June 9, 1953 J. L. McCLEARY ET AL 2,641,416

APPARATUS FOR AND METHODS OF ALIGNING WEBS FOR LAMINATION

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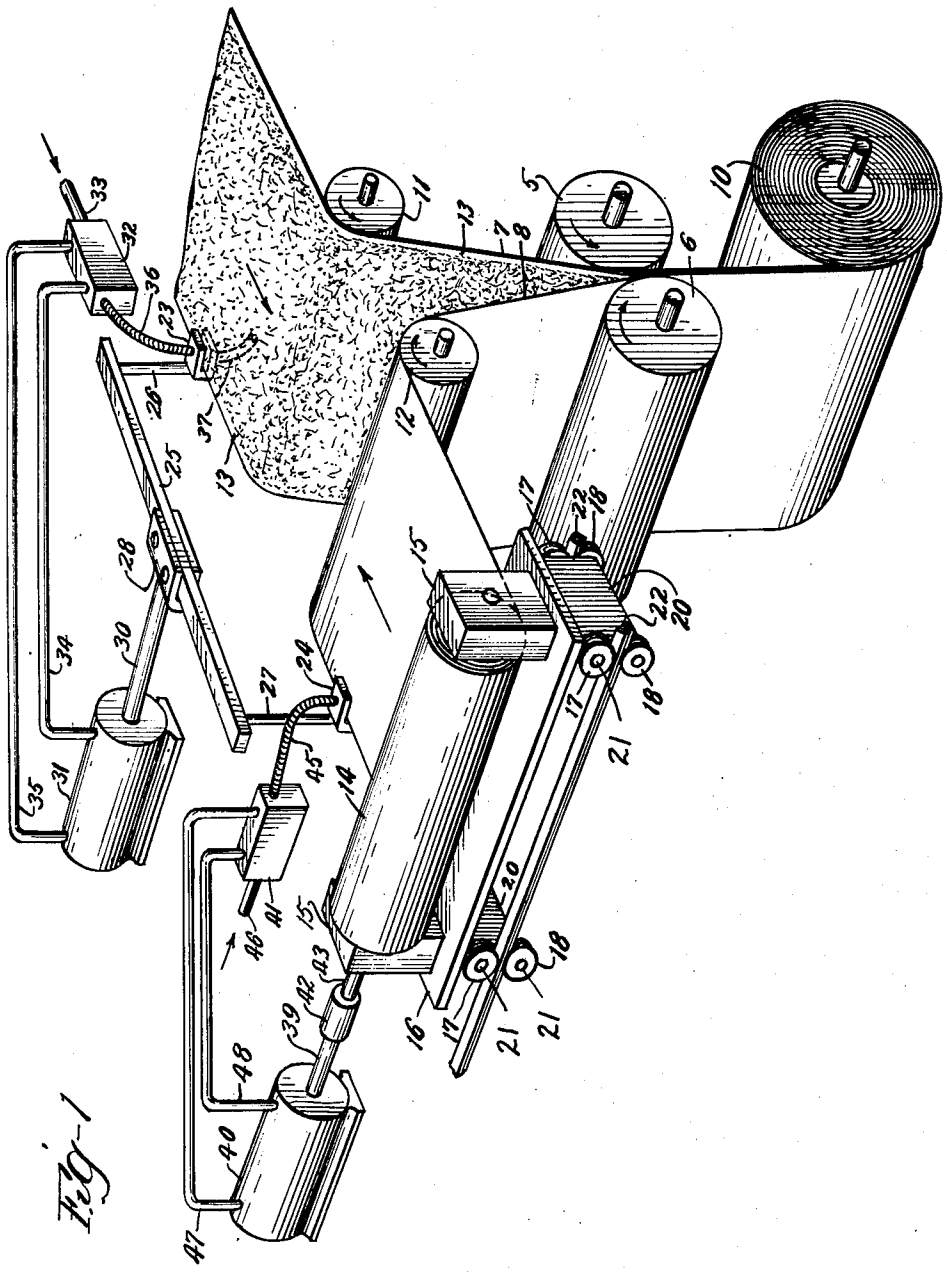


Fig. 1

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Fig-2

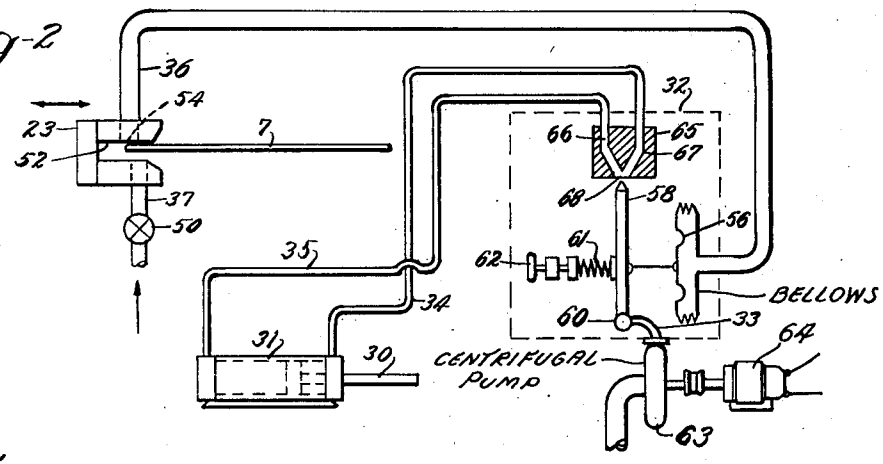


Fig-3

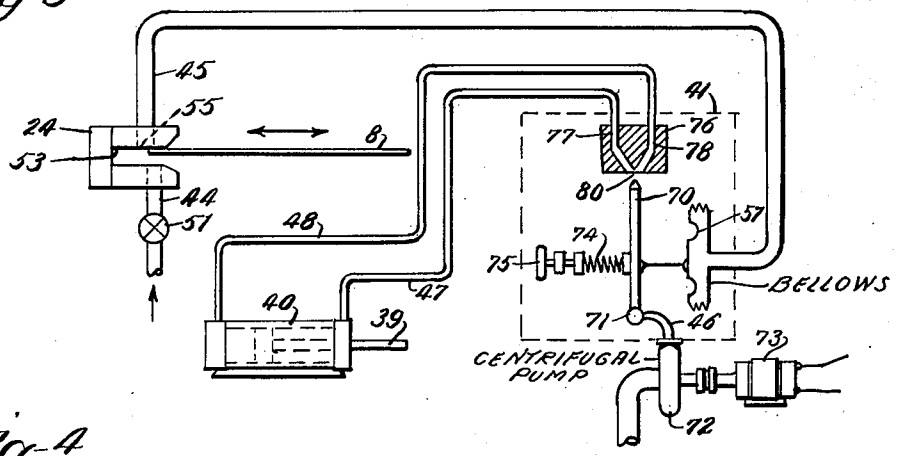
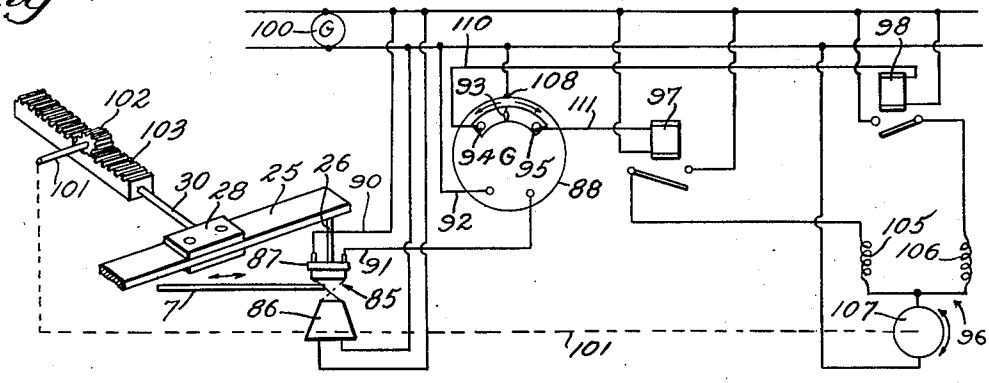


Fig-4



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APPARATUS FOR AND METHODS OF ALIGNING WEBS FOR LAMINATION

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4 Claims. (Cl. 242—76)

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This invention relates to new and useful improvements and innovations in apparatus for and methods of aligning webs undergoing continuous lamination.

In the art of laminating two or more webs together by passing the webs between combining rolls, accurate alignment of the running webs so that the edges register has constituted a difficult and annoying problem for which there has heretofore been no completely satisfactory solution. We are aware that various schemes and apparatus have been previously proposed for the purpose of maintaining webs in alignment. A number of patents have issued covering different forms of apparatus for aligning webs two of which are 1,691,772 and 1,858,436.

It is current practice in modern laminating plants to employ commercially available automatic type devices for the purpose of aligning webs as accurately as practical before they pass between the combining rolls. In so far as we are aware these various control and aligning devices now in use all operate on the same principle of attempting to keep the edge of each running web in a fixed line as nearly as practical. While these presently available web control devices are of some value, at best they only do a relatively incomplete job of accurately aligning the primary webs and secondary webs as they run in between the combining rolls.

For example, in present laminating apparatus it is the practice to have the width of the primary web exceed the width of the adhesive coating thereon by from 1/8 to 3/16 of an inch along each edge. The purpose of having these uncoated margins along the edges of the primary web is to allow for inaccuracy in alignment of the secondary web with the primary web as the webs pass between the combining rolls. In other words, the primary and secondary webs may be out of alignment as much as 1/8 of an inch on a side and yet the secondary will still mask or cover the adhesive coating on the primary web. However, even with this overlap of 1/8 to 3/16 of an inch on each side of the primary web, it is still not unusual for the webs to become so unaligned that the adhesive coating on the primary web is not covered along one edge whereupon some of the adhesive is picked-up on the combining rolls. When this happens, the webs stick and break resulting in a waste of material as well as loss of time and production due to the shut down time required to clean the machine and then put it back into production. In this connection, when the machines are put back into production there

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is also some wastage which occurs at the initial portion of the new run. At the present time it is also frequently necessary to rewind secondary web rolls after they are printed and before lamination in order to lay each successive roll directly on the top of the preceding one. If these poorly wound secondary web rolls are not thus rewound, there will be sudden and frequent changes in the positions of the edges of the secondary web as it is unwound so that the laminating operation cannot be properly carried out on the present apparatus.

According to the present invention novel apparatus and methods are provided which apply a new principle to the problem of aligning webs undergoing lamination. When the new apparatus and methods are applied to laminating machines now in use, the uncoated overlap or margin along the edges of the primary webs which is now customarily from 1/8 to 3/16 of an inch, can be safely reduced to 1/32 to 1/16 of an inch thereby effecting a substantial saving of waste in the material due to trimming of the edges after lamination. Based on the foregoing figures, the waste due to trimming can ordinarily be reduced from as much as 50% to as much as 100%. Furthermore, when the new apparatus and methods are employed the overlaps of 1/32 of an inch to the overlaps of 1/16 of an inch give sufficient tolerance so that even when poorly wound secondary web rolls are used, there is practically no difficulty encountered due to adhesive sticking on the combining rolls and subsequent breakage of the webs and shut downs. Accordingly the savings which can be effected by use of the present invention by way of decreased waste and shut down time, are very substantial.

The principal object of the present invention is the provision of new methods and new automatic type apparatus for aligning webs undergoing lamination between combining rolls wherein one of the webs (e. g. the primary web) serves as a reference or control web and the other webs (e. g. the secondary webs) are automatically maintained in alignment with the reference web which may shift or weave from side-to-side.

Certain other objects of the invention will, in part, be obvious and will in part appear hereinafter.

For a more complete understanding of the nature and scope of the present invention, reference may now be had to the following detailed description thereof taken in connection with the accompanying drawings, wherein:

Fig. 1 is a partly diagrammatic and schematic

view showing one complete embodiment of the invention;

Figs. 2 and 3 are, respectively, diagrammatic views of the two servomotors and control apparatus forming part of the apparatus shown in Fig. 1; and

Fig. 4 is a diagrammatic view showing an electrical type of servomotor and control apparatus that may be employed in lieu of the servomotors and control apparatus shown in Figs. 2 and 3.

In Fig. 1 of the drawings two conventional combining rolls, one being a rubber covered roll and the other being a steam heated steel roll, are indicated at 5 and 6 for laminating a primary web 7 and a secondary web 8 with the laminated sheet being wound up on roll 10 which is suitably driven. The primary web 7 is guided into the combining rolls 5 and 6 by means of a free running support or idler roll 11 while the secondary web 8 is similarly passed over a free running guide and support roll 12. The webs 7 and 8 may be formed of any suitable material such as paper, metal foil or plastic. Specifically 7 and 8 may be formed of such materials as kraft paper, glassine paper, aluminum foil, cellophane, Pliofilm, saran, polyethylene, etc. A laminating adhesive is coated onto one of the webs and this web is customarily referred to as the "primary" web. The adhesive coating is shown on the surface of the primary web 11 in Fig. 1 and is shown to extend up to a short space from the opposite edges of the web 7. This uncoated marginal strip along each edge of the web 7 is indicated at 13—13 and is for the purpose of allowing the secondary web 8 to completely cover the full width of the adhesive coating so that none of the adhesive will be allowed to come off on the surfaces of the combining rolls 5 and 6 thereby causing sticking and breakage with resultant shut down of the machine. As pointed out above, the present invention allows the marginal overlap or uncoated strips 13 to be substantially reduced in width as compared to the marginal widths which previously had to be allowed for this purpose and which eventually had to be trimmed off and lost as waste.

The primary web 7 is usually fed onto the support and guide roll 11 from coating apparatus for applying the adhesive and, when required, it may first pass through an oven or under banks of heat lamps to place it in proper condition for laminating with the secondary web 8. The secondary web 8 may be supplied from a roll 14 on which it is wound. In practice, the secondary web is often printed with suitable advertising and descriptive material. According to the present invention the roll 14 has to be supported in such a way that it may be readily and freely shifted laterally from side-to-side in order that the secondary web 8 may be maintained in accurate alignment with the primary web 7. In Fig. 1 the web roll 14 is shown supported between end support bearings 15—15 which are mounted on the platform 16 of a carriage provided with supporting wheels at each corner. Each of the wheel or roller units comprises an upper wheel or roller 17 and a bottom wheel or roller 18 supported from the corner of the platform 16 by means of a bracket or leg 20 with the wheels 17 and 18 being supported and journaled on stub shafts 21—21. The carriage runs over rails or tracks 22—22 with the upper wheels 17 supporting the weight of the carriage on the tracks and the lower wheels 18 insuring that the carriage cannot tilt or otherwise disengage from the tracks 22. It will be understood and appreciated that numerous other arrangements may be provided whereby the web roll 14 may be movably supported so that it may be shifted from side-to-side during the course of the laminating operation.

The combining rolls 5 and 6 and the wind up roll 10 will be driven in synchronism thereby pulling the webs 7 and 8 through the laminating apparatus and unwinding the secondary web 8 from the supply roll 14.

According to the present invention, one of the webs 7 or 8 serves as a reference or control web while the other web is maintained in accurate alignment with the reference or control web. In the arrangement shown in Fig. 1, the primary web serves as the reference or control web and the secondary web 8 is continuously maintained in accurate alignment therewith. The automatically operated mechanism for maintaining the secondary web 8 inaccurate alignment with the primary web 7 as these webs pass over the support rolls 11 and 12 and into the combining rolls 5 and 6 includes a pair of devices 23 and 24 which are sensitive to the location of the corresponding edges of the running webs 7 and 8, respectively. As will appear more fully hereinafter, the edge sensitive devices 23 and 24 may take several forms and the invention in its broader aspects is not limited in respect to any particular form of the edge sensitive devices as employed. Normally, the edge sensitive devices on one installation will be of the same or similar type, although there is no reason to prevent devices of different types being used. In the arrangement shown in Fig. 1 each of the edge sensitive devices 23 and 24 is rigidly supported on opposite ends of a rigid member 25 by means of the supporting members 26 and 27 respectively. The edge sensitive device 24 may be spaced somewhat farther from the guide roll 12 than the edge sensitive device 23 is spaced from the guide roll 11. This difference in spacing compensates for any time lag which may be involved in the operation of the apparatus to bring the controlled edge of the secondary web 8 into alignment with the control edge of the primary web 7 when the latter has shifted to one side or the other. Where this time lag is not consequential, this difference in spacing is not necessary.

The transverse member 25 is supported at the middle by a clamp member 28 carried on the outer end of the connecting rod 30 of a servomotor 31. In the embodiment of the invention shown in Fig. 1 the servomotor 31 takes the form of a double-acting cylinder wherein the piston and the connecting rod 30 constitute the output elements. The servomotor 31 is controlled and operated by means of a control unit 32. This unit and the edge sensitive devices 23 and 24 will be described in detail below in connection with Figs. 2 and 3. The control unit 32 is connected with a source of fluid pressure delivered through the pipe 33 and operates to supply fluid under pressure to the servomotor 31 at opposite ends of the cylinder through the pressure lines 34 and 35. The control unit 32 is in turn actuated by variations in air pressure received from the conduit 36 leading from the edge sensitive device 23. Air under regulated pressure is introduced into the device 23 through a flexible connection 37.

When a zero line through the device 23 is in registration with the edge of the web 7 the amount of pressure delivered to the control unit 32 through the connection 36 will be of such a magnitude that the control unit 32 will serve to maintain equal pressures on opposite sides of

the double-acting piston within the servomotor 31 and there will be no movement of the piston and the connecting rod 30. However, if the zero line of the device 23 is not in registration with the edge of the web 7, then a greater or lesser pressure will be delivered to the control unit 30 depending upon which side of the zero line the web edge lies. The result will be that the control unit 30 will apply an excess of pressure to one side or the other of the piston of the servomotor 31 thereby causing the piston to move in one direction or the other carrying with it the connecting rod 30 and the edge sensitive devices 23 and 24 supported from the cross beam 25. As will appear from the following description in connection with Figs. 2 and 3, the piston within the servomotor 31 will continue to move in the proper direction until the device 23 is back in zeroed position with respect to the edge of the running web 7.

With respect to the edge sensitive device 24 and the running web 8, since the position of the device 24 is determined by the operation of the device 23, the zero relationship between the guided edge of the web 8 and the device 24 is obtained and maintained by shifting the position of the web roll 14. A servomotor 40 operated by a control unit 41 which is regulated or controlled by the edge sensitive device 24 serves to shift the carriage on which the web roll 14 is supported. The servomotor 40 may be of the same type as the servomotor 31 and the control unit 41 may likewise be of the same type as the control unit 32. The connecting rod 39 of the servomotor 40 is coupled to the carriage for the web roll 14 by means of a suitable coupling 42 joining the outer end of the connecting rod 39 and the outer end of a rod 43 which projects from the carriage unit as shown. Air pressure for the edge sensitive device 24 is delivered through a flexible connection 44 and the pressure from the device 24 is communicated to the control unit 41 through a flexible connection 45. Fluid pressure for operating the servomotor 40 is introduced into the control unit 41 through the inlet connection 46 and is delivered to the opposite ends of the cylinder of the servomotor 40 through the pressure lines 47 and 48. If the device 24 is zeroed with the edge of the web 8, then the control unit 41 delivers equal pressure to the opposite sides of the double-acting piston of the servomotor 40 and the piston remains stationary so that no movement is imparted to the carriage supporting the web roll 14. If the zero relationship between the device 24 and the edge of the web 8 is disturbed either through shifting of the device 24 or shifting of the edge of the web, then an excess of pressure will be applied to the proper side of the double-acting piston so that it moves in the proper direction to shift the carriage so as to bring the edge of the web 8 back into zero relationship with the edge sensitive device 24.

The construction and operation of the servomotors 31 and 40 and their control units 32 and 41 will now be set forth in greater detail in connection with Figs. 2 and 3. The servomotor control apparatus consisting of the servomotors 31 and 40, the control units 32 and 41, and the edge sensitive devices 23 and 24 may be adaptions of a commercial type such as those which may be obtained from the Askania Regulator Company, Chicago, Illinois. The air inlet connections 37 and 44 may be provided with check valves 50 and 51 respectively so that the air pressure may be turned off when the regulators are not in use.

The air connections 37 and 44 may be connected with the plant air pressure system or separate air compressor units may be utilized. Each of the edge sensitive devices 23 and 24 has a slot opening 52 or 53, respectively, in which the respective edges of the webs 7 and 8 run. Preferably the devices 23 and 24 are positioned so that the edges of the webs run close to the air pressure intake ports 54 and 55 respectively. The flexible air pressure connections 36 and 45 communicate between the intake ports 54 and 55, respectively, and bellows units 56 and 57, respectively, which form elements of the control units 32 and 41. The control unit 32 has an oil jet pipe 58 which is pivotally connected at 60 to the oil pressure inlet line 33. The jet pipe 58 is connected on one side to the bellows unit 56 while on the opposite side it is connected to a fixed part of the apparatus 32 by means of a connection which includes a compression spring 61 which may be adjusted by turning the thumb wheel 62. A centrifugal pump 63 driven by an electric motor 64 serves to supply oil under pressure to the jet pipe 58. The oil discharged from the outlet end of the jet pipe 58 is directed into an oil pressure distributor block 65 having branched conduit paths 66 and 67 communicating with a common inlet port 68. The oil pressure line 34 to the servomotor 31 is connected with the right-hand conduit or passageway 67 while the pressure line 35 is connected with the left-hand passageway 66 as shown in Fig. 2.

When initially starting up the apparatus the tension on the spring 61 is so regulated that the oil jet pipe 58 will distribute the oil under equal pressures to both of the passageways 66 and 67 when the adjacent edge of the web 7 coincides with a diameter line through the intake port 54. When this relationship exists the device 23 is zeroed with the web 7. Under these conditions the pressures delivered to opposite sides of the double-acting piston within the servomotor 31 will be equal and the piston will be held motionless. If the web 7 should now shift to the right as viewed in Fig. 2, a greater portion of the area of the intake port 54 would be uncovered and a greater amount of air pressure introduced from the line 37 will be picked up and delivered through the flexible conduit 36 to the bellows unit 56. The bellows unit 56 is thereby expanded so as to allow the oil jet pipe 58 to be turned counterclockwise thereby delivering an excess of oil pressure into the passageway 66 while the oil pressure delivered into the passageway 67 is decreased. The excess in pressure will build up on the rear (left) side of the piston of the servomotor 31 thereby forcing the piston to the right and forcing the connecting rod 30 also to the right. As described above in connection with Fig. 1 the edge sensitive device 23 is operatively connected to the connecting rod 30 and this will shift the device 23 to the right as viewed in Fig. 2 thereby covering up a greater portion of the intake port area 54. The excess pressure continues to exist and move the connecting rod 30 until the device 23 has been so shifted that it is once again zeroed with respect to the edge of the moving web 7 whereupon the pressures to the servomotor 31 will again be equalized and the connecting rod 30 and the device 23 will be stationary. Conversely, should the web 7 shift to the left as viewed in Fig. 2 so as to cover up more than half of the intake area of the port 54, the pressure delivered to the bellows unit 56 would be decreased and the oil jet pipe 58 would be moved clockwise to a position

where an excess of oil pressure would be delivered to the passageway 67 and the oil pressure delivered to the passageway 66 would be decreased. Accordingly, an excess of pressure will be applied to the front (right) side of the double-acting piston and the piston will be moved so as to retract the connecing rod 30 and shift the edge sensitive device 23 away from the edge of the web until it is again zeroed and the pressures are equalized.

The control unit 41 which operates the servomotor 40 corresponds in construction to the control unit 32. In addition to its bellows element 57, it has an oil jet pipe 70 pivotally mounted at 71 and connected with the oil inlet connection 46 which is supplied with oil under pressure by means of a pump 72 driven by an electric motor 73. The oil jet pipe 70 is connected on one side to the bellows element 57 and on the other side is connected by an adjustable tension spring 74 to a rigid connection. The tension on the spring 74 may be adjusted by turning a thumb knot 75. The oil distributor block 76 has two passageways 77 and 78 connecting with a common inlet port 80 into which the oil under pressure is delivered from the oil jet pipe 70. In this case the oil pressure line 48 to the servomotor 40 is connected to the right-hand passageway 78 while the oil pressure line 47 is connected to the left-hand passageway 77 of the oil distributor block 76.

As explained above in connection with Fig. 1 the position of the edge sensitive device 24 is determined by means of the operation of the edge sensitive device 23. If the device 24 should be moved to the left as viewed in Fig. 3, it would no longer be zeroed with respect to the edge of the web 8 and more than half of the area of the intake port 55 would be uncovered so that the flexible conduit 45 would receive and deliver an increased pressure to the bellows unit 57 thereby causing the oil jet pipe 70 to swing to the left of its center position. The result is that an excess of pressure is delivered to the oil line 47 and the oil pressure in oil line 48 is decreased. The double-acting piston of the servomotor 40 and the connecting rod 39 are thereby caused to shift to the left as viewed in Fig. 3 and through the connection to the carriage supporting the web roll 14 this web 8 will be shifted to the left until one-half of the area of the intake port 55 is again covered. Should the edge sensitive device 24 be shifted to the right, the apparatus would operate in just the reverse to provide a greater pressure to the rear side of the double-acting piston and result in the shifting of the web roll 14 to the right so as to uncover the exact one-half of the area of the intake port 55. The servomotor control apparatus in Fig. 3 operates in a like manner to take care of shifts in the web 8 due to unevenness in winding on the roll 14.

The operation of the embodiment of the invention shown in Figs. 1, 2 and 3 has been described above in connection therewith. It will be seen that the primary web 7 serves as a control or reference web and that the edge sensitive device 23 is automatically maintained in zeroed relationship with respect to the edge of the web 7. On the other hand, the edge sensitive device 24, the position of which is determined by the edge sensitive device 23, serves to operate the apparatus which shifts the web 8 and maintains it in zeroed relationship with respect to the device 24. The net result is that, within the limits of accuracy of the apparatus, the controlled edge of the secondary web 8 is always maintained with alignment with the corresponding edge of the primary web 7.

If there is more than one secondary web being laminated, then it will be understood that additional apparatus of the type shown in Fig. 3 will be added for each such additional web.

As mentioned above the servomotors and the control apparatus may take several different forms. In Fig. 4 of the drawings an electrical type servomotor control apparatus is shown which may be substituted for that shown in Fig. 2. The edge sensitive device indicated generally at 85 is in the form of a photoelectric eye comprising a light source 86 and a photoelectric cell 87 placed above the light source 86 so as to receive a light beam therefrom. The photoelectric cell 87 is connected in series circuit relationship with a galvanometer-type instrument 88 by means of the conductors 90, 91 and 92. The photocell 87 is of the type wherein the resistance of the cell varies with the amount of light received by it and the galvanometer 88 is adjusted so that when the web 7 is zeroed so that it covers just one-half of the photocell 87 the movable element 93 of the galvanometer 88 will lie midway between electrical contacts 94 and 95. The photocell 87 may be of the blocking layer type for example.

The field windings 105 and 106 of a reversible electric motor 96 (the servomotor in this embodiment of the invention) are connected in circuit relationship through relay units 97 and 98, respectively, to one terminal of the current source 100 and to the other terminal of the current source through the winding of the rotor 107, as shown. The galvanometer 88 has a terminal 108 which is connected to one terminal of the current source 100. There is an internal connection in the galvanometer which connects the terminal 103 to the movable element 93 which is formed of a conducting metal. The electrical contacts 94 and 95 are connected by conductors 110 and 111 to relays 98 and 97, respectively. When the movable element 93 of the galvanometer 88 is in contact with terminal 94 the relay 98 is energized and the field winding 106 of motor 96 is energized. When the element 93 is in contact with the contact element 95 the relay 97 is energized and the field winding 105 of the motor 96 is energized. The drive shaft 101 of the motor 96 carries a pinion 102 which meshes with a rack 103 which is suitably connected with the edge sensitive device 85. For example, the unit 85 may be supported on the rod 26 carried on one end of the beam 25 shown in Fig. 1. In this embodiment the rack 103 constitutes the output element of the electric motor 96 and is connected to the beam 25 through the rod 30.

In operation, if the web 7 is zeroed with respect with the photocell 87 then the element 93 of the galvanometer 88 will lie midway between the contacts 94 and 95 and neither of the fields 105 or 106 of the motor 96 will be energized and the rack and pinion combination 102 and 103 will be stationary. If the web 7 should now shift to the left so as to uncover more than one-half of the light receiving surface of the photocell 87, the resistance of this cell will change and the galvanometer 88 will become unbalanced so that the element 93 moves into contact with one of the terminals 94 or 95 so as to energize one of the fields of the reversing motor 96 which will move the rack so as to shift the edge sensitive device 85 to the left until it is again zeroed with respect to the edge of the web 7. Conversely, if the web 7

should shift to the right from the zeroed position so as to thereby cover up more than half of the light receiving area of the photocell 87, then the opposite contact will be engaged by the movable element 93 and the other field of the motor 96 will be energized so as to shift the edge sensitive device to the right until it is once more zeroed.

While in Fig. 1 of the drawings we have shown the edge sensitive devices 23 and 24 located in advance of the idler guide rolls 11 and 12, respectively, it will be understood that these air pick-up heads or devices may also be located in rear of the idler rolls. That is, the device 23 would be located between idler roll 11 and the combining rolls 5 and 6 and device 24 would be similarly located between the idler roll 12 and the combining rolls 5 and 6. In this latter arrangement, the idler roll 12 and the web roll 14 are preferably both mounted on the same movable carriage which is shifted by the servomotor 40. Having the idler roll 12 co-mounted with the web roll 14 facilitates the shifting of the secondary web 8.

In view of the foregoing disclosure those skilled in the art will be able to provide other embodiments of the invention which will come within the spirit and scope of the appended claims. Accordingly, it is to be understood that the foregoing specific embodiments of the invention described above in connection with the accompanying drawings are intended to be interpreted as illustrative and are not to be construed in a limiting sense.

What is claimed as new is:

1. In laminating apparatus of the class described for the continuous lamination of a plurality of webs between combining rolls, means for maintaining corresponding edges of said webs in alignment as they feed into said combining rolls, comprising in combination, a first device sensitive to the location of the edge of a moving web supported in sensitive relationship with an edge of one of said webs, a first servomotor including control means therefor, said first servomotor being operatively controlled by said first edge sensitive device whereby the output element of said first servomotor is in a stationary position when a zero line through said first device is maintained in registration with the edge of said first web and said output element moves in one of two opposite directions depending upon which side of said zero line said web edge may lie, support means for said first edge sensitive device operatively connected with said output element of said first servomotor whereby said servomotor operates to maintain said first edge sensitive device in zeroed registration with the edge of said first web as the latter shifts from side-to-side, a second edge sensitive device, support means for said second edge sensitive device supporting it in sensitive relationship with the edge of a second web which is to be aligned with the edge of said first web and operatively connecting it with said first edge sensitive device whereby it is moved in unison therewith, a second servomotor including control means therefor, said second servomotor being operatively controlled by said second edge sensitive device whereby the output element of said second servomotor is in a stationary position when a zero line through said second edge sensitive device is in registration with the edge of said second web and said latter output element moves in one of two opposite directions depending upon which side of said zero line said latter web edge may lie, a support roll for said second web, a shiftable support for said support roll whereby the latter may be shifted from side-to-side, and connecting means operatively interconnecting said support means with the output element of said second servomotor whereby when said second edge sensitive device is shifted in unison with said first edge sensitive device said second servomotor operates to shift said support roll so as to bring the edge of said second web into zero registration with said second edge sensitive device and thereby into registration with the edge of said first web.

2. In the continuous lamination of a plurality of webs wherein the webs are run over support rolls and fed in between combining rolls, the improvement which comprises, allowing one of said webs to serve as a reference web, automatically following one edge of said control web as it weaves from side-to-side, and automatically shifting the support rolls on which the remaining webs are supported so as to shift the remaining webs into alignment with said reference web.

3. The apparatus called for in claim 1 wherein each of said devices sensitive to the location of the edge of a moving web comprises an air discharge jet and an air receiving port aligned with said jet and spaced therefrom so as to permit the edge of a moving web to pass between said jet and receiving port, and each of said servomotors includes a double-acting cylinder unit controlled by a regulator unit sensitive to the variation in air pressure in said receiving port and operating to admit fluid pressure equally to opposite sides of the piston of said cylinder unit or to admit excess fluid pressure to one of the opposite sides of the piston depending, respectively, upon whether said edge sensitive device is zeroed with respect to said web edge or whether said web has shifted to one side of said zero line.

4. The apparatus called for in claim 1 wherein each of said devices sensitive to the location of the edge of a moving web comprises a photoelectric eye unit, and each of said servomotors comprises a reversible electric motor controlled by a regulator unit sensitive to the variation in the amount of light transmitted by said photoelectric eye and operating to de-energize the fields of said motor or to energize one of the fields depending, respectively, upon whether said edge sensitive device is zeroed with respect to the web edge or whether said web has shifted to one side of said zero line.

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ROY E. LOWEY, JR.

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