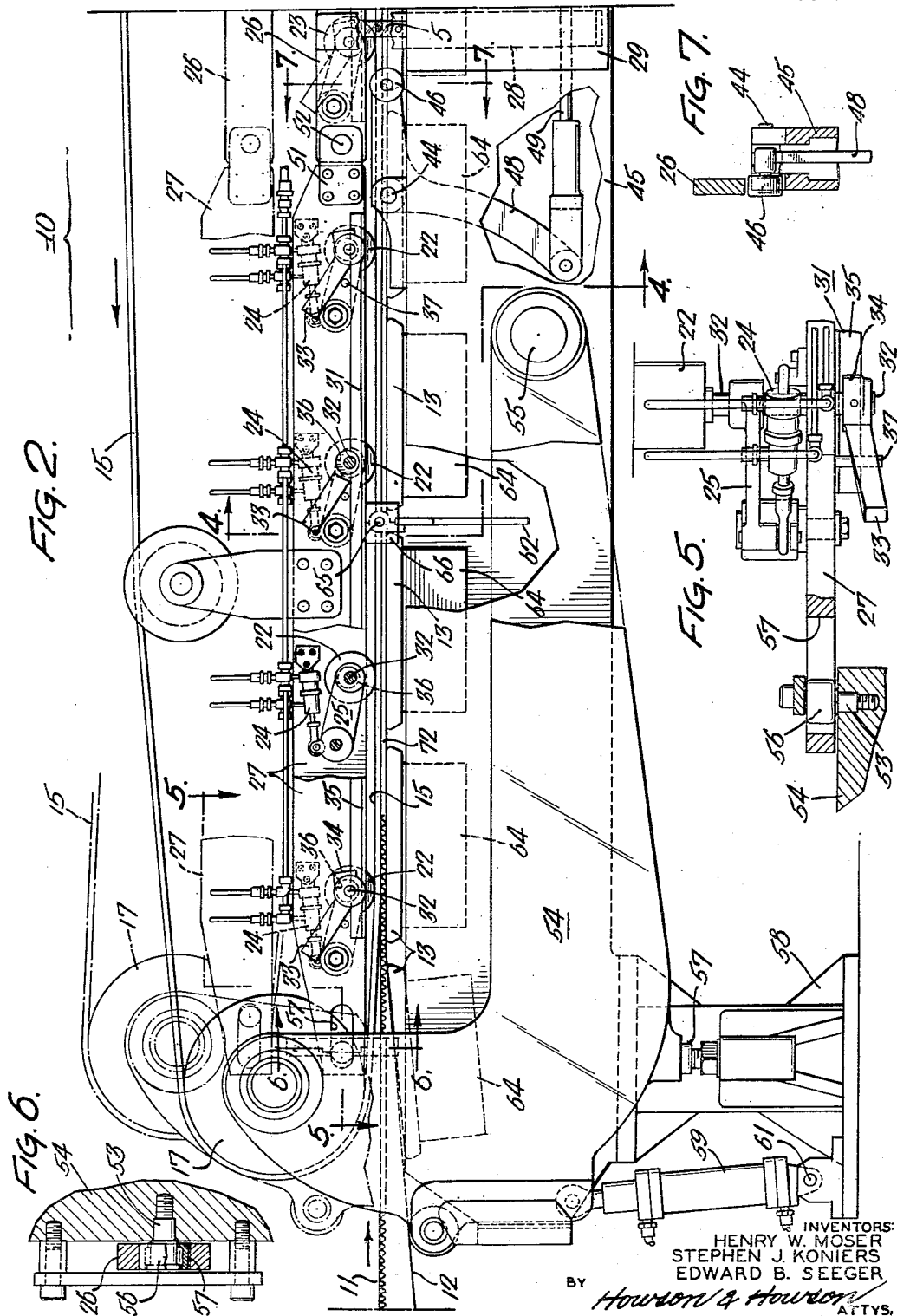
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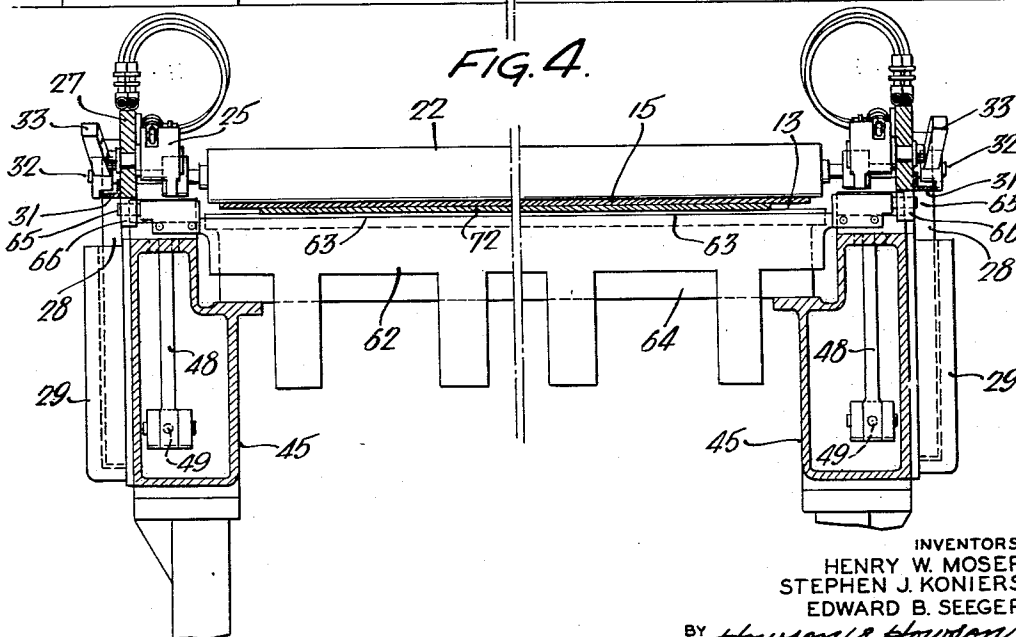
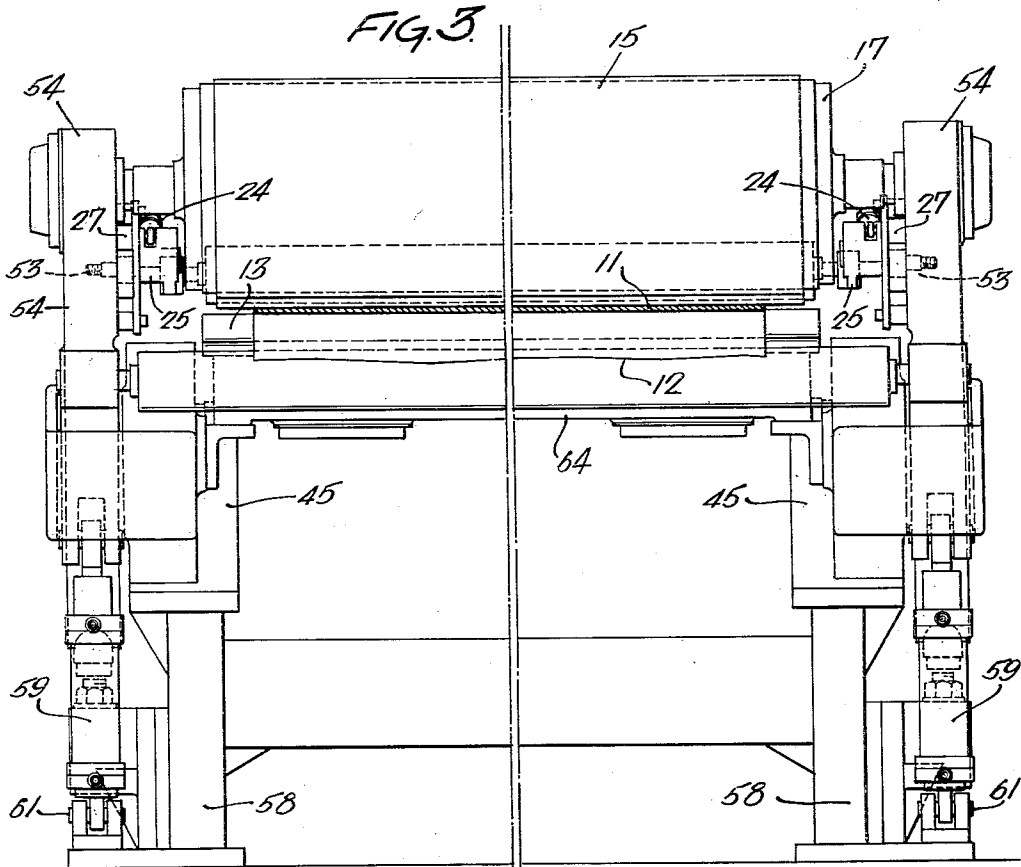
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6 Sheets-Sheet 3



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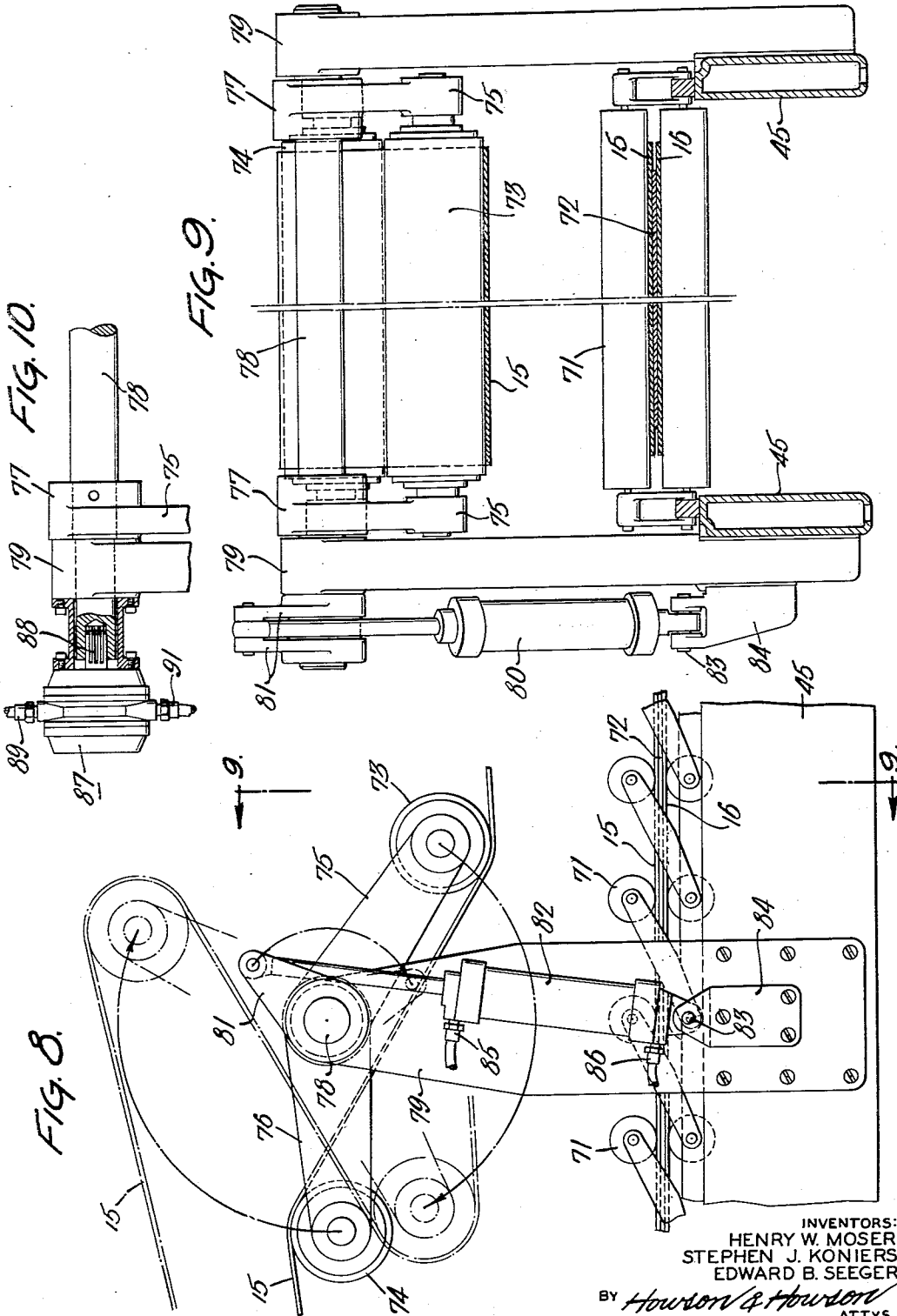
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6 Sheets-Sheet 4



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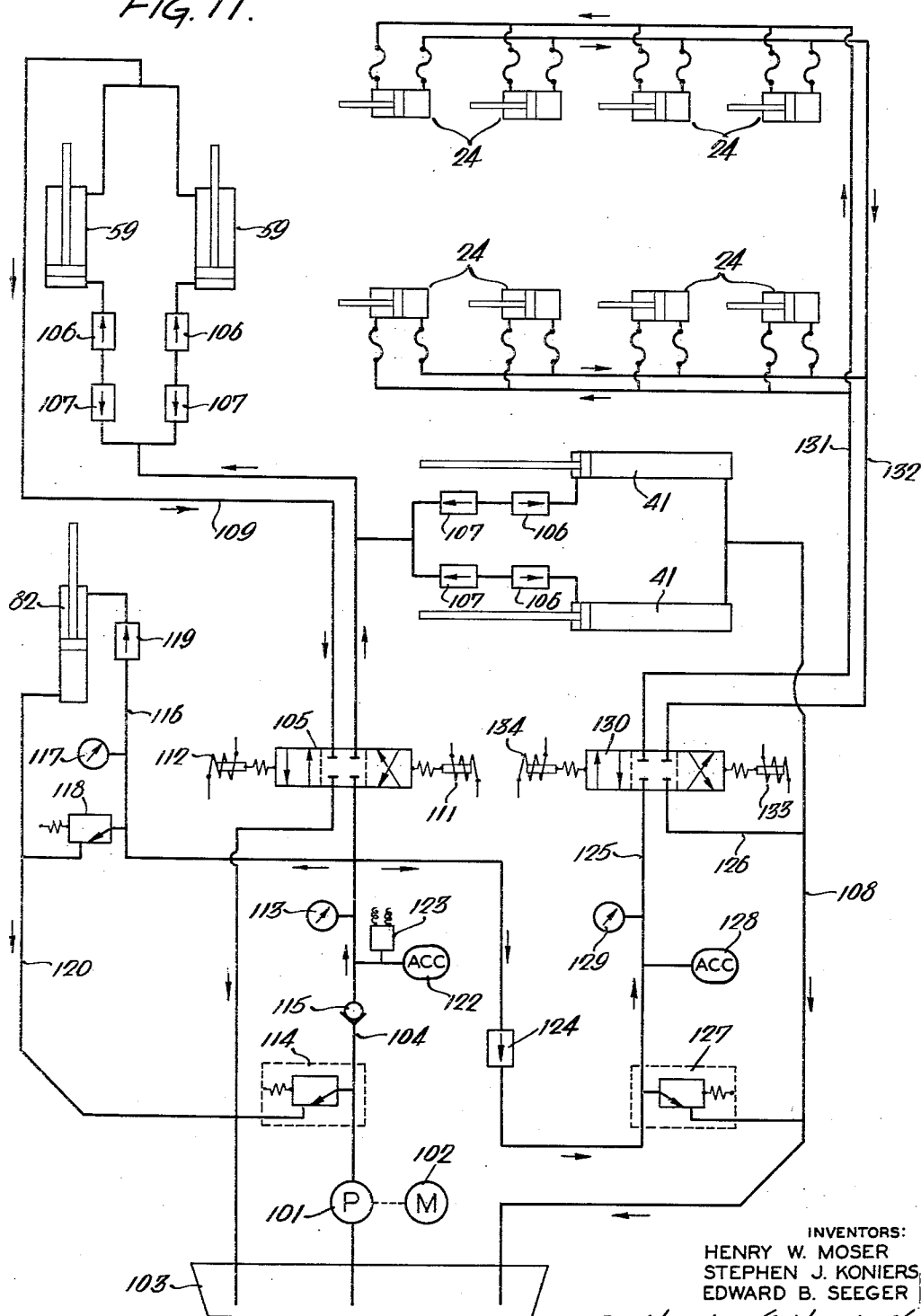
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6 Sheets-Sheet 5

FIG. 11.



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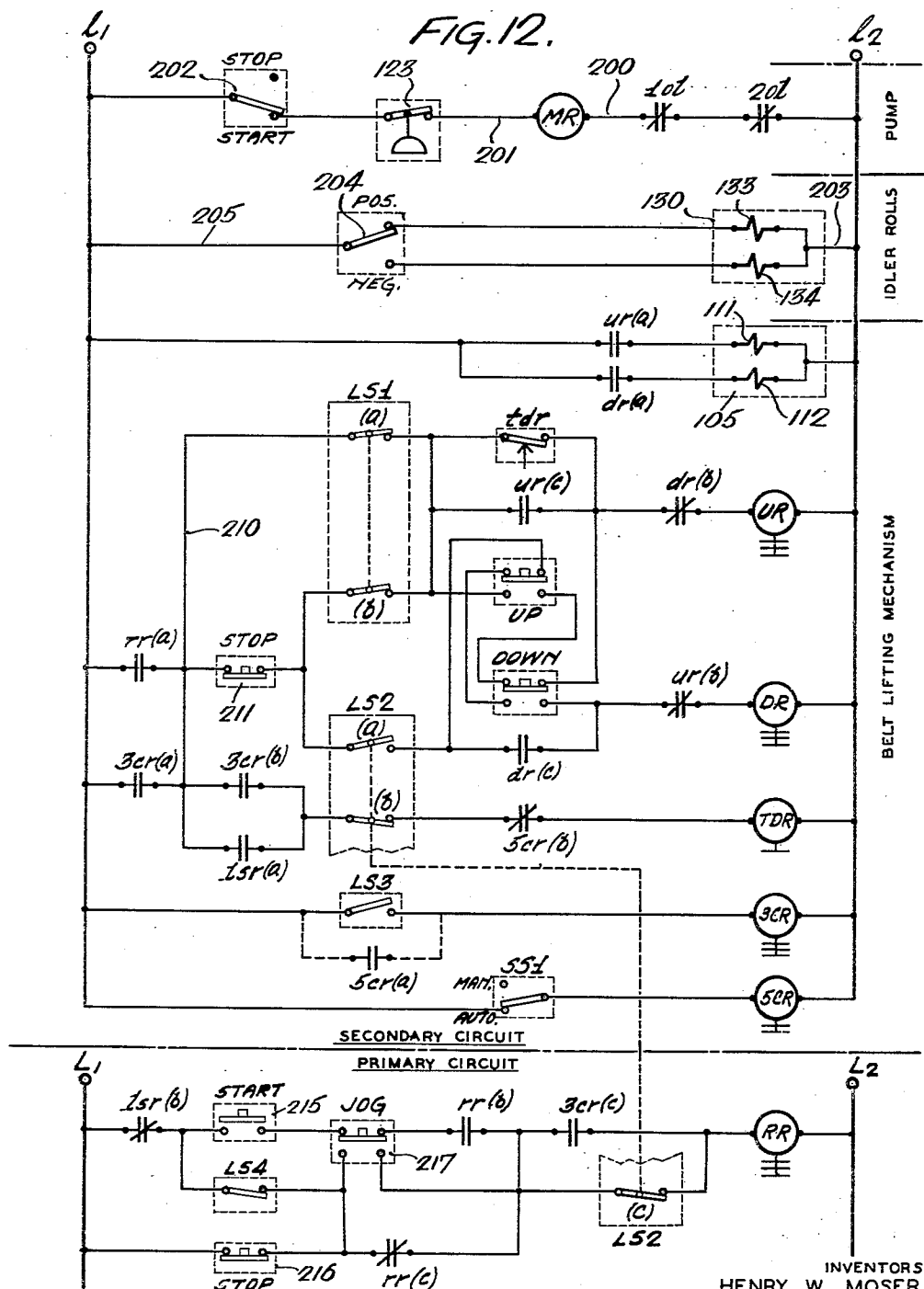
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6 Sheets-Sheet 6



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2,993,527

DOUBLE FACER MACHINES

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18 Claims. (Cl. 154—32)

This invention relates to improvements in machines of the type used in the production of double faced corrugated board.

In the conventional machine of this type a single faced corrugated web is delivered from a roll or from a single facer, to the infeed end of the double facer machine simultaneously with a facing web for the exposed face of the corrugated component of the single faced web. The crowns of the corrugations carry adhesive and in the double facer the facing web is pressed against the adhesive coated crown and is subject successively to heat which cures the adhesive and to cooling which completes the bond and produces the double faced product. From the double facer machine, the double faced web then conventionally passes to trimming, and scoring, and cut-off, mechanisms which provide finished double faced blanks of the desired form.

The double facer comprises a pair of traction belts, which by engagement with the opposite faces of the composite web draw the web through the machine, the web passing first over hot plates for the aforesaid curing operation and then through the cooling section. The upper traction belt extends over the full length of the double facer and serves to press the composite web into intimate heat exchange contact with the surface of the hot plates, and assisting in this function is a series of idler pressure rolls which ride on and in effect load the lower run of the belt. The lower traction belt is confined to the cooling section and operates jointly with the upper belt in the traction function and also in firmly pressing the facings of the web against the opposite faces of the corrugated component during the cooling period. In this latter function the belts are assisted by two series of idler rolls which respectively seat on the lower run of the belt and load the lower run of the upper belt to increase the effective weight of the latter and the joint pressure on the web. From the cooling section the composite web passes to the slitting, scoring, and cut-off mechanisms which work the web as described above to the desired blank form.

The heat to which upper traction belt is subjected in the heating section rapidly reaches a critical stage if movement of the belt is stopped. Since the belt extends over the full length of the double facer including both the heating and cooling sections, its replacement cost is high, and it is important therefore that means be provided for preventing the serious damage that may occur during periods when the belt is stationary. A principal object of the invention is to provide means for automatically lifting the belt from the critical heat zone when operation of the double facer and movement of the belt is interrupted.

Where the double facer belts are connected directly to a machine main drive motor, a further object of the invention is to automatically elevate the belt from the normal operative position when the operation of said motor is interrupted.

Where the double facer is connected to a main drive motor by a clutch, the invention contemplates further an automatic elevation of the belt as described upon disengagement of the clutch and resulting interrupting of belt travel.

Another object of the invention is to provide means

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precluding restarting of the double facer while the belt is in the elevated position.

Still another object of the invention is to provide means for again automatically elevating the belt if, after the belt has been lowered to operating position by manually actuated means, the double facer is not started up within a predetermined limited period of time.

A further object of the invention is to provide means for elevating the hold down or idler rolls from the belt while leaving the belt in the normal operating position and for operating the belt under these conditions to facilitate threading into the machine of board having backing sheets of coarse surface texture.

A further object of the invention is to provide means for delaying elevation of the belt for a predetermined limited grace period after an interruption in its operation.

Still another object is to provide means precluding elevation of the belt by the lifting means of the invention while the belt is running.

The invention contemplates also provision of improved means for tensioning the upper traction belt to afford extreme accuracy of feed of the double faced web.

Still another object of the invention is to provide in the infeed end of the double facer novel means for applying a predetermined adjusted pressure to the incoming elements of the composite web to hold the elements securely in face-to-face contact against the heating surfaces and to constantly maintain said contact during a sufficient period of the heating cycle to insure an effective bonding together of the said elements.

A further object is to provide novel means for adjusting the aforesaid pressures over an extended range to meet the requirements of widely varying characters and/or weights of web materials.

The invention will be more readily understood by reference to the attached drawings, wherein:

FIGS. 1^a and 1^b jointly show a double facer machine made in accordance with the present invention;

FIG. 2 is an enlarged fragmentary side elevational view showing the infeed end of the double facer;

FIG. 3 is an end elevational view of the infeed end of the double facer;

FIG. 4 is a sectional view on the line 4—4, FIG. 2;

FIG. 5 is a fragmentary sectional view taken on the line 5—5, FIG. 2;

FIG. 6 is a fragmentary sectional view on the line 6—6, FIG. 2;

FIG. 7 is a fragmentary sectional view on the line 7—7, FIG. 2;

FIG. 8 is an enlarged fragmentary side elevational view showing details of the upper traction belt tensioning device;

FIG. 9 is a sectional view on the line 9—9, FIG. 8;

FIG. 10 is a fragmentary elevational and partial sectional view illustrating a modification within the scope of the invention;

FIG. 11 is a diagrammatic view showing the fluid pressure system for the double facer or such part thereof as may be essential to an understanding of the present invention, and

FIG. 12 is a diagrammatic view showing the complementary electrical control circuit.

With reference to FIGURES 1^a and 1^b of the drawings, the double facer therein illustrated is generally of conventional form. It comprises at the infeed end, as illustrated in FIG. 1^a, a heating section 10 into which is fed a single faced corrugated web 11 with the corrugated component at the under side, together with a backing web 12 which is to be adhesively attached to the crowns of the corrugated component to form the double faced web. In entering the machine an adhesive is applied to the crowns of the corrugations by conventional means (not shown)

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and thereafter the facing web 12 is pressed against the adhesive coated crowns.

In the heating section 10 of the double facer, the composite web is passed over a series of hot plates 13 which function to cure and/or set the adhesive and to establish a bond between the web 12 and the corrugated board. From the heating section 10 the composite web passes to a cooling section 14, shown in FIG. 1^b. Movement of the web through the double facer is effected by upper and lower traction belts 15 and 16, the upper belt 15 extending the full length of the double facer including the heating and cooling sections while the lower belt 16 is confined to the latter section. As illustrated the upper belt 15 passes around a roll 17 at the infeed end of the double facer and around a drive roll 18 at the outfeed end of the cooling section 14. The belt 16 passes around a roll 19 at the infeed end of the cooling section and around a drive roll 21 at the outfeed end of this same section. The rolls 18 and 21 are driven from a main drive motor 8 through a line shaft 7 and suitable transmission which in certain instances referred to above may include a clutch 9. When a clutch is used, it is associated with a limit switch LS3 for junctions hereinafter described. This drive is shown schematically in FIG. 1^b. The lower run of the upper belt 15 engages the upper face of the composite board over the full length of its movement through the double facer, and the upper run of the lower belt 16 engages the underface of the composite web during its movement through the cooling section, the two belts providing the traction required to draw the web through the facer.

In the heating section 10 the composite web is pressed into firm contact with the surfaces of the hot plates 13 by the belt 15 and through the medium also of a plurality of idle pressure rolls arranged in longitudinal series over the length of the heating section, said rolls seating upon the upper surface of the lower run of the belt 15 and holding the belt down against the web. These idler rolls are divided in the present instance into two sets one of which comprises a plurality of the rolls at the extreme infeed end of the machine. In the present instance this set comprises four rolls designated by the reference numeral 22, and the rolls of this set are distinguished from those of the other set 23, by the fact that they may be loaded or unloaded through the medium, in the present instance, of individual hydraulic cylinders 24. The rolls 23 seat by gravity upon the belt.

Each of the rolls 22 and 23 is journaled in a pair of arms 25, 25, respectively at opposite sides of the machine, which arms are pivotally attached to side rails 26, 26 and 27, 27, also positioned respectively at opposite sides of the machine as best shown in FIG. 4. As shown in FIG. 1^a the rails 26 are composed of longitudinal sections each of which is supported on a plurality of vertical members 28 slidably supported in guides 29. As shown in FIG. 4 the upper ends of the support members 28 are attached to angle bars 31 which are secured to the rails 26 and which extend longitudinally of the latter. The shafts 32 on which the individual rolls 22 and 23 rotate extend outwardly at both ends through the rails 26 and 27 and attached to the projecting ends of the shafts are levers 33 which normally occupy the position shown in FIGS. 2 and 4 but which may be rotated to bring radially projecting portions 34 thereof into engagement with the horizontal flange 35 of the angle 31, to thereby elevate the rollers from their seating engagement with the lower run of the upper belt 15. The shafts 32 pass through enlarged openings 36 in the side rails which permits elevation of the rollers as described independently of the rails. The levers are supported in the normal position by pins 37, see FIG. 2, and in this position, when the roller is riding on the belt as in normal operation, the hub portion of the lever 33 lies above the flange 35 of the angle 31. Elevation of the rail and of the angle 31, as hereinafter described, will bring the flange 35 into engagement with the underside of the lever and through the latter will also elevate the roller.

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Provision is made for elevating the rails 26 and 27 to thus move the rolls 22 and 23 to an elevated position above the belt. This means comprises in the present instance a hydraulic cylinder 41, one at each side of the machine, each of which is connected, as best shown in FIG. 1^a, to the downwardly extending arm 42 of a bell crank lever 43 pivotally mounted at 44 in the fixed side frame 45 of the machine. A roller 46 at the outer end of the other arm 47 of bell crank lever 43 underlies the lower edge of the proximate side rail 26. A number of similar bell crank levers, designated collectively by the reference numeral 48, are provided longitudinally of and at each side of the machine similarly associated with the rails 26 and 27 and each connected to the bell crank lever 43 at its side of the machine through a common connecting rod 49. The rails 26 when in the normal depressed position are supported on blocks 5 which rest on and extend upwardly from main frame 45 to the undersides of the rail, these blocks being located at the inner sides of the respective slides 28 as shown at the right of FIG. 2. When the cylinder 41 is actuated to turn the levers 43 in counterclockwise direction about the pivots 44, as viewed in FIG. 1^a, this lever and the associated levers 48 operate to elevate the rails 26. Elevation of the rails 26 carries with them the rollers 23 which are thereby lifted from the belt 15.

As shown in FIGS. 1^a and 2, the rails 27 are connected to the rails 26 by means of links 51 which are rigidly secured to the ends of the rails 27 and are pivotally attached at 52 to the proximate ends of the adjoining rails 26. The opposite ends of the rails 27 are connected by pins 53 to lever arms 54 located one at each side of the machine, the arms being pivotally connected to the main frame 45 as indicated at 55 in FIG. 2. As shown in FIG. 6 the pins 53 are attached to and project from the inner faces of the levers 54 and carry on their projecting ends rollers 56 which ride in longitudinal slots 57 in the ends of the rails 27. These levers 54 also provide a bearing support for the belt roll 17. The free ends of the levers 54 are supported in their normal depressed positions upon adjustable stops 57 in the base 58 of the machine, and these ends of the lever are also connected to the upper ends of cylinder and piston assemblies 59, 59, the lower ends of which are pivotally anchored at 61 in the said base 58. Means is provided for admitting a hydraulic or other fluid pressure medium to the cylinder 59 to elevate the free ends of the levers 54 about the pivots 55. Such elevation, occurring simultaneously with actuation of the cylinders 41 as described above results in elevation of the rails 26 and 27 and also of the belt pulley 17 as indicated in broken lines in FIG. 2. Relatively fixed limit switches LS1, LS2, and LS4, see FIG. 1^a, are operatively associated with the rail 26 so as to be responsive to the movements of the rails as hereinafter more specifically described.

Depending from the lower edge portions of the rails 26 and 27 is a series of cross plates 62 which collectively extend over the full length of the heating section of the double facer. As shown in FIG. 4 these plates extend across the machine and normally occupy a normal position, corresponding to the normal depressed position of the rails 26 and 27, wherein the upper edges 63 of the plates lie below the upper or working surfaces of the hot plates 13. This is shown in FIG. 4 wherein one of the hot plates 13 with the steam chest 64 of which it forms a part is shown behind a plate 62. The plates 62 are suspended through the medium of trunnions 65, one at each side of the machine, which extend through bearing blocks 66 on the lower edges of the respective rails 26 and 27. The normal distance of the upper edges of the cross plates 62 and the upper surfaces of the hot plates 13 is so related to the aforesaid normal clearance between the levers 33 and the horizontal flange 35 of the angle bars 31 that an initial elevation of the rails 26 and 27 sufficient to elevate the rollers 22 and 23 from the belt 15 will not

carry the plates 62 above the level of the hot plate surfaces so that it is possible to lift the rollers from the belt without lifting the belt from the hot plates. The purpose of this provision will appear below. Further elevation of the rails 26 and 27 as previously described will however elevate the plates 62 above the tops of the hot plates and the plates will then act to lift the lower run of the belt 15 from the hot plates or from the composite web then supported by the plates.

The cooling section 14 of the double facer is also of generally conventional form. In machines of the continuously running type, such as shown for example in U.S. Patent 2,309,728, the belt drive rolls 18 and 21 are geared to the main drive motor of the double facer machine; whereas in machines of another type the belt rolls are conventionally connected to the main drive motor through the medium of a clutch through which the double facer may be operatively disconnected from the main drive for the other parts of the double facer machine. In the present instance the conventional idler rolls 71 are provided for maintaining adequate traction between the belts 15 and 16 and the opposite faces of the double faced composite web which is designated in the drawings by the reference numeral 72.

In machines of this class the accuracy of feed depends in large degree on maintenance of a proper belt tension. Tensioning of the upper belt is a particular problem in machines, such as that described above, wherein the belt is long and is subjected to the widely differing moisture conditions of the web between the infeed and outfeed ends of the machine. In order to maintain a constant upper belt tension our invention provides a tensioning device illustrated more particularly in FIGURE 1^b and in FIGURES 8 and 9.

This device consists of two idler rolls 73 and 74 which are journaled at each end in arms 75 and 76 rigidly connected by a central hub structure 77. The hub structures are connected by a shaft 78 which is journaled in brackets 79, 79 at opposite sides respectively of the main frame 45 of the machine. The shaft is extended at one end for attachment thereto of an arm 81 which is pivotally connected at its outer end to one end of a piston-cylinder assembly 82, the lower end of this assembly being pivotally anchored at 83 in a bracket 84. The cylinder 80 of the assembly 82 may be connected to a source of fluid pressure through fittings 85 and 86 to subject the shaft 78 and the arms 75 and 76 to torque tending to rotate the shaft in clockwise direction, as viewed in FIG. 8, the rollers 73 and 74 being thereby forcibly urged against opposite sides of the belt 15. The effect, as best shown in FIG. 1^b, is to shorten the effective length of the upper belt 15 and to thereby subject it to tension. By providing means for controlling the fluid pressure applied to the upper end of the cylinder 82 as hereinafter described, a substantially constant tensioning pressure may be applied to the belt regardless of variable conditions to which the belt might be subjected affecting its length. It will be noted that the plates 62 in elevating the lower run of the belt as described will materially reduce the load to which the tensioning devices is subjected when the rails 26 and 27 are elevated as described above.

In FIG. 10 we have illustrated a modified form of tensioning device wherein the piston-cylinder assembly 82 is replaced by a hydraulic torque actuator designated in the drawing by the reference numeral 87. This actuator comprises a rotor which is connected through a splined rotor shaft 88 to the shaft 78 previously described. The rotor may be subjected through hydraulic connections 89 and 91 respectively to hydraulic pressures tending to rotate the rotor in either direction selectively, the hydraulic pressure thus applied to the rotor applying torque in desired direction to the shaft 78. By adequate control of the fluid pressure it is possible with this actuator to apply a predetermined desired torque to the shaft 78 and there- through to apply a predetermined desired tension to the

belt in the manner described above. Torque actuators of this type are known in the art and require no further description.

The fluid pressure system, hydraulic in the present instance, through which the several parts of the machine are actuated, is shown in FIG. 11. It consists of a pump 101 which is driven by a motor 102 and which supplies pressure fluid from tank 103 to a pressure line 104. This line may be connected through a solenoid operated valve 105 to the rod ends of the cylinders 41, 41 and to the rod and head ends selectively of the cylinders 59, 59. The pressure when applied simultaneously to the rod ends of cylinders 41 and to the head ends of cylinders 59 will elevate the rails 26 and 27 as described above. Between the valve 105 and each of the cylinders 41 and 59 is a complementary pair of adjustable flow regulating valves 106, 107 of conventional type which serve to regulate the rate of flow of the hydraulic medium to and from the said cylinders and thereby the rate of movement of the pistons in the cylinders. When the head ends of cylinders 59 are connected to the pressure line 104, the rod ends of these cylinders are connected through the valve 105 with the tank 103 for discharge of the hydraulic medium to the latter, and vice versa. The head ends of cylinders 41 are continuously connected to the tank through line 108.

The valve 105 is shown in the neutral position in which the connections to both ends of the cylinders 59 and to the rod ends of the cylinders 41 are stopped, the pump 101 being disconnected from the cylinders of both sets. Adjustment of valve to the right as viewed in the drawing, under actuation by solenoid 111, connects the cylinders to the pump and to the tank as described above for elevation of the rails. When adjusted to the left by actuation of solenoid 112, the valve acts to connect the rod ends of the cylinders 41 to tank and the rod ends of cylinders 59 to the pressure line 104 through line 109 while at the same time connecting the head ends of the cylinders 59 to the tank. The rails 26 are then lowered by their own weight and the rail sections 27 return to the low position by gravity plus the fluid pressure applied through cylinders 59. After the rails are lowered and the valve 105 is returned to neutral position the pressure fluid is locked in the upper end of cylinders 59 and acts to maintain the levers 54 and rails 27 in the depressed positions.

The line 104 contains a pressure relief valve 114, which may be set as required, and also a check valve 115. Connected also to the line 104 below the valve 105 is the cylinder assembly 82 of the belt tensioning device described above. This cylinder, through line 116 and flow regulator 119, is under constant pressure to tension the belt, the pressure as indicated on gauge 117 being subject to regulation through adjustment of relief valve 118. The head end of the cylinder is continuously connected through line 120 with the tank.

The pressure line 104 is connected with an accumulator 122 which is precharged to a predetermined pressure. Connected in the line is a pressure actuated switch 123 which is open at normal line pressure to shut down pump motor 102 and which closes automatically to restart the pump when the pressure falls to a predetermined minimum. Pressure in line 104 is indicated by gauge 113. Also connected with pressure line 104 is a system containing the cylinders 24 of the pressure rolls 22. As illustrated in the diagram, the cylinders are in pairs of which the component cylinders are connected respectively to the opposite ends of the respective rolls. The system comprises a pressure line 125 connected to the pump, and a return line 126 extending to the tank 103. The line 125 is maintained at a relatively low pressure as compared with line 104 by flow regulator 124 and relief valve 127. This line contains also an accumulator 128 and pressure gauge 129. Connection of the lines to the cylinders 24 is controlled by solenoid actuated valve 130 which in the neutral position, as shown, stops off the lines 125 and 126. In this neutral position of the valve, the lines 131

and 132 which extend from the valve to the opposite ends respectively of the cylinders 24 are also stopped so that the fluid medium is confined in both ends of the cylinders so that the rolls 22 are locked in position.

Adjustment of the valve 130 to the left, as viewed in the drawing, by solenoid 134, connects pressure line 125 with cylinder line 132, and the return line 126 to line 131. Pressure is then applied to the head ends of cylinders 24 and the rod ends of the cylinders are open to discharge. The cylinder assemblies then exert pressures tending to increase the weight of the associated rolls 22 on the belt. The amount of increase over the dead weight of the rolls may be regulated by adjustment of valve 127. If the valve 130 is adjusted to the right from the neutral position by solenoid 133, the pressure line 125 is connected to line 131, and line 132 is connected to discharge. The cylinders then tend to elevate the rolls and to reduce the dead weight thereof on the belt. The real pressure of the rolls on the belt can again be regulated through valve 127.

This ability afforded by the cylinders 24 and the associated fluid pressure system to accurately regulate the pressures exerted on the web components by the belt 15 as it enters the double facer machine is an important feature of the present invention. The formation of an effective bond between the corrugated component of the single faced web 11 and the backing 12, particularly with certain of the adhesive conventionally used, depends not only upon application of adequate pressure on the webs as they enter the machine but also on maintaining the pressure constant during passage of the web over the hot plates until the adhesive is sufficiently set to hold the backing to the corrugations. The infeed portion of the machine is the critical area in this respect since if the pressure is relaxed in this area even momentarily, due for example to any tendency of the pressure rolls to chatter, the adhesive contact may be lost and if lost cannot be regained. Defective board from this cause is not uncommon with the double facer mechanisms of the prior art. The present invention provides in effect a hydraulic lock by means of which a predetermined pressure may be applied and constantly maintained at the infeed end of the double facer holding the single faced web and the backing together against the hot plate surface during the critical adhesive setting period.

The invention also affords an effective means for adjusting the aforesaid pressure to the individual requirements of the different characters and/or weights of the web material so that the maximum effective weight which may be applied safely to any web material at the operating speed may be utilized. The pressure of the rollers may, in accordance with the invention, be made additive to the weight of the belt or subtractive, so that pressures may be obtained over a wide effective range. It may be noted further that the positive character of the weighting means is aided by the hydraulic lock in the cylinders 59 which tends to hold the lever 54 and upper belt pulley 17 in the depressed and normal operative position.

FIG. 12 is a schematic representation of the various components of the electrical control circuit of the double facer and illustrates particularly those circuits controlling such elements and/or functions of the hydraulic system of the machine such as the pump, the positive or negative loading of the forward idler rolls and the belt lifting mechanism. The diagram also shows a portion of the main drive motor control circuit. Since the circuitry involves both D.C. and A.C. voltage sources, the diagram is divided into two inter-related parts identified as primary and secondary circuits respectively.

The A.C. control voltage source is shown at I_1 and I_2 for operating all controls except the main drive motor which is a function of the run relay shown at RR, said relay being in the D.C. circuit with the main drive motor. L_1 and L_2 represent D.C. voltage sources.

It will be understood that the run relay RR is responsive to the main drive motor circuit to the extent that shut down originating either at the main drive motor power source or at any one of the auxiliary units of the battery which would necessitate double facer shut down, would also act to deenergize the run relay. Accordingly the control circuit as illustrated is shown only as it affects the double facer machine per se up to and including the said run relay. It will also be understood that deenergization of said run relay will initiate shut down at the main drive source of the unit and vice versa.

As previously stated, there are two modes of operation of the double facer unit regarding procedure in effecting change over. In the more conventional type of operation, that is the one involving complete shut down of the double facer during change over periods, a clutch 9 (see FIG. 1^b) is used to disconnect the double facer from the main drive motor 8. In the other mode of operation change over is effected while the double facer continues operation, but at a substantial reduction in speed. This latter is referred to as continuous running operation.

In the following description with particular reference to the diagram of FIG. 12 the first referred to or clutch type of operation will be considered first. Common to either mode of operation, however, a shut down initiated at the main drive unit whether the mode of operation is of the conventional or continuous running type, the run relay will be deenergized initiating the sequence of the automatic belt lift operation.

Identification of the various machine elements and/or functions as related to the control circuit and the particular area of the diagram in which they appear will be noted at the right hand border of the diagram.

In the motor circuit of the hydraulic pump, the motor starter relay MR is shown connected to one side of a voltage source I_2 by line 200 thru overload relay contacts 10 l and 20 l , and to the other side I_1 of said voltage source by line 201 thru the pressure switch 123 and start-stop switch 202. It will be obvious that pump operation is initiated by closing the start contacts of the switch 202 to energize the starter relay MR which in turn closes a run circuit to the pump motor (not shown). Once established, pump operation will remain under control of the switch 123 which, in response to fluid pressure in the system, will open or close the motor circuit.

The solenoids 133 and 134 for operation of the four-way self-centering valve 130 for control of the loading of the forward idler rolls of the heating section of the double facer are shown connected to one side I_2 of the voltage source thru line 203, and to the other side I_1 thru selector switch 204 and line 205. Operation is in obvious manner. Closing of the circuit thru switch 204 will energize solenoid 133 or 134 to give either positive or negative loading respectively, to the idler rolls.

Considering now the automatic belt lift feature, it will be assumed that the double facer is in operation with the belts in the normal lower run position and that stock is being fed between the belt and the surface of the hot plates. With the selector switch SS1 in the "automatic" position, the belts will continue to run in normal fashion until the clutch of the double facer disconnects the machine from the main drive source. Disengagement of the clutch operates to close the contacts of limit switch LS3 thereby energizing relay 3CR with the resultant closing of said relay contacts 3cr(a) and 3cr(b) in the secondary control circuit, and contacts 3cr(c) in the primary control circuit.

In the latter, i.e. the primary or main drive motor circuit, closing of the contacts 3cr(c) permits continued operation of said main drive motor by maintaining the main drive run relay RR energized when the contacts (c) of limit switch LS2 open due to subsequent operation of the belt lifting mechanism.

Closing of the contacts $3cr(a)$ and $3cr(b)$ closes a circuit to the time delay relay TDR thru the contacts (b) of limit switch LS2 and contacts (b) of relay 5CR, energizing said relay TDR and initiating a "timing out" period which upon expiration thereof closes the contacts tdr of the relay in the "up" control circuit with the resultant energization of the "up" relay UR by completing a circuit from line l_1 thru contacts $3cr(a)$, line 210, contacts (a) of limit switch LS1, said contacts tdr and closed contacts (b) of "down" relay DR. The time delay relay TDR is responsive to the main drive motor circuit and serves to prevent operation of the belt lift mechanism unless the belt drive is interrupted for a period of time in excess of the "timing out" period set initially in the relay. Restarting the drive before the expiration of the above mentioned "timing out" period will maintain the relay contacts tdr open.

The relay UR thus energized, closes a circuit thru its contacts $ur(a)$ to solenoid 111 of the belt-life hydraulic control valve 105, initiating the belt lifting sequence, simultaneously opening contacts $ur(b)$ in the "down" relay control circuit and closing contacts $ur(c)$ in the "up" control circuit. Said latter contacts close a hold circuit to the "up" control relay UR to insure uninterrupted operation of the belt lift mechanism to its upper limit position regardless of the setting of the time delay relay which at the moment of "timing out" would open its contacts tdr and thus possibly preclude complete elevation of the belts.

Upon reaching the upper limit position of the belt lifting mechanism however, the upper limit switch LS1 opens its contacts (a) and (b) thereby deenergizing the "up" control relay UR. As a consequence, the contacts of said relay are reversed from the positions described above and restored to those normal to deenergization of the relay.

It should be noted here that elevation of the belt lift mechanism may also be instituted manually at the discretion of the operator by depressing the "up" push-button provided the machine is at a standstill. Such procedure closes a circuit to the "up" control relay UR from the line l_1 , thru contacts $3cr(a)$, line 210, normally closed contacts of "stop" switch 211, contacts (b) of limit switch LS1, contacts of "up" push button switch, contacts of normally closed "down" push button switch and normally closed contacts $dr(b)$ to said relay, resulting in like operation of the solenoid controlled hydraulic valve 105 as afordescribed.

It should be noted also that closing of the contacts $3cr(c)$ upon energization of the relay 3CR, that a shunt circuit to the run relay in the main motor drive circuit is established, so that continued operation of the main drive may be assured when the contacts (c) of limit switch LS open upon the belt lifting mechanism reaching its upward limit position. By this procedure the double facer although disengaged from the main drive permits the other auxiliary machines of the battery to continue normal functioning so that all adjustments, etc. attending changeover may be accomplished.

While the above described automatic operation of the belt lift mechanism has been concerned with belt protection in the event of a shut-down of the double facer by disconnection from the main drive motor thru the medium of the double facer clutch 9, the same result obtains should the main drive motor 8 be stopped with the double facer clutch engaged. In such an event contacts $rr(a)$ of the main drive run relay RR which is in the hold circuit of the main drive motor close upon deenergization of the said relay and thru the circuit connections, switch contacts, etc. previously described, effect in like manner the operation of the "up" control relay UR with subsequent elevation of the belts from off the hot plates. In this instance, however, the connection with the line l_1 is made thru the contacts $rr(a)$, the contacts $3cr(a)$ being open. Time delay relay TDR now energized thru

the presently closed contacts LSR (a) (being responsive to a slow speed relay in the main drive motor circuit) holds out its contacts tdr for the prescribed time interval for which it is set, say 15 seconds, now permits closure of said contacts upon expiration of said time interval closing the circuit to the "up" control relay UR as previously set forth.

It will be obvious then, from the foregoing, that the belt lifting mechanism is operative to effectively elevate the belts from a position of normal run condition wherein stock is being fed thru the machine, and that any interruption of the belt drive mechanism whether by disconnection of the double facer from the main drive motor by means of the clutch 9 or by stoppage of the main drive motor 8 itself, will result in automatically raising the belts out of engagement with the double facer hot plates or the stock being fed thereover.

Once the belts have been raised to the upper limit position, however, in response to automatic or manual control, the machine may not again be started until the belts have been lowered to their normal run position adjacent the hot plates. In the elevated position of the belts the contacts (c) of limit switch LS2 in the main drive circuit are open.

The following procedure is necessary to initiate normal run of the double facer after the belts have been elevated as a result of a shut-down period. In the case of stoppage due to disengagement of the double facer clutch, the said clutch must first be reengaged thereby opening the contacts of limit switch LS3 and deenergizing the relay 3CR with subsequent opening of its contacts $3cr(a)$, $3cr(b)$ and $3cr(c)$. The belt lift mechanism being in the upper limit position contacts (c) of LS2 (main drive circuit) are also open resulting in deenergizing relay RR in the main drive circuit with resultant closing of said relay contacts $rr(b)$ and opening RR relay hold contacts $rr(c)$.

Contacts $rr(a)$ of said relay located in the lift circuit however are closed, completing a circuit from line l_1 , thru stop switch 211, presently closed contacts (a) of LS2, thru the "up" push-button to one side of the open contacts of the "down" push-button. The belt may now be lowered by depressing the "down" push-button and closing the circuit to the down relay DR thru the presently closed contacts (b) of the "up" relay UR. Energization of the said relay closes a relay "hold" circuit thru the contacts $dr(c)$ and $dr(a)$. Thru contacts $dr(a)$ the solenoid 112 of the control valve 105 is energized with the resultant lowering of the belts to their lower limit position in the proximity of the hot plates.

Upon reaching the lower limit position the limit switch LS2 reverses, deenergizing the "down" relay by opening its hold circuit established thru contacts $dr(c)$, simultaneously closing its contacts $dr(b)$ in the "up" control circuit and deenergizing the valve solenoid 112 by opening contacts $dr(a)$.

Contacts (b) of limit switch LS2 are also closed in the "down" position of the belt and thru the presently closed contacts (a) of the slow speed relay LSR, a circuit is closed to the time delay relay TDR. Energization of said relay results in initiation of the "timing out period" previously referred to which upon expiration closes the contacts tdr of the relay in the event the main motor circuit is not closed thru the run relay RR as previously described.

Contacts (c) of limit switch LS2 also closed, together with closed contacts $rr(b)$ in the run relay RR circuit may now be utilized to initiate normal run operation of the double facer by depressing the start button 215 in said circuit thereby energizing the said run relay and closing the contacts $rr(c)$ of the relay hold circuit. If completion of the double facer drive circuit takes place within the prescribed run out period of the time delay relay TDR and machine operation is thus initiated the

belts will remain down so long as machine operation continues uninterrupted.

A stop switch shown at 216 in the run relay circuit may be used at the discretion of the operator of the double facer to stop the machine at any time with resultant automatic elevation of the belts thru the aforedescribed belt lift mechanism.

The contacts $sr(a)$ and $sr(b)$ of the low speed relay (not shown), associated with the main drive motor are shown in the diagram, it being understood that said contacts $sr(b)$ will open in the event of stoppage of the main drive motor and will only close to permit initiation of the run circuit thru start button 215 after the said motor has come to rest.

The control is particularly adaptable for facilitating the threading operation of the machine when introducing a new end of stock to the double facer. For this purpose, a fourth limit switch LS4 is provided in the primary control circuit which is normally closed with the belt lifting mechanism in its lowermost position and which, together with limit switch LS2 remains unactuated during limited movement of the lift mechanism away from this position, but beyond this limited range will reverse contacts in response to continued upward movement of the said mechanism. Stoppage of the belt lift mechanism during this increment of initial movement results in raising the lift mechanism to a degree sufficient to relieve the belt from idler roll pressure and to the extent that the belt lifting bars are still below the surface of the hot plates so as to preclude possible frictional contact thereof with the belt when in motion as previously described.

Such a position is obtained by first bringing the machine to a stand-still by depressing the stop switch 216 in the primary circuit, thereby deenergizing the run relay RR by opening its hold circuit thru contacts $rr(c)$ with resultant stoppage of the main drive motor. The clutch 9 remains engaged.

Contacts $rr(a)$ of the relay in the secondary circuit are now closed and the "up" relay UR may now be energized by depressing the "up" push button switch to initiate upward movement of the lift mechanism. However, such movement is immediately cancelled by depressing stop push button switch 211, arresting such upward movement of the lift mechanism within the range permitted by limit switch LS4. This limited movement of the lifting mechanism according to the conditions set forth will maintain the limit switch LS4 closed and permit low-speed "jogging" of the main drive motor circuit through the "jogging" switch 217 as identified in the run circuit; provided such "jogging" occurs with sufficient frequency that the duration of any one "jog" does not exceed the time run out setting of the time delay relay TDR. Otherwise, the belt lifting mechanism will be automatically actuated thru the control circuit as previously described, and the belts will be elevated to the upper limit position.

Upon completion of the threading operation the lifting mechanism may restore idler roll pressure again by normal operation of the "down" control push-button.

It will be noted that the belt lifting mechanism must be returned to its lower limit position before normal continuous run operation of the double facer is started and that the run relay circuit must be energized by closing the start switch 215 in the primary circuit before expiration of the "timing out" period of the time delay relay TDR. Failure to do so will result in the belt lift mechanism automatically returning to its elevated position.

If for any reason, it is desirable to lock-out the automatic belt lift feature of the control circuit, the selector switch SS1 in the secondary circuit may be set to its "manual" position with the resultant deenergization of the relay 5cr and dropping out of the time delay relay TDR. Thereafter elevation and lowering of the belt lift mechanism will be under control of the manually operable push-button switches for "up" and "down" position-

ing respectively at the discretion of the machine operator.

In the case of the continuous running mode of operation the clutch 9 is dispensed with and the double facer is directly connected to the main drive source through differential gearing. Accordingly the limit switch LS3 is also deleted and a pair of normally open contacts $5cr(a)$ on relay 5CR are connected in the line as indicated by dotted lines in the diagram. Closing of the circuit through the selector switch SS1 to energize the relay 5CR also closes the contacts $5cr(a)$.

In all other respects the operation of the belt lifting mechanism is the same as previously described.

We claim:

1. In a machine for adhesively uniting travelling webs in face-to-face relation, the combination with a heated surface over which the webs are advanced in the face-to-face relation, a travelling belt traversing the heated surface and retaining the composite web in intimate heat exchange contact with the surface by pressure on the side of the web out of contact with the heating surface, and means controlled by and responsive to interruption in the traverse movement of the belt for automatically displacing the belt away from the plane of the heated surface into spaced relation therefrom.

2. In a mechanism for adhesively uniting travelling webs in face-to-face relation, the combination with a heated surface providing a support for the webs and means for advancing the webs in face-to-face relation over said surface, said web advancing means comprising a traction belt overlying and exerting pressure on the composite web to hold the latter in intimate heat-exchange contact with the heated surface, mechanism for operating the belt to traverse the said surface, and means controlled by and responsive to an interruption in the said operation of the belt for elevating the belt to clear the heated surface.

3. In a mechanism for adhesively uniting travelling webs in face-to-face relation, the combination with a heated surface providing a support for the webs and means for advancing the webs in the face-to-face relation over said surface, said web advancing means comprising a traction belt overlying and exerting pressure on the composite web to hold the latter in intimate heat-exchange contact with the heated surface, mechanism for operating the belt to traverse the said surface, belt elevating mechanism for elevating the belt above the plane of the heated surface so as to clear said surface, and control means for automatically actuating the belt elevating mechanism when the belt operating mechanism is interrupted.

4. The combination according to claim 3 wherein the belt operating mechanism comprises a drive motor and wherein the said control means comprises devices operating automatically when the operation of the motor is interrupted to actuate the belt elevating mechanism.

5. The combination according to claim 3 wherein the belt operating mechanism comprises a drive motor and a clutch connecting the motor to said mechanism, and wherein the said control means comprises devices responsive to disengagement of the clutch for actuating the belt elevating mechanism.

6. The combination according to claim 3 including manually actuated means for reversely actuating the belt elevating mechanism to lower the belt into operative position, and devices for preventing restarting of the belt operating mechanism until the belt is in the said operative position.

7. The combination according to claim 6 including devices responsive to a predetermined delay in restarting of the belt operating mechanism after the said lowering of the belt for reactuating the belt elevating mechanism to again elevate the belt.

8. The combination of claim 2 including hold down rolls for the belt operatively connected to the belt elevating mechanism for elevation by the latter, and lost

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motion means between the belt and said mechanism whereby in operation the mechanism act initially to elevate the rolls from the belt in advance of elevation of the belt.

9. The combination of claim 8 wherein the belt elevating mechanism comprises members forming a mount for the hold down rolls and belt elevating elements suspended from said members below the level of heated surfaces when the rolls and belt are in normal operating positions.

10. The combination of claim 8 including control means for actuating the said elevating mechanism simultaneously with the belt operating mechanism and for interrupting operation of the elevating mechanism after initial elevation of the hold down rolls from the belt and prior to elevation of the belt.

11. The combination of claim 1 including control means for delaying displacement of the belt for a predetermined time lapse after interruption of the traverse movement of the belt.

12. The combination of claim 1 including control means precluding operation of the displacing means to displace the belt until the traverse movement of the belt has been interrupted.

13. The combination of claim 1 including means for exerting a constant tensioning force on the belt.

14. In a machine for adhesively joining travelling webs in face-to-face relation for continuous production of a composite web, means at the infeed end of the machine for pressing the webs together in the face-to-face relation, said pressure means including an underlying support for the webs, a travelling belt overlying and confining the webs to said support, a plurality of rollers arranged along the run of the belt to press the belt against the web, and means for regulating the pressure of each of the rollers on the belt, said pressure means being operable for positively continuously maintaining the pressure during a predetermined part of the travel of the webs through the machine.

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15. A machine according to claim 14 wherein the pressure regulating means comprises devices for both increasing and decreasing the dead weight of the individual rollers on the belt.

16. A machine according to claim 15 wherein the pressure regulating means consists of fluid-pressure motor means operatively connected to the respective rollers, and means for actuating the motor means both to add and subtract from the dead weight of the rollers on the belt.

17. A machine according to claim 14 wherein the pressure means includes a fluid-pressure motor means including a movable member connected to the rollers and an associated pressure chamber, means for introducing a pressure fluid to said chamber to actuate the said member to urge the roller into pressure-applying relation to the web, and means for locking the said fluid in the chamber to maintain the pressure constant.

18. A machine according to claim 14 wherein the pressure means includes a series of rollers for applying pressure to the web, fluid pressure motor means operatively associated with the rollers, and means for actuating the motors to afford a predetermined pressure of the rollers on the web.

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