

[54] **WEB-GUIDING APPARATUS AND POSITION-SENSING AND CONTROL UNIT THEREFOR**[75] Inventors: **Ferenc Edes**, Bolingbrook; **Henry L. Gianatasio**, River Forest, both of Ill.[73] Assignee: **Air-Trol Systems, Inc.**, Addison, Ill.[22] Filed: **Dec. 1, 1971**[21] Appl. No.: **203,594**[52] U.S. Cl. **242/57.1, 226/19**[51] Int. Cl. **G65h 25/26**[58] Field of Search **242/57.1, 76; 226/19, 22; 73/37.7; 198/202; 137/82**[56] **References Cited**
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Primary Examiner—George F. Mautz*Assistant Examiner*—Edward J. McCarthy*Attorney*—Charles B. Cannon[57] **ABSTRACT**

A web-guiding apparatus and position-sensing and control unit therefor for use in sensing and maintaining the proper position and alignment of a web of paper or like flexible sheet material unwound from a roll thereof mounted on a web-supporting roll or cylinder which, in turn, is mounted on a movable supporting frame or carriage for use with web-laminating or sheet-laminating apparatus for laminating a first sheet or web of flexible sheet material, such as paper, plastic resinous film, or the like, to a second sheet or web of the same or comparable flexible sheet material, and for similar purposes, such as sensing and maintaining the proper posi-

tion of an endless belt conveyor. The supporting frame or carriage is movable transversely of the web of sheet material by hydraulically actuated power means which is under the control of pneumatic pressure-applying means so as to maintain proper alignment of the web and its lateral or side marginal edges during movement of the web during the operation of laminating the first web of flexible sheet material to a second web of flexible sheet material, or when the web is moved for other purposes. The pneumatic pressure-applying means is under the control of air flow control valve means which, in turn, is under the control of pneumatically controlled web-misalignment and position sensing means which senses and is responsive to the normal proper operating position of a marginal or lateral edge portion of the web of flexible sheet material, and to lateral movement thereof during lengthwise movement of the web. The position-sensing means or unit controls the operation of the air flow control valve means for the pneumatic pressure-applying means and actuates the pneumatic pressure-applying means and the hydraulically-actuated power means so as to move the movable roll-supporting frame or carriage and the roll of flexible sheet material mounted thereon transversely of the long axis or direction of travel of the web to correct lateral misalignment or movement of the web and thus maintain the web of flexible sheet material in its normal and proper operating position. The position sensing means or unit maintains the air flow control means in normally-closed position and the pneumatic pressure-applying means inactive when the web of flexible sheet material is in its normal and proper operating position. The invention embodies manually operable control means for the air flow control valve means to enable the pneumatic pressure-applying means and the power means to be controlled manually. The position-sensing and control unit may also be used with a web of flexible sheet material having a scalloped, notched or like serrated marginal edge portion and for sensing and maintaining proper alignment of an endless belt conveyor.

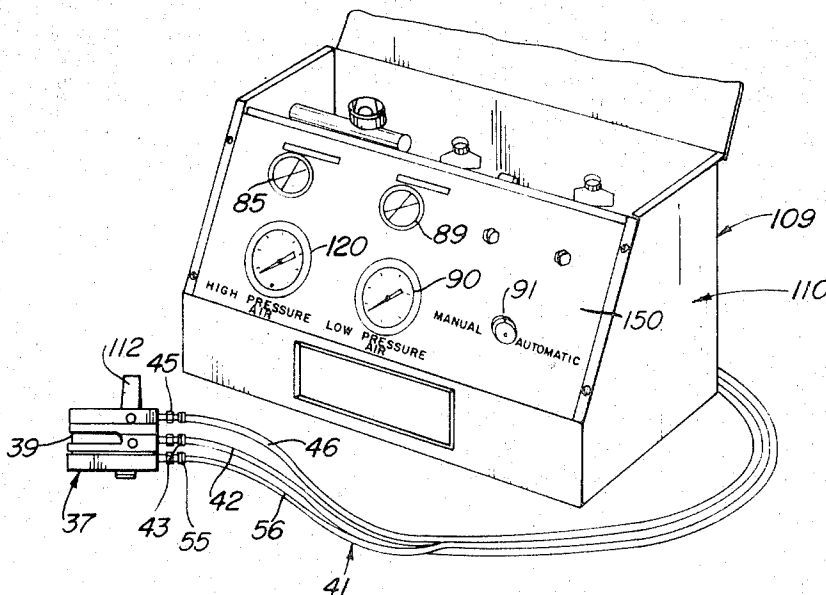
16 Claims, 29 Drawing Figures

FIG. 1

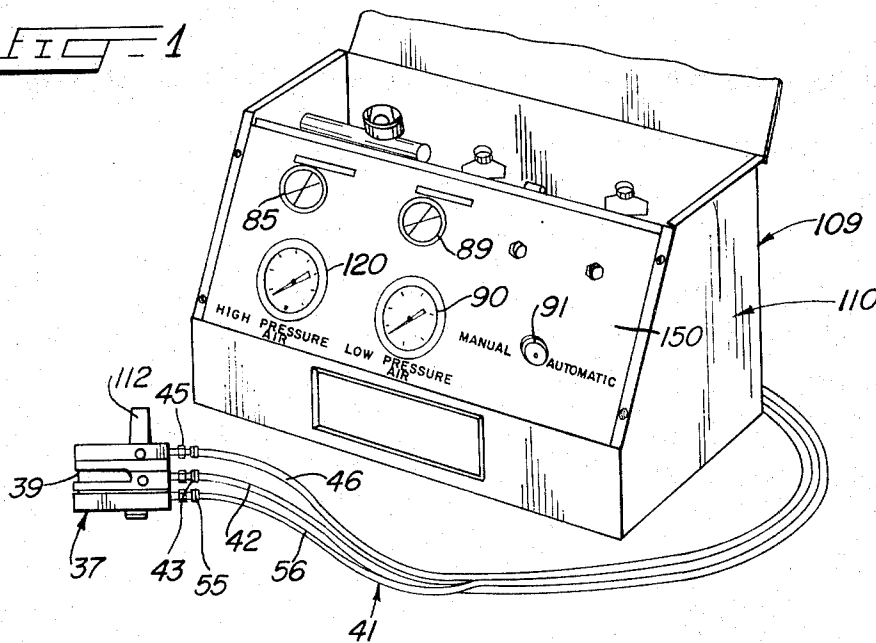


FIG. 12

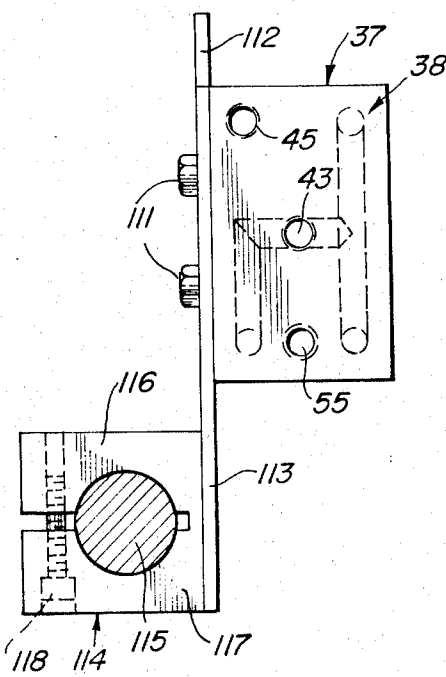
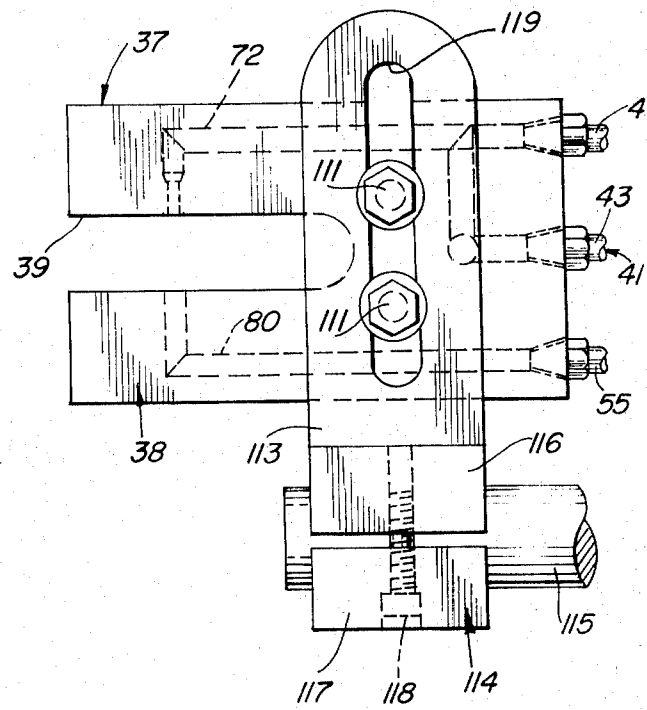
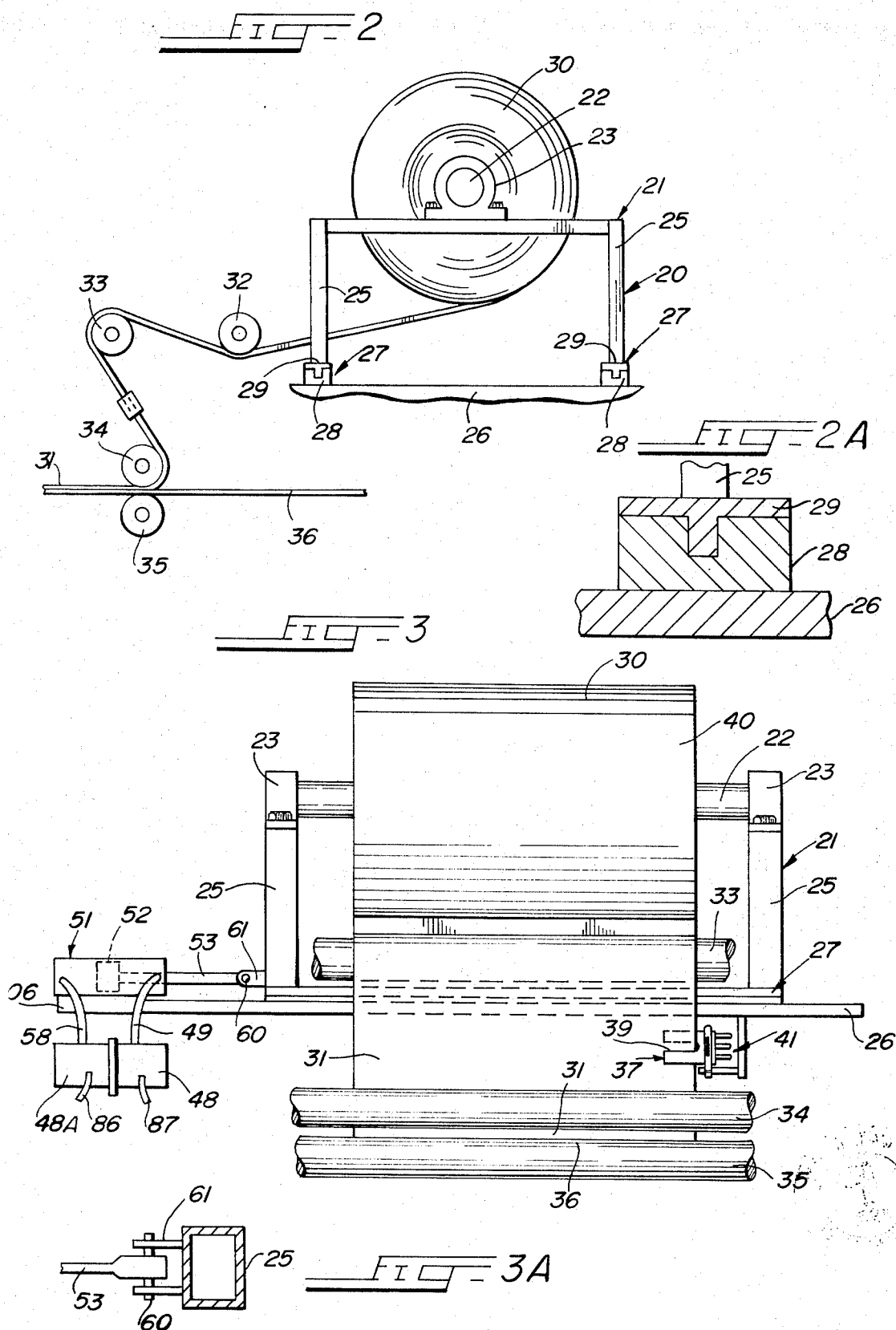


FIG. 13

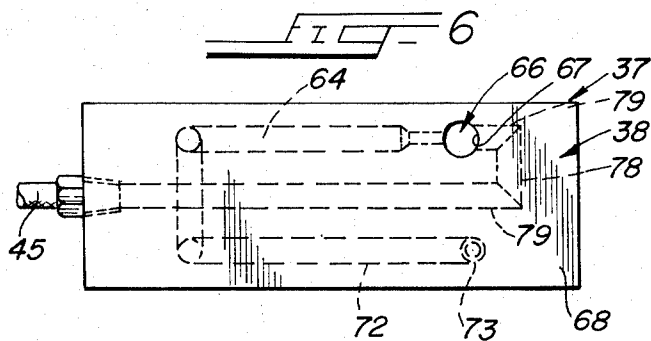
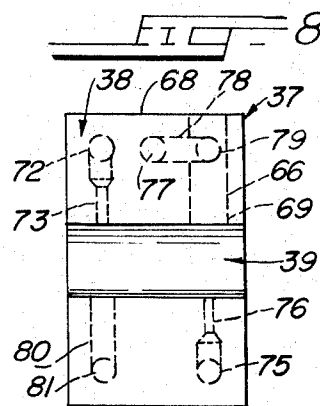
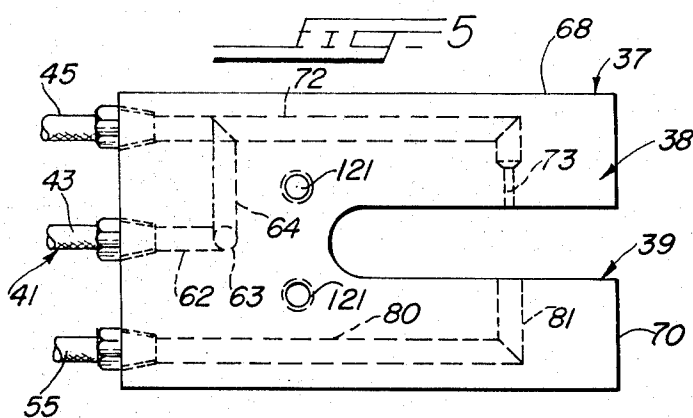
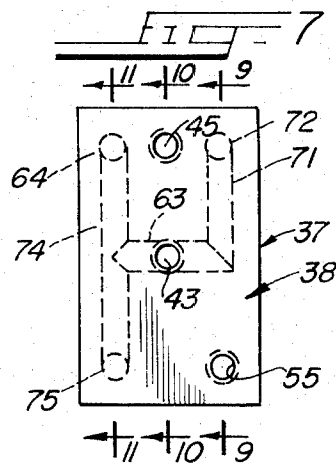
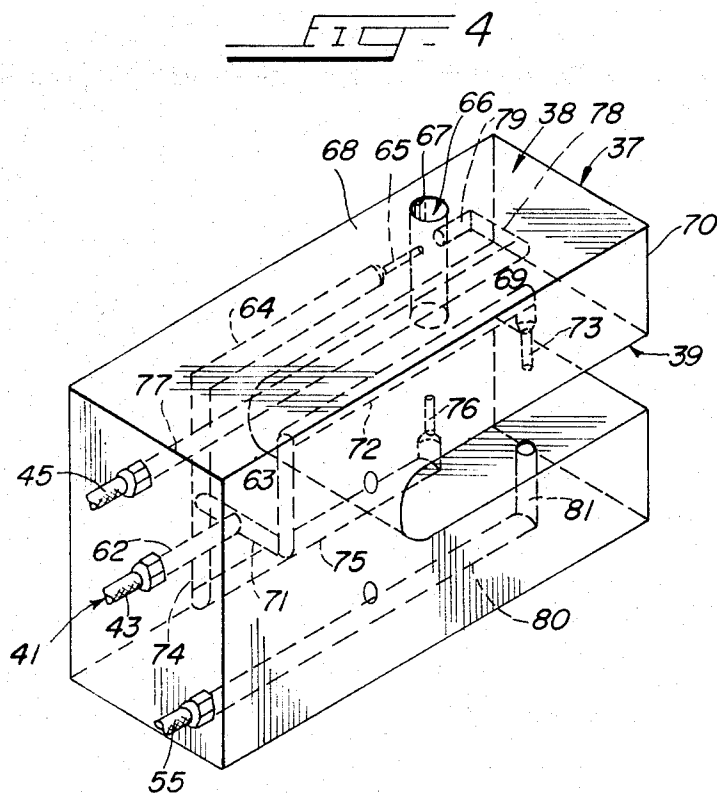


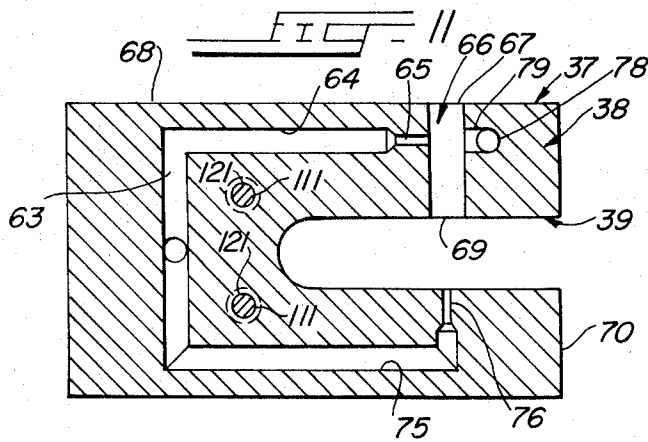
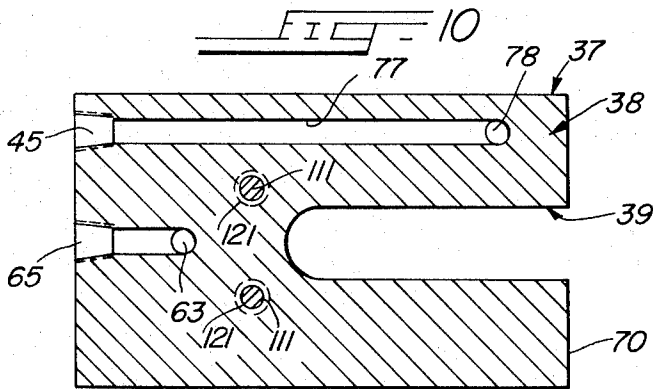
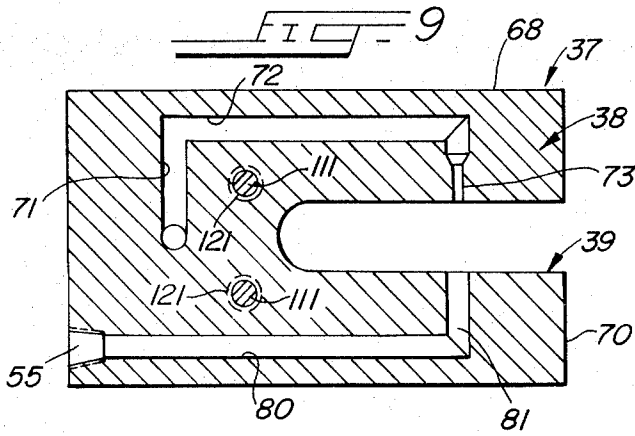


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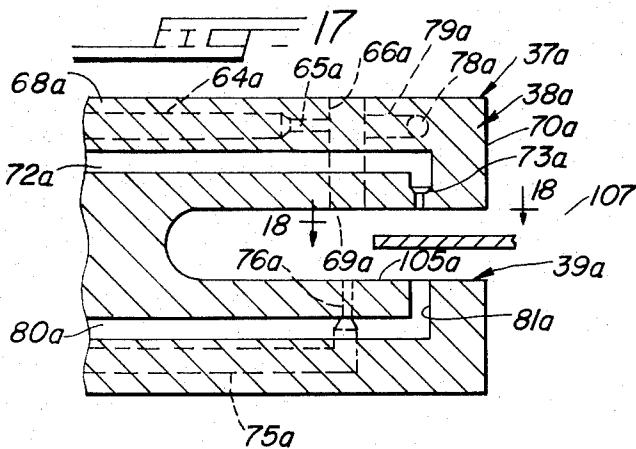
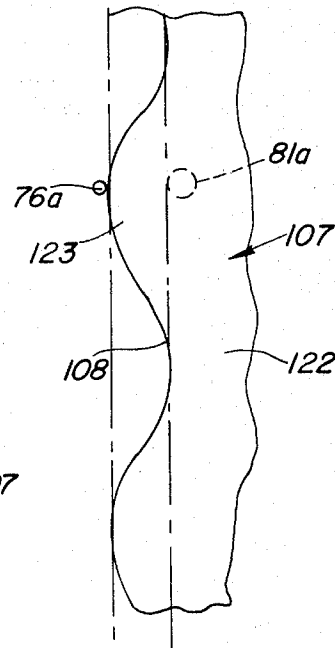
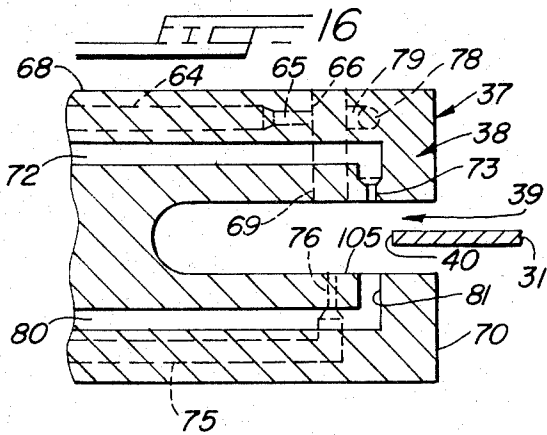
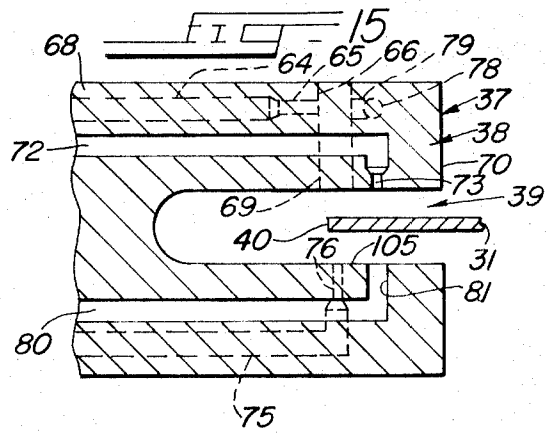
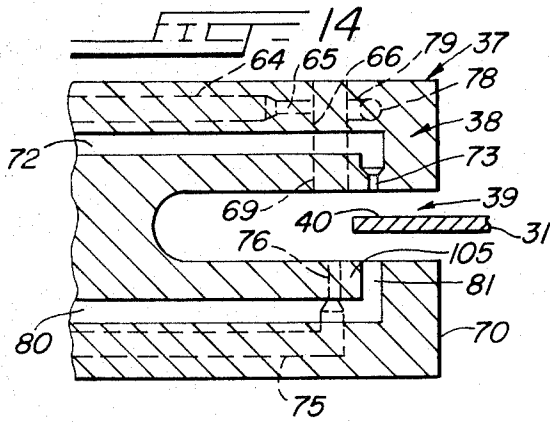


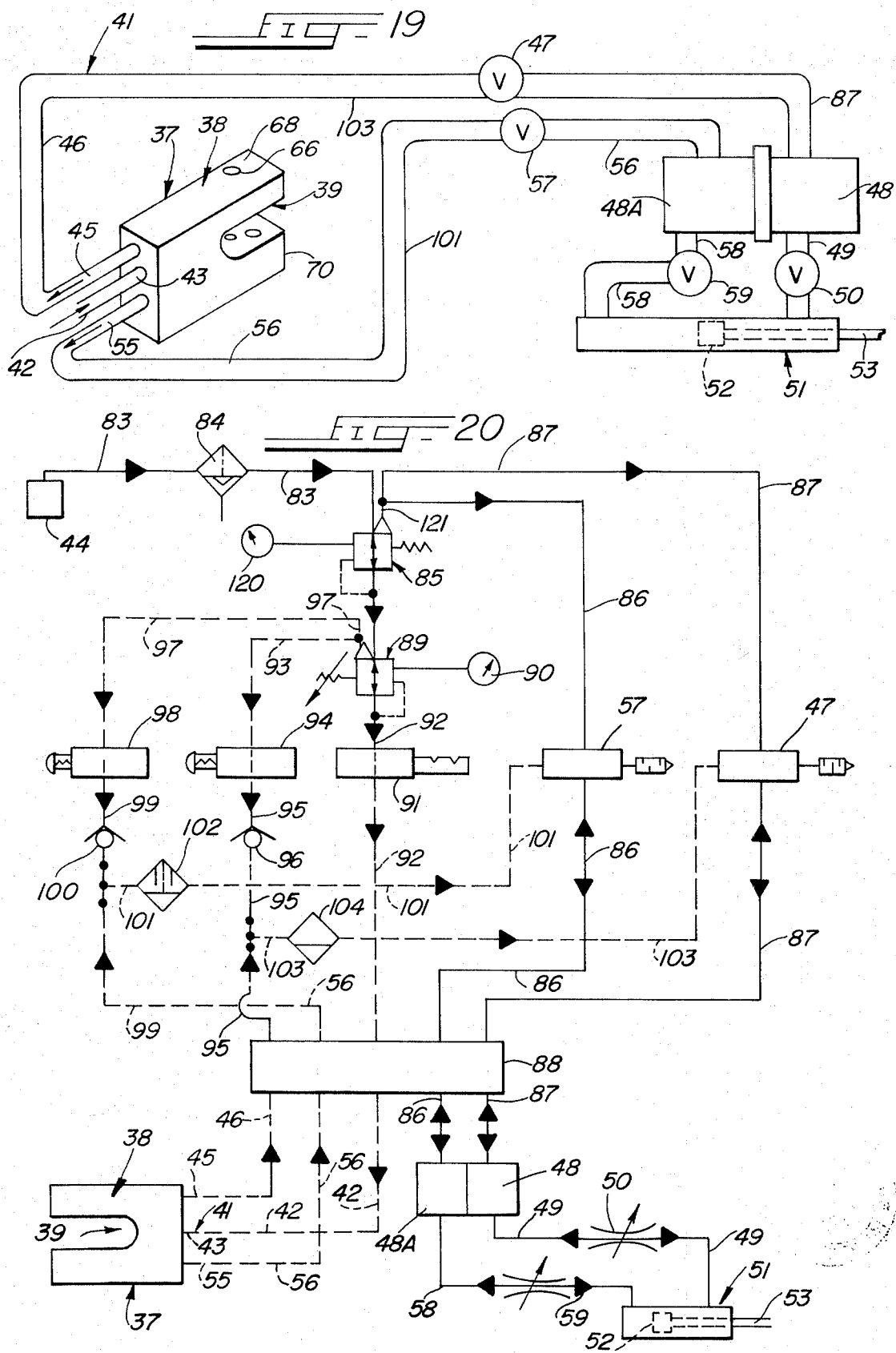


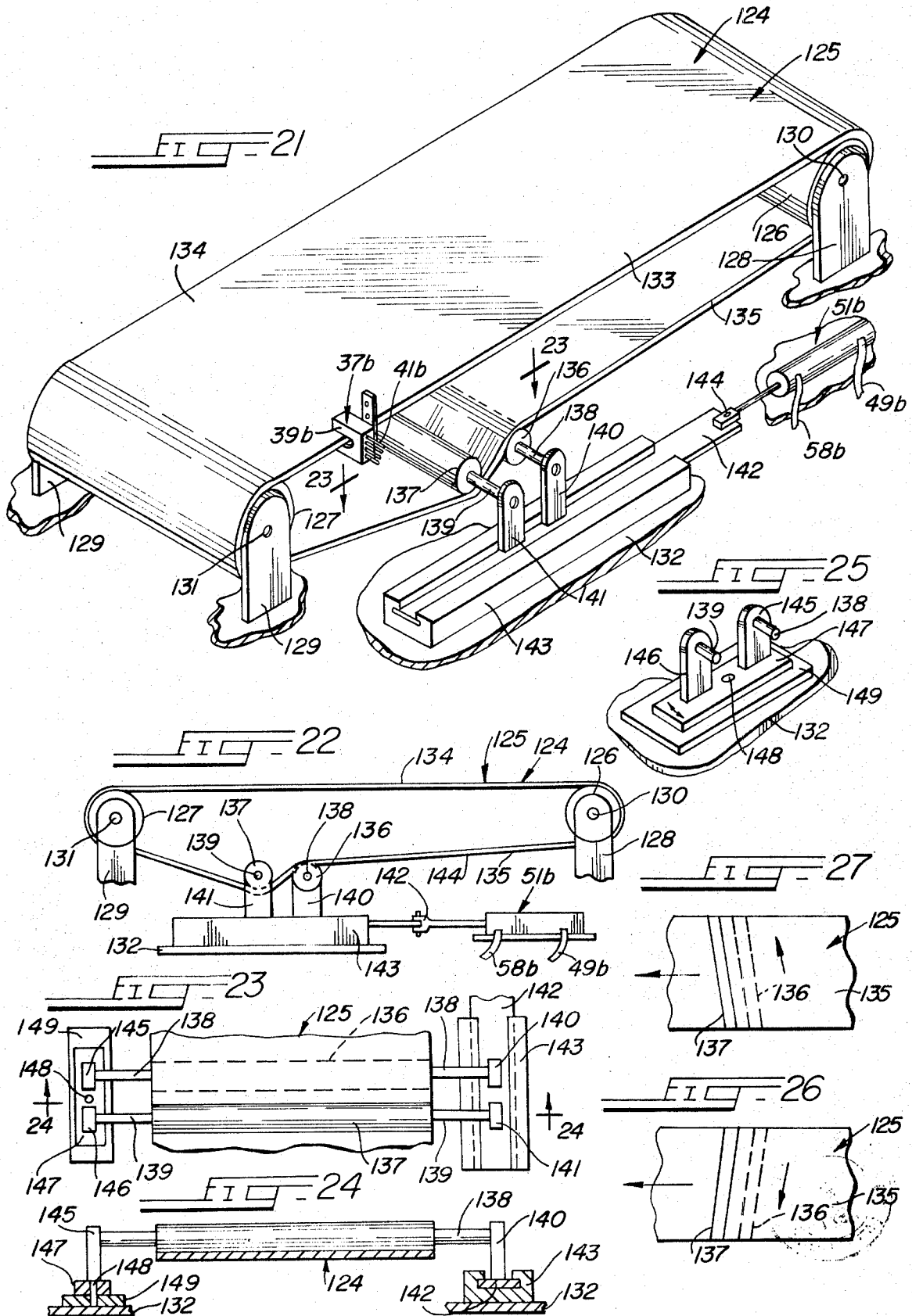
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WEB-GUIDING APPARATUS AND POSITION-SENSING AND CONTROL UNIT THEREFOR

OBJECTS

An object of the invention is to provide a new and improved web-guiding apparatus and position-sensing and control unit therefor for maintaining a web of paper, plastic resinous film, or the like, in properly aligned position while a web of such flexible sheet material is being unwound from a web-supporting roll therefor.

Another object of the invention is to provide a new and improved web-guiding apparatus and position-sensing and control unit therefor for use in conjunction with laminating apparatus for laminating two webs or sheets or paper, plastic resinous film, or like flexible sheet material together, and for automatically maintaining one of the two webs in proper alignment or registration with the other web during the laminating operation.

A further object of the invention is to provide a new and improved web-guiding apparatus and position-sensing and control unit therefor for use with laminating apparatus for laminating two sheets or webs of paper, plastic resinous film, or like flexible sheet material together, and which automatically senses and corrects any misalignment of one web of paper, plastic resinous film, or like flexible material, relative to the other web of such material.

An additional object of the invention is to provide a new and improved web-guiding apparatus and position-sensing and control unit therefor which embodies a novel combination of: a roll-supporting frame or carriage for a roll of paper, plastic resinous film, or like flexible sheet material; mounting means for movably mounting the roll of paper, plastic resinous film, or like flexible sheet material to enable the said roll-supporting frame or carriage and the said roll to be moved laterally relative to the length or long axis of the web and its lateral or outer marginal edge portions; power means for moving the roll-supporting frame or carriage laterally on the mounting means therefor; hydraulically-actuated means for operating the said power means; pneumatic pressure-applying means for applying pneumatic pressure to the hydraulically actuated operating means for the power means; air flow control valve means for controlling the flow of air under relatively high air pressure to the pneumatic pressure-applying means; and pneumatic position-sensing and control means which senses and is responsive to the normal and proper operating position of the web and to lateral movement of a marginal edge portion of the web during operation thereof for controlling the operation of the air flow control valve means so as to supply air under relatively high pressure to the pneumatic pressure-applying means and thus actuate the hydraulically actuated operating means for the power means and thereby move the roll-supporting frame or carriage on its mounting means, and the roll of paper, plastic resinous film, or like flexible sheet material carried thereby, laterally in a direction to correct misalignment of the web from its normal and proper operating position.

A further object of the invention is to provide therein a novel pneumatically actuated portable web-misalignment position-sensing and control unit.

Another object of the invention is to provide a novel web-guiding apparatus and position-sensing and control unit therefor for automatically sensing and correcting misalignment of a web of paper, plastic resinous film, or like flexible sheet material, which is being laminated during movement of the web to a second web or sheet of paper, plastic resinous film, or like flexible sheet material, and which is entirely pneumatically controlled and is free from electronic components so that the risk and danger of explosions caused by such electronic components, particularly in the presence of highly volatile solvents and other highly flammable materials employed in such web-laminating operations, is eliminated.

Still another object of the invention is to provide therein a novel portable automatically operated and pneumatically controlled web-misalignment position-sensing and control unit which is adapted to be positioned at a selected point along one marginal edge of a web of paper, plastic resinous film or like flexible sheet material, for sensing and correcting any lateral shifting movement of the web of such material as it is unwound from a web thereof for lamination with a second web of such flexible sheet material, or further purposes.

A further object of the invention is to provide a novel pneumatically operated position-sensing and control unit for web-guiding apparatus for automatically sensing and correcting the misalignment of a web of paper, plastic resinous film, or like flexible sheet material, and which position-sensing and control unit (1) embodies a minimum number of moving parts; (2) is compact and portable so that it may be readily installed in position of use adjacent to and in association with roll-supporting apparatus and means for movably mounting such roll-supporting apparatus for movement transversely of the long axis or length of the web; (3) which is relatively simple and inexpensive in construction in that it is entirely pneumatically controlled and does not embody any complex electronic or complex hydraulic components; (4) embodies novel web misalignment position sensing means which can readily be adapted for use in conjunction with a web of paper, plastic resinous film, or like flexible sheet material, having continuous straight marginal edge portions or for use with a web of paper, plastic resinous film, or like flexible sheet material having a notched, scalloped or like serrated marginal edge portion; and (5) which may also be used for sensing and correcting the misalignment of an endless belt conveyor. conjunction

Another object of the invention is to provide novel manually operable pneumatic control means for use in conjunction with the pneumatically operated web-guiding apparatus to enable the normally closed air flow control valve means embodied in the apparatus to be manually controlled and thus enable the movably mounted roll-supporting frame or carriage to be moved transversely of the long axis or length of the web of paper, plastic resinous film, or like flexible sheet material, under the control of the manually operable pneumatic control means and independently of the automatically operating web-misalignment position-sensing means, and thus enable the movable roll-supporting frame or carriage to be shifted or moved laterally at the start-up of a web-laminating or like operation to correct misalignment of the web, and to enable entanglements of the web to be readily corrected manually if and when

they occur in web-laminating or like operations; and for other reasons wherever it may be desirable to control the lateral movement of the movable roll-supporting frame or carriage independently of the automatic pneumatic web-misalignment and position-sensing and control means embodied in the invention.

An additional object of the invention is to provide therein novel means for adjustably mounting the position-sensing and control unit for movement axially along or lengthwise of a web of paper or like flexible sheet material so that the position-sensing and control unit may be mounted at a suitable selected position therealong.

Another object of the invention is to provide a novel web-guiding apparatus and position-sensing and control unit therefor which may be used for sensing and correcting the misalignment of a web of paper or like flexible sheet material having a scalloped, notched or like serrated marginal edge portion.

A further object of the invention is to provide, in one form thereof, a novel endless belt-guiding and position-sensing and control unit therefor which may be used to sense and correct the misalignment of an endless movable flexible belt conveyor.

Other objects will appear hereinafter.

DESCRIPTION OF FIGURES IN THE DRAWINGS

FIG. 1 is a perspective view illustrating a preferred embodiment of the new web-guiding apparatus and position-sensing and control unit embodied in the present invention;

FIG. 2 is a side elevational view of a typical embodiment of the new web-guiding apparatus and position-sensing and control unit of the present invention;

FIG. 2A is an enlarged sectional detail view of one of the trackways embodied in the invention as illustrated in FIG. 2;

FIG. 3 is an end elevational view of the web-guiding apparatus and position-sensing and control unit shown in FIG. 2;

FIG. 3A is a sectional detail view of part of the web-guiding apparatus shown in FIGS. 1 and 2;

FIG. 4 is a perspective view of the sensing head of the position-sensing and control unit embodied in the invention;

FIG. 5 is a side elevational view of the sensing head of the position-sensing and control unit shown in FIG. 4, as seen from the right hand side in FIG. 4;

FIG. 6 is a top plan view of the sensing head of the position-sensing and control unit shown in FIGS. 4 and 5;

FIG. 7 is an end elevational view of the sensing head of the position-sensing and control unit shown in FIGS. 4, 5 and 6, as seen from the left hand end in FIG. 4;

FIG. 8 is an end elevational view of the sensing head of the position-sensing and control unit shown in FIGS. 4 to 7, inclusive, as seen from the right hand end in FIG. 4;

FIG. 9 is a longitudinal vertical sectional view of the sensing head on line 9—9 in FIG. 7;

FIG. 10 is a longitudinal vertical sectional view of the sensing head on line 10—10 in FIG. 7;

FIG. 11 is a longitudinal vertical sectional view of the sensing head on line 11—11 in FIG. 7;

FIG. 12 (sheet one) is an end elevational view illustrating the manner in which the sensing head is mounted in position of use;

FIG. 13 (sheet one) is a side elevational view of the parts shown in FIG. 12, as seen from the right hand side in FIG. 12;

FIG. 14 is a fragmentary enlarged vertical sectional view of the sensing head shown in FIGS. 4 to 11, inclusive, and illustrating the functioning of the sensing head when the lateral or outer marginal edge portion of a sheet of paper, plastic resinous film, or like flexible sheet material is disposed in its normal and properly aligned position relative to the sensing head and relative to the long axis or length of travel of the web from its roll-supporting frame or carriage;

FIG. 15 is a fragmentary enlarged vertical-sectional view of the sensing head, as shown in FIG. 14, but illustrating the functioning of the sensing head when the outer marginal portion of the web has moved out of proper alignment and has moved laterally inwardly relative to the sensing head and in relation to the long axis or length of travel of the web and into a misaligned position;

FIG. 16 is a fragmentary enlarged vertical sectional view of the sensing head as shown in FIGS. 14 and 15 but illustrating the functioning of the sensing head when the outer marginal edge portion of the web has moved laterally outwardly into a misaligned position relative to the sensing head and in relation to the long axis or length of travel of the web;

FIG. 17 is a fragmentary enlarged vertical sectional view of the sensing head, similar to FIG. 14, but illustrating the sensing head used in conjunction with a web of paper, plastic resinous film, or like flexible sheet material, which has a scalloped, notched or like serrated or irregularly shaped lateral outer marginal edge portion;

FIG. 18 is a fragmentary top plan view, on line 18—18 in FIG. 17, illustrating the use of the sensing head with a web of paper, plastic resinous film, or like flexible sheet material, having a scalloped, notched, or like serrated or irregularly shaped lateral outer marginal edge portion;

FIG. 19 is a partial or fragmentary schematic view illustrating the arrangement of the position-sensing and control unit and the power means embodied in the invention;

FIG. 20 is a diagrammatic view illustrating the arrangement of the various parts and components embodied in the form of the invention illustrated in FIGS. 1 to 19, inclusive, and their functional relationship;

FIG. 21 is a perspective view illustrating a modification of the invention as used in conjunction with an endless belt conveyor;

FIG. 22 is a side elevational view of a modified form of the invention illustrated in FIG. 21;

FIG. 23 is a fragmentary top plan view on line 23—23 in FIG. 21;

FIG. 24 is a fragmentary vertical sectional view on line 24—24 in FIG. 23;

FIG. 25 is a fragmentary perspective view of part of the modified form of the invention illustrated in FIGS. 21 to 24, inclusive;

FIG. 26 is a diagrammatic view illustrating the manner in which one form of misalignment of the endless conveyor belt shown in FIGS. 21 to 23, inclusive, is corrected; and

FIG. 27 is another diagrammatic view illustrating the manner in which another form of misalignment of the

endless conveyor belt shown in FIGS. 21 to 23, inclusive, is corrected.

**GENERAL DESCRIPTION OF THE FORM
OF CONSTRUCTION OF THE WEB-GUIDING
APPARATUS
AND POSITION SENSING AND CONTROL UNIT
THEREFOR
SHOWN IN FIGS. 1 TO 19, INCLUSIVE**

A typical and preferred embodiment of the new web-guiding apparatus and control unit therefor is illustrated in FIGS. 1 to 19, inclusive, of the drawings, wherein it is generally indicated at 20, and comprises a movable web roll-supporting frame or carriage, generally indicated at 21, and which has a web-supporting shaft 22 rotatably mounted thereon in bearing members 23 which are mounted on horizontal top frame members 24 of the movable roll-supporting frame or carriage 21 (FIGS. 2 and 3). The web roll-supporting frame or carriage 21 includes upright supporting frame members 25 which are slidably mounted on a stationary supporting frame 26 by means of spaced parallel trackways 27, each of which trackways 27 includes a stationary channel-shaped rail 28 which is attached to the stationary supporting frame 26, and correspondingly shaped movable runner 29 which are slidably mounted in the stationary channel-shaped rails 28. A roll or web of paper, plastic resinous film, or like flexible sheet material 30 is carried by the roll-supporting shaft 22.

In a typical use of the new web-guiding apparatus and position-sensing and control unit therefor, as illustrated in FIGS. 1 to 19, inclusive, of the drawings, the web of paper, plastic resinous film, or like flexible sheet material 31, is withdrawn from the roll 30 and is fed between guide rolls 32 and 33, and thence between laminating rolls 34 and 35 where the web 31 of paper, plastic resinous film, or like flexible sheet material is laminated to a second sheet 36 of paper, plastic resinous film, or other sheet or film material.

The invention embodies a novel position-sensing and control unit for the web-guiding apparatus 20 and a preferred embodiment of this position-sensing and control unit is illustrated in the drawings (FIGS. 1, 3 and 4 to 19, inclusive) wherein it is generally indicated at 109, and comprises a portable casing or housing 110 in which major components of the position-sensing and control unit are arranged. The housing or casing 110 for the position-sensing and control unit 109 embodies a front wall 150 on which certain of the components embodied in the position-sensing and control unit 109 are arranged (FIG. 1). The position-sensing and control unit 109 embodies an automatically operated and pneumatically actuated web-alignment position-sensing and control head 37 which is adapted to be positioned at a selected point along and adjacent to one lateral or outer marginal edge portion of the web 31 of paper, or like flexible sheet material, and may be made of any suitable material, such as aluminum, or steel, or plastic resinous material (FIGS. 4 to 16, inclusive), and has a web-receiving throat or web passage 39 formed therein through which one outer marginal edge portion 40 of the web 31 of paper or like flexible sheet material is adapted to travel in use (FIGS. 14 to 16, inclusive). A pneumatic control and pneumatic operating system, generally indicated at 41, is associated with and is

under control of the position-sensing head 37 (FIGS. 4 to 19, inclusive) and certain of the air-conducting lines embodied in the invention lead from the sensing head 37-38 into the casing or housing 110 wherein they are operatively connected to components of the pneumatic control and pneumatic operating system 41 (FIGS. 1 and 19 and 20).

The pneumatic control and operating system 41, which will be described in detail hereinafter, includes a low-pressure air supply line 42 which is connected to a low pressure air inlet 43 to the position-sensing head 37-38 (FIGS. 1, 4, 5, 7, 19 and 20); the low pressure air supply line 42 being connected indirectly to a suitable source 44 of compressed air (FIG. 20) from which compressed air under relatively high pressure is supplied to the pneumatic control and operating system 41, as will be described hereinafter. The pneumatic control and operating system 41 includes a low pressure air outlet 45 from the body 38 of the position-sensing head 37 and this low pressure air outlet 45 is connected to a low pressure air line 46-103 in which a first normally closed three-way pilot-operated high pressure air flow control valve unit 47 is arranged (FIGS. 19 and 20). The first pilot-operated high pressure air flow control valve unit 47 is normally closed but is adapted to be opened by a supply of low pressure air from the position-sensing head 37-38 by way of the low pressure air supply line 46-103, as will be described more fully hereinafter.

A high pressure air supply line 87 (FIGS. 19 and 20) leads from the first three-way pilot-operated high pressure air flow control valve 47 into a hydraulic reservoir 48 for oil, or other suitable hydraulic fluid, for operating the power means, described hereinafter, and an oil line 49 leads from the oil reservoir 48 through an oil flow control valve 50 to an oil or like hydraulic cylinder 51 at one side of a piston 52 which is slidably mounted in the cylinder 51. The piston 52 is connected to a piston rod 53 having a portion which projects exteriorly of the oil or like hydraulic cylinder 52 (FIGS. 3, 19 and 20), and the cylinder 51 is suitably mounted on the supporting frame 26, as by means of a mounting bracket 106 (FIG. 3).

The pneumatic control and operating system 41 includes a second low pressure air supply outlet 55 from the body 38 of the sensing head 37 and this second low pressure air outlet 55 is connected to a second low pressure air supply line 56-101 which leads to one side of a second normally closed three-way pilot-operated high pressure air flow control valve 57, and thence by way of a high pressure air supply line 86 into a second oil reservoir 48A (FIGS. 19 and 20). An oil line 58 leads from the oil reservoir 48A through an oil flow control valve 59 and thence into the oil or like hydraulic cylinder 50 at the opposite side of the piston 52 from the side thereof at which the oil line 49 leads into the oil cylinder 51 (FIGS. 19 and 20).

As shown in FIGS. 3 and 3A, the piston rod 53 is connected, as at 60, to a yoke 61 which is attached to one of the upright frame members 25 of the movable supporting frame or carriage 31 adjacent one of the runners 29 of one of the trackways 27.

GENERAL DESCRIPTION OF THE OPERATION OF THE WEB-GUIDING APPARATUS AND POSITION-SENSING AND CONTROL UNIT THEREFOR

SHOWN IN FIGS. 1 TO 20, INCLUSIVE

The general operation of the new web-guiding apparatus and position-sensing and control unit therefor (which will be described in detail hereinafter), as shown in FIGS. 1 to 20, inclusive, is as follows: The position-sensing and control unit, including the housing or casing 110 therefor, may be arranged adjacent the roll-supporting frame or carriage 21 and the position-sensing head 37-38 positioned at a suitable selected point along and adjacent to one lateral or outer marginal edge portion 40 of the web 31 with the said lateral or outer marginal edge portion 40 of the web 31 extended through and adapted to travel through the web-receiving slot or passage 39 in the body 38 of the position-sensing head 37 in its normal or proper position as in FIG. 14.

When the web 31 and its lateral or outer marginal edge portion 40 of the web 31 are in their normal and properly aligned position, as in FIG. 14, first air flow valve control means in the position-sensing head 37-38 normally maintains the two high pressure air flow control and pilot-operated valve units 47 and 57 closed so that air under high pressure is not supplied by way of either of the two high pressure air supply lines 87 and 86, respectively, to either of the oil or hydraulic cylinders 48 and 48A for the hydraulic cylinder-piston power means 51-52-53 with the result that the movable roll-supporting frame or carriage 21 and the roll 30 and the web 31 remain in their initial and properly aligned operating position, as in FIG. 14.

However, in the event that the web 31 from the roll 30 of paper, plastic resinous film, or like flexible sheet material moves laterally inwardly from its normal operating position, as in FIG. 14, in and relative to the web-receiving throat or passage 39 in the sensing head 38 (left to right, FIGS. 3 and 14), into the misaligned position in which it is shown in FIG. 15, so that the two webs or sheets 31 and 36 would not be properly laminated, the position of the outer marginal edge portion 40 of the web 32 in the web-receiving throat or passage 39 in the position-sensing head 37, actuates a second low pressure air flow valve control means in the position-sensing head 37-38, as will be described more fully hereinafter, to supply low pressure air from the position-sensing head 37-38, by way of the low pressure air outlet 45, low pressure air supply line 46-95-8-8-103-104-103 (FIGS. 19 and 20), to the normally closed high pressure air flow control pilot-operated valve 47 so as to open the valve 47 and thus allow high pressure air to flow by way of the high pressure air supply line 87-88-87 to the oil reservoir 48 and thence by way of the high pressure air line 49-50-49 to the hydraulic cylinder 51 at one side of the piston 52 (right side, FIGS. 3, 19 and 20) so as to move the piston 52 and attached piston rod 52-53 inwardly (right to left, FIGS. 3, 19 and 20) and thereby move the roll-supporting frame or carriage 21 laterally (right to left, FIG. 3) on the trackways 27-28-29 and thus move the roll 30 and the web 31 and its lateral or outer marginal edge portion 40 from their misaligned inwardly extended position (as in FIG. 15) back into their normal and properly aligned position, as in FIG. 14.

On the other hand, if the roll 30, or the web 31 being withdrawn therefrom, for any reason, moves laterally relative to the long axis or direction of travel of the web 31, in a direction opposite to the direction referred to above, that is, from their normal operating position as in FIGS. 3 and 14, into an outwardly extended and misaligned position, in which the lateral or outer marginal edge portion 40 of the web 31 is shown in FIG. 16, a third air flow control valve means in the position-sensing head 37-38 acts to allow air under relatively low air pressure to flow out of the position-sensing head 37-38, by way of the low pressure air outlet 55, through the low pressure air supply line 55-56-88-5-6-99-101-102-101 to the normally closed high pressure air flow control pilot-operated valve 57 so as to open the valve 57 and thereby allow air under relatively high air pressure to flow through the high pressure air line 86-88-86 to the oil reservoir 48A, thereby causing oil to flow by way of the oil line 58-59 to the hydraulic cylinder 51 at the opposite side of the piston 52 relative to the side thereof discussed above (left side, FIGS. 3 and 20). This action causes the piston 52 and its attached piston rod 53 to move outwardly in and relative to the hydraulic cylinder 51 (left to right, FIGS. 3, 19 and 20), thereby causing the link connection 60-61 (FIG. 3) to move the roll-supporting frame or carriage 21 on its trackways 27-28-29 in a direction (left to right, FIG. 3) to move the roll 30 and its web 31 and the lateral or outer marginal edge portion 40 thereof back into normal and properly aligned position, as in FIG. 3, and from the outwardly extended misaligned position in which the lateral or outer marginal edge portion 40 of the web 31 is shown in FIG. 16 into its normal and proper operating position in which it is shown in FIG. 14.

DETAILED DESCRIPTION OF THE CONSTRUCTION OF THE POSITION-SENSING HEAD 37-38 (FIGS. 1, 3, 4 TO 16, INCLUSIVE, 19 AND 20)

The construction of the position-sensing head 37 and the air flow valve control means embodied therein, is shown in detail in FIGS. 1, 3, 4 to 16, inclusive, 19 and 20 of the drawings. Thus, by reference to FIG. 4 it will be noted that the low pressure air supply inlet 43 into the body 38 of the position-sensing head 37 leads by way of an internal passage 62 and a branch passage 63 to a first low pressure longitudinally extending air supply passage 64 which opens at its inner into a Venturi air port 65 which, in turn, opens into a vertically extending generally cylindrical-shaped passage 66 which opens, at its upper end, as at 67, on the top wall 68 of the body 38 of the position-sensing head 37 and opens at its inner end, as at 69 (FIG. 11) into the web-receiving throat or passage 39 of the position-sensing head 37 inwardly of one end wall 70 thereof.

The low pressure air supply inlet 62 is connected, by way of a branch line 71, to a second longitudinally extending low pressure air supply passage 72 which opens at its inner end, by way of a Venturi port 73, into a web-receiving throat or passage 39 in the position-sensing head 37 inwardly of the vertical air passage 66 (FIGS. 4, 5, 6, 8, 9, 14, 15 and 16). The low pressure air supply inlet 62 is connected, by way of a vertically extending branch passage 74 to a third longitudinally extending air supply passage 75 which opens at its inner end, by

way of a Venturi port 76, into the web-receiving throat or passage 39 in the sensing head 37 in registry with and below the vertical air passage 66 (FIGS. 4, 8, 11, and 14 to 16, inclusive).

The first low pressure air outlet 45 from the body 38 of the sensing head 27 is connected to a first longitudinally extending low pressure air outlet passage 77 which is connected at its inner end, by way of a branch passage 78, to an outlet port 79 from the vertically extending generally cylindrical-shaped passage 66 (FIGS. 4, 8, 10, 11, and 14 to 16, inclusive).

The second low pressure air outlet 55 from the body 38 of the sensing head 37 is connected to a second low pressure generally longitudinally extending air outlet passage 80 which is formed in the body 38 of the sensing head 37, and this second low pressure air outlet passage 80 is connected, at its inner end, to a branch passage 81 which opens at its upper end into the web-receiving throat or passage 39 in the position-sensing head 37 below and in registry with the Venturi jet port 73 (FIGS. 4, 5, 8, 9, and 14 to 16, inclusive).

As pointed out above, the position sensing head 37-38-39 and the air flow valve control means embodied therein, are responsive to the normal and properly aligned operating position of the roll 30 and its web 31, and the lateral or outer marginal edge portion 40 thereof, and maintain control over the normally closed high pressure air flow control valves 47 and 57 and the high pressure air supply lines 87 and 86 from the normally closed high pressure air flow control valves 47 and 57, respectively, to the oil cylinders 48 and 48A, respectively, which supply oil or like hydraulic fluid to the piston cylinder 51, which forms part of the power means for operating the movable roll-supporting frame 21, as described above. All of these parts, including the position-sensing head 37-38, are arranged with the air flow control valves 47 and 57, and the high pressure air supply lines 87 and 86, and other parts, in an automatic pneumatically controlled and pneumatically operated system 41 which is embodied in the invention, as illustrated in FIGS. 19 and 20 of the drawings, and as will now be described.

THE MOUNTING OF THE POSITION-SENSING HEAD 37-38

In the use of the new web-guiding apparatus, and position-sensing and control unit therefor, as illustrated in the drawings, and as described above, the position-sensing head 37 may be slidably but removably mounted on the roll-supporting carriage 21 in the manner illustrated in FIGS. 12 and 13 of the drawings, with the housing or casing 109 and the operating parts housed therein mounted adjacent the roll-supporting frame or carriage 21 and with the cylinder 51 of the power means 48-48a-49-58-51-52-53, etc., suitably mounted on an auxiliary supporting frame or bracket 106 adjacent the roll-supporting frame or carriage 21 (FIGS. 1 and 3).

Thus, by reference to FIGS. 12 and 13 it will be noted that the position-sensing head 37-38 is adjustably mounted, as by fastening elements in the form of bolts 111, which are inserted into screw-threaded openings 121 in the body 38 of the position-sensing head 37 (FIGS. 5, 9, 10, 11, 12 and 13), on the upright support-

ing bracket 112 which has a lower end portion 113 which is adjustably mounted, as by means of a split clamping collar unit 114, on a horizontal supporting shaft 115 which extends lengthwise of the roll-supporting frame 21 and lengthwise of the web 31. The split clamping collar unit 114 includes a pair of clamping collar members 116 and 117 which are adjustably connected together by a fastening element in the form of a bolt 118.

A vertically extending centrally arranged slot 119 is provided in the upright supporting bracket 112 and the fastening elements or bolts 111 extend through the slot 119 and thus enable the position-sensing head 37-38 to be adjusted vertically on and relative to the upright supporting bracket 112 and the roll-supporting frame 21 and the web 31. At the same time, the split clamping collar unit 114 enables the upright supporting bracket 112 and the position-sensing head 37-38 mounted thereon, to be adjusted lengthwise of and on the supporting shaft 115 and axially or lengthwise of the roll-supporting frame 21 and the web 31.

THE AUTOMATIC PNEUMATICALLY CONTROLLED AND PNEUMATICALLY OPERATED SYSTEM 41 (FIGS. 19 AND 20)

The automatic pneumatically controlled and pneumatically operated system 41 of the present invention is shown diagrammatically in FIGS. 19 and 20 of the drawings, and will now be described; all air lines therein being preferably constructed of flexible plastic resinous air and moisture-resistant tubing.

THE HIGH PRESSURE PNEUMATIC SYSTEM

The pneumatic control and operating system 41 includes a first and high pressure pneumatic system which is illustrated in FIGS. 19 and 20 of the drawings, and includes the source or reservoir 44 for compressed air under which air is maintained at a relatively high pressure of from preferably about 200 p.s.i. by means of an air compressor unit (not shown). From the high pressure air supply source or reservoir 44 air under relatively high pressure is supplied by way of a high pressure air line 83, through a combination air filter and moisture control unit 84, thence through a first stage air pressure regulating unit 85 with which an air pressure gauge 120 is associated (FIGS. 1 and 20) and by which the pressure of the air from the high pressure air reservoir 44 is reduced preferably to an air pressure in the order of 125 p.s.i. and not less than 30 p.s.i.; thence by way of the high pressure air line 121-86 to the normally closed high pressure air flow control valve 57; thence by way of the high pressure air supply line 86 to a so-called junction box or manifold 88; and thence by way of the high pressure air supply line 86 to the oil reservoir 48A (FIGS. 3, 19 and 20).

The high pressure pneumatic system embodied in the invention also includes a second high pressure air supply line 121-87 which leads from the first stage air pressure regulator 85 to the other normally closed air flow control valve 47 and thence, by way of the high pressure air supply line 87, through the manifold or junction box 88, and the air line 87 to the other oil reservoir 48 (FIGS. 3, 19 and 20).

THE LOW PRESSURE PNEUMATIC SYSTEM

The pneumatic control and operating system 41 also includes a second low pressure pneumatic system and which, as discussed above, includes the position-sensing head 37-38 to which air under relatively low pressure, preferably in the order of about 3 to 5 p.s.i., is supplied as follows: Air from the first stage air pressure regulator 85 also flows through a second stage air pressure regulator 89 (with which an air pressure gauge 90 is associated, FIGS. 1 and 20) by which the air pressure is reduced to a relatively low pressure in the order of 3-5 p.s.i.; thence through a three-way two-position detented toggle switch or valve control unit 91; thence by way of the low pressure air supply line 92-42 to the low pressure air supply inlet 43 of the position-sensing head 37-38.

The low pressure pneumatic system also includes an air outlet passage 64-77-45 from the position-sensing head 37-38 from which air under relatively low pressure flows by way of the low pressure air supply line 46, manifold or junction box 88, air line 95, air line 103, through a so-called mini-filter 104, and thence by way of the low pressure air supply line 103 to the normally closed high pressure air flow control valve 47 to open the latter under certain conditions as described more fully hereinafter.

In addition, the second and low pressure pneumatic system embodied in the present invention includes the low pressure air outlet passage 81-80-55 from the position-sensing head 37-38, from which low pressure air is supplied by way of the air line 56; manifold or junction box 88, air line 56-99-101, mini-filter 102, and low pressure air supply line 101 to the normally closed high pressure air flow control valve 57 to open the latter under certain conditions, as described more fully hereinafter.

DETAILED DESCRIPTION OF THE OPERATION OF THE INVENTION IN THE NORMAL OPERATING POSITION OF THE ROLL 30 AND WEB 31

The dimensions of certain of the parts of the position-sensing head 37-38, as illustrated in FIGS. 9, 10, 11 and 14 to 16, inclusive, have been exaggerated for the purpose of illustration, but in the construction of the new web-guiding apparatus and

The normal operating position of the roll 30 of paper, plastic resinous film, or the like, as indicated by the position of the lateral outer marginal edge portion 40 of the web 31, is illustrated in FIG. 14 of the drawings and from which it will be noted that the lateral outer marginal edge portion 40 of the web 31 is so disposed between the inner side walls of the web-receiving throat or passage 39 in the sensing head 37-38 that it lies between and blocks the flow of low pressure air (3 to 5 p.s.i.) from the low pressure air inlet passage 72 and the Venturi outlet port 73 thereof to the low pressure air outlet port 81 and the low pressure air outlet passage 80 in the position-sensing head 37-38 (FIG. 14). The result of this is to cut off the flow of low pressure air from the sensing head 37-38 to the low pressure air line 55-56, by way of the junction box or manifold 88, air line 99, air line 101, mini-filter 102 and air line 101 to

the normally closed high pressure pilot air flow control valve 57 so that the valve 57 will remain in its normally closed position and air under relatively high pressure (125 p.s.i.) will not flow from the high pressure air line 86, through the air flow control pilot-operated valve 57, air line 86, junction box or manifold 88 and air line 86 to actuate the power means, that is, the oil reservoir 48A, oil line 58-59, piston-cylinder 51-52, connecting rod 53, and related parts, with the result that oil will not be forced by way of the oil line 58 and oil flow control valve 59 to the cylinder 51, piston 52 and the piston rod 53 and the connecting rod member 61 attached thereto, at 60, with the result that the power means embodying these parts 51-52-53-60-61 will remain in its normal at rest operating position, as in FIG. 3.

Similarly, when the web 31 is disposed in its normal and properly aligned position, and the outer marginal edge portion 40 thereof is disposed in the web-receiving throat or passage in the sensing head 37-38 in the position in which it is shown in FIG. 14 of the drawings, the supply of low pressure air to the other normally closed high pressure air flow control valve 47 is likewise prevented, in a manner which will now be described, so that the valve 47 will remain in its normally closed position. Thus it will be noted that when the outer marginal edge portion 40 of the web 31 is disposed in the position in which it is shown in FIG. 14 of the drawings, the supply of low pressure air entering the sensing head 37-38 by way of the low pressure air supply inlet 43 will flow through the low pressure air passage 62-71-75-76 in the sensing head 37-38 and will thence flow across the web-receiving throat or passage 39 into the vertical or generally cylindrical passage 66-67-69 from which such low pressure air will escape to the atmosphere by way of the outlet 67 of the vertical or generally cylindrical passage 66 in the position-sensing head 37-38. At the same time the low pressure air entering the position-sensing head 37-38 by way of the low pressure air inlet passage 43 will flow by way of the air line 62-63-64-65 into the vertical or generally cylindrical passage 66 in the position-sensing head 37-38 from which the low pressure air supply will be forced by the relatively high speed air stream from the passage 75 and its Venturi outlet port 76 out of the passage 66 by way of the outlet 67 thereof and will thus be prevented from flowing across the passage 66 into the outlet port 79 and the low pressure air line 79-78-77-45-46-95-103-104-103 to the other high pressure air flow control valve 47 so that the normally closed high pressure air flow control valve 47 will remain in its normally closed position and the piston 52 will remain in its normal position in the cylinder 51 while, at the same time, the roll-supporting frame or carriage 21 and the roll 30 and web 31 will remain in their normal operating position, as in FIG. 3.

DETAILED DESCRIPTION OF THE OPERATION WHEN THE OUTER MARGINAL EDGE PORTION 40 OF THE WEB 31 MOVES INWARDLY IN THE WEB-RECEIVING THROAT OR PASSAGE 39

OF THE POSITION-SENSING HEAD 37 (FIG. 15)

In the event that the roll 30 or the web 31, for any

reason, shifts laterally in a direction to move the lateral outer marginal edge portion 40 of the web 31 inwardly in and relative to the web-receiving throat or passage 39 in the position-sensing head 37, from the normal position of the lateral outer marginal edge portion 40 of the web 31, as shown in FIG. 14, into the inwardly extended misaligned position in which it is shown in FIG. 15, the lateral outer marginal edge portion 40 of the web 31 will then be disposed in the web-receiving throat or passage 39 between the Venturi air outlet port 73 from the low pressure air inlet passage 72 and the low pressure air outlet port 81 into the low pressure air outlet passage 80 in the sensing head 37-38. Hence a supply of low pressure air will not flow from the low pressure air outlet passage 80-55 and by way of the low pressure air supply line 56-88-99-101-102-101 to the high pressure air flow control valve 57 so that the valve 57 will remain in its normally closed position.

Moreover, when the outer marginal edge portion 40 of the web 31 is disposed in its inwardly extended position in the web-receiving throat or passage 39 in the position-sensing head 37-38 (as in FIG. 15), low pressure air entering the position sensing head 37-38 by way of the low pressure air supply line 43-71-75-76 will be blocked by the outer marginal edge portion 40 of the web 31 from flowing across the web-receiving throat or passage 39 in the position-sensing head 37-38 into the vertically extending generally cylindrical passage 56 so that it will not interfere with the flow of low pressure air from the low pressure air line 43-62-63-64-65 across the vertically extending passage 66 and thence into and by way of the low pressure air outlet 79-78-77-45-46-88-103-104-103 to the other high pressure air control valve 47 which will thus be opened by the low pressure air thus supplied thereto. In this manner the high pressure air flow control valve 47 is opened and high pressure air (125 p.s.i.) will flow therefrom by way of the air line 87, junction box or manifold 88, air line 87, to the power means, that is, to the oil reservoir 48, and related parts 49-51-52-53, etc., thereby forcing oil from the oil reservoir 48 into the oil line 49, through the oil flow control valve 50, into the cylinder 51 at one side of the piston 52 therein (right side, FIGS. 3, 19 and 30) thereby moving the piston 52 in the cylinder 51 in a direction (right to left, FIGS. 3, 19 and 20). This action causes the piston rod 52 and attached arm 61 to move in a direction (right to left, FIG. 3) to move the slidable roll-supporting carriage 21 and the roll 30 carried thereby in the same direction (right to left, FIGS. 3, 19 and 20) to move the web 31 and its outer marginal edge portion 40 outwardly in and relative to the web-receiving throat or passage 39 in the sensing head 37-38, thereby moving the outer marginal edge portion 40 of the web 31 from its misaligned inwardly extended position, as in FIG. 15, back to its normal and proper operating position, as in FIGS. 3 and 14. In this manner the web 31 is repositioned in proper alignment and in proper registration with the marginal edge portion of the second web or sheet 36 for lamination between the laminating rolls 34-35 (FIG. 3), or for other purposes.

DETAILED DESCRIPTION OF THE OPERATION WHEN THE OUTER MARGINAL EDGE PORTION 40 OF THE WEB 31 MOVES OUTWARDLY

IN THE WEB-RECEIVING THROAT OR PASSAGE IN THE POSITION-SENSING HEAD

37-38 (FIG. 16)

If in the use of the new web-guiding apparatus and the position-sensing and control unit therefor, the web 31, for any reason, moves out of proper alignment relative to the second web or sheet 36 (FIG. 3), and the lateral outer marginal edge portion 40 of the web 31 moves from its normal operating position, as in FIG. 14, to an outwardly extended and misaligned position in and relative to the web-receiving throat or passage 39 in the position-sensing head 37-38, as illustrated in FIG. 16, the flow of low pressure air (3-5 p.s.i.) from the low pressure air inlet line 43 into the sensing head 37-38 by way of the low pressure air inlet passage 62-63-71-75-76 will flow across the web-receiving throat or passage 39 and will escape to the atmosphere by way of the vertical generally cylindrical passage 66-67 and its outlet 69 on the top wall 68 of the sensing head 37-38 (FIG. 16) and hence will not affect either of the normally closed air flow control valves 47 and 57. However, at the same time, that is, when the outer marginal edge portion 40 of the web 31 is moved into an outwardly extended and misaligned position, as in FIG. 16, the low pressure air supply entering the position-sensing head 37-38 by way of the low pressure air inlet 43 will flow, by way of the low pressure air passage 62-71-72-73 across the web-receiving throat or passage 39 in the sensing head 37-38, thence through the low pressure air outlet port 81 into the low pressure air passage 80, and thence into the low pressure air outlet line 55, air line 56, junction box or manifold 88, air line 56, air line 99, air line 101, mini-filter 102 and air line 101 to the normally closed three-way two-position pilot-operated high pressure air flow control valve 57, thereby opening the high pressure air flow control valve 57 and allowing air under high pressure (125 p.s.i.) to flow from the high pressure air line 86, through the then opened high pressure air flow control valve 57, air line 86, manifold or junction box 88, air line 86, to the power means, that is, to the oil reservoir 48A and related parts, 58-51-52-53 etc., thereby forcing oil out of the oil reservoir 48A by way of the oil line 58, and oil flow control valve 59 into the cylinder 51 at one side of the piston 52 (left side, FIGS. 3, 19 and 20). This action moves the piston 52, piston rod 53, and the connecting arm 61 in a direction (left to right, FIGS. 3, 19 and 20) and thus moves the slidable roll-supporting carriage 21 and the roll 30 and web 31 carried thereby, on the trackways 27 (left to right, FIG. 3), thereby moving the web 31 in the same direction and thus moving the lateral outer marginal edge portion 40 of the web 31 laterally inwardly back into its normal position in and relative to the web-receiving throat or passage 39 in the position-sensing head 37, into the position in which it is shown in FIGS. 3 and 14.

At the same time, that is, when the outer marginal edge portion 40 of the web 31 is disposed in a misaligned outwardly extended position in and relative to the web-receiving throat or passage 29 in the position-sensing head 37-38 (as in FIG. 16) low pressure air entering the position sensing head 37-38 by way of the low pressure air inlet 43 and flowing through the low pressure air passage 67-63-64-65 into the vertical passage 66 in the position-sensing head 37-38 is prevented

from entering the low pressure air outlet passage 79-7-8-77-45 for travel by way of the low pressure air supply line 46-88-95-103-104-103 to the high pressure air flow control valve 47 and the low pressure air thus flowing through the low pressure air passage 62-63-6-4-65 in the position-sensing head 39-38 into the vertical passage 66 therein is dissipated out of the outlet 67 of the vertical passage 66 at the tope of the latter by the relatively high speed air delivered across the web-receiving throat or passage 39 in the position-sensing head 37-38 from the low pressure air inlet passage 75 and its Venturi jet outlet port 76 into and up the vertical passage 66 therein (FIG. 16). Hence, during this operation the high pressure air flow control valve 47 will remain in its normally closed position.

THE MANUAL CONTROL FOR THE PNEUMATIC AIR CONTROL AND OPERATING SYSTEM (FIG. 20)

The new web-guiding apparatus 20 and position-sensing and control unit 109 therefor includes a manually operated control system which is embodied in the second and low pressure air system and is illustrated in FIG. 20 of the drawings and may be advantageously used under certain conditions, as will be described more fully hereinafter, when it is desired to control manually the first or high pressure air system. Thus, it has been found that there are times in the use of the present invention when it is desirable to be able to control the high pressure air flow control valves 47 and 57 manually as, for example, when starting up the web-advancing roll 30 and its web 31; when the body of the web 31 or one or both of its lateral outer marginal edge portions becomes entangled or badly misaligned in use; and on other occasions. To this end pneumatic control and operating system 41 for the high pressure air flow control valves 47 and 57 includes a low pressure air supply line 92 which leads from the second stage air pressure regulator unit 89 to the three way two position detented toggle switch or valve (control) unit 91 (FIGS. 1 and 20) and the switch or valve (control) unit 91 is connected by way of the low air pressure air line 92-88-42 to the low pressure air inlet 43 of the position-sensing head 43.

In addition the pneumatic control and operating system 41 includes a low pressure air supply line 93 which leads from the second stage air pressure regulator unit 89 to a first manually operable push-button air control valve unit 94; thence by way of a low pressure air supply line 95 through a check valve 96 to the manifold or junction box 88, and thence by way of the low pressure air supply line 56 to the low pressure air outlet 55 of the position-sensing head 37-38 (FIG. 20).

As shown in FIG. 20, a branch air line 101 leads from the low pressure air supply line 99 through a so-called mini-filter 102 which is adapted to filter out any small solid particles which may be in the low pressure air stream passing therethrough; and thence by way of the air line 101 to the low pressure air inlet side of the high pressure air flow control valve 57. A second branch air line 103 leads from the air line 95 through a second so-called mini-filter unit 104 and thence by way of the air line 103 to the low pressure air inlet side of the second high pressure air flow control valve 47 (FIG. 20).

In the use of the new web-guiding apparatus and position-sensing and control unit therefor the three manu-

ally operable air flow control valves 91, 94 and 98 (FIG. 20) may be employed to convert the new web-guiding apparatus and position-sensing and control unit from automatic to manual operation. Thus it will be noted (FIGS. 1 and 20) that the three-way two-position detented toggle switch or valve control unit 91 is normally disposed in open position, as indicated by the legend "Automatic" in FIG. 1, so that the pneumatic operating and control system 41 is arranged for automatic operation and low pressure air flows through the switch or valve control unit 91 by way of the low pressure air supply line 92-88-42-43 into the sensing head 37-38. However, when it is desired to convert the invention to manual operation, the three-way two-position detented switch or valve control unit 91 is moved into closed position, (as indicated by the legend "Manual" in FIG. 1), thereby cutting off the supply of low pressure air through the switch or valve control unit 91 and the low pressure air line 92-88-42-43 to the sensing head 37-38.

When the invention is arranged for automatic operation, the two manually operable so-called override push button low pressure air flow control valves 94 and 98 are disposed in closed position but when it is desired to connect the system 41 for manual operation, the three way two position detented toggle switch or valve control unit 91 is moved into closed position as indicated by the legend "Manual" in FIG. 1, whereupon the two manually operable push button switches or valves 94 and 98 may be selectively opened to open the normally closed high pressure air flow control valves 47 and 57, respectively, so as to allow air under high pressure (125 p.s.i.) to flow from the high pressure air flow control valves 47 and 57, respectively, into the junction box or manifold 88, thence into one of the oil reservoirs 48 and 48A, and thence into the cylinder 51 so as to move the piston 52 therein, the connecting arm 61, and the slidable carriage 21 on the trackways 27 in a direction to correct misalignment of the web 31, per se, or in reference to the second web or sheet 36 being laminated thereto, as in FIG. 3.

As set forth above, the two high pressure air flow control valves 47 and 57 are normally closed so that the flow of high pressure air from the two air flow control valves 47 and 57 by way of the air lines 87 and 86 and junction box or manifold 88 to the oil reservoirs 48 and 48A is normally cut off.

However, in the manual operation of the system, if it is desired to move the piston 52 in the cylinder 51, and the piston rod 53 and attached connecting arm 61 and roll-supporting carriage 21 and the roll 30 and web 31 carried thereby, to correct a misalignment of the web 31, per se, or relative to the second web or sheet 36, or for any other reason, this may be accomplished by manually operating the proper one of the two manual air control push button air flow valves 94 and 98 (FIG. 20). Thus, if it is desired to manually open the high pressure air flow control valve 47 and to move the piston 52 in the cylinder 51 and the connecting rod 53 and attached connecting arm 61 and the movable roll-supporting carriage 21 and the roll 30 and web 31 carried thereby in a direction (right to left, FIGS. 3, 19 and 20) this may be accomplished by manually opening the push button control valve unit 94 whereupon a supply of low pressure air (3-5 p.s.i.) will flow from the second stage air pressure regulator 89 by way of the low pressure air line 93-94-95-96-103-104-103 to the

high pressure air flow control valve 47, thereby opening the latter. High pressure air (125 p.s.i.) will then flow from the high pressure air supply line 87, through the then opened high pressure air flow control valve 47, air line 87, junction box or manifold 88, and air line 87 to the oil reservoir 48 so as to force oil therefrom by way of the oil line 49 and oil flow control valve 50 into the cylinder 51 to move the piston 52, piston rod 53, connecting arm 61 and the roll-supporting carriage 21, roll 30 and web 31 on the trackways 27 in the desired direction (right to left, FIGS. 3, 19 and 20), to correct misalignment of the web 31, or for other reasons.

On the other hand, if it is desired to move the roll-supporting carriage 21, roll 30 and web 31 in the opposite direction (left to right, FIGS. 3, 19 and 20), to correct a misalignment of the web 31, per se, or for other reasons, this may be accomplished by manually opening the other push button air flow control valve unit 98, whereupon a supply of low pressure air will flow from the second stage air pressure regulator 89 by way of the low pressure air line 97, through the then opened push button air control valve unit 98, check valve 100, air line 101, mini-filter 102, and air line 101 to the normally closed high pressure air flow control valve 57, thereby opening the latter. High pressure air will then flow from the high pressure air line 86, through the then opened high pressure air flow control valve 57, into the high pressure air line 86, to the junction box or manifold 88, air line 86, and thence into the oil reservoir 48A, thereby forcing oil under pressure through the oil line 58 and oil flow control valve 59 into the cylinder 51 at one side of the piston 52 so as to move the piston 52, piston rod 53, connecting arm 61 and roll-supporting carriage 21 and the roll 30 and web 31 carried thereby on the trackways 27 in a direction (left to right, FIGS. 3, 19 and 20) to correct a misalignment of the web 31, per se, or for other reasons.

The manual control system for the new web-guiding apparatus and control unit therefor, as described above, has a number of advantages, and among these are the following:

(a) It enables the air operating and air control circuits for the new web-guiding apparatus and the position-sensing and control unit therefor to be activated and deactivated manually as may be necessary during the use of the new web-guiding apparatus and position-sensing and control unit therefor to correct a badly wound or tangled web or a weaving roll, or for other reasons, during operation of the apparatus; and

(b) It is helpful in threading up the web 31 and the second web or sheet 36 at start-up.

MODIFICATION OF THE

INVENTION SHOWN IN FIGS. 17 AND 18

FOR USE WITH A WEB HAVING A SERRATED MARGINAL EDGE FORMATION

A modification of the invention for use with a web of paper, plastic resinous film, or like flexible sheet material, having notched, scalloped or like serrated marginal edge formation, is illustrated in FIGS. 17 and 18 of the drawings, and is adapted for use with a web of paper, or like flexible sheet material 107, which has a scalloped, notched, or like serrated marginal edge formation 108 (FIG. 18).

The construction of the position-sensing head shown in FIGS. 17 and 18 is similar to that shown in FIGS. 14,

15 and 16 and hence those parts of FIGS. 17 and 18 which are similar to corresponding parts in the form of the invention illustrated in FIGS. 14 to 16, inclusive, have been given similar reference numerals followed by the additional and distinguishing reference character "a".

As pointed out above, the space at the point 105 in the position-sensing head 37-38, as shown in FIGS. 14 to 16, inclusive of the drawings, is preferably in the order of 0.025 inch and this or comparable dimensions work well with a web, as 31, having a straight lateral outer marginal edge portion 40. However, in the use of a web, as 107, FIG. 18, having a scalloped, notched, or like serrated marginal edge portion 108, or when the new web-guiding apparatus and position-sensing and control unit therefor are used for belt-guiding, or like purposes, the distance at the point 105a, in the position-sensing head 37a (FIG. 17) between the outer side of the Venturi port 76a for the low pressure intake passage 75a and the inner side of the low pressure air outlet port 81a from the web-receiving throat or passage 39a of the sensing head 37a to the air outlet passage 80a, should be substantially greater than 0.025 inch, and is preferably in the order of from 0.25 inch to 1 inch, or more, as indicated in FIGS. 17 and 18. This arrangement enables the new web-guiding apparatus and position-sensing and control unit therefor to be used with webs 107 having scalloped, notched or like serrated marginal edge portions 108 (FIG. 18), in substantially the same manner as described above in connection with the use of the new web-guiding apparatus and control unit therefor with a web 31 having a straight lateral outer marginal edge portion 40, and as illustrated in FIGS. 14 to 16, inclusive, as well as for use for belt-guiding, or like purposes.

It will be noted in connection with the modification of the invention illustrated in FIGS. 17 and 18, that when the web 107 is disposed in its normal and proper operating position, as in FIG. 17, the body 122 of the web 107 is so disposed in the web-receiving throat or passage 39a of the sensing head 37a-38a that it blocks the flow of air from the low pressure air inlet passage 72a and the Venturi jet outlet port 73a thereof across the web-receiving throat or passage 39a into the low pressure air outlet passage 81a-80a in the sensing head 37a-38a, in the same manner as that in which the laterally outer edge portion 40 of the web 31 blocks the flow of low pressure air from the low pressure air inlet passage 72-73 across the web-receiving throat or passage 39, as shown in FIG. 14, and with the same result.

However, in the modification shown in FIGS. 17 and 18, the width of the area 105a (FIG. 17) is such that the serrated marginal edge portion 108 of the web 107 passes outwardly of the Venturi jet inlet port 76a so that the Venturi jet low pressure air inlet 76a remains open and unobstructed by the serrated marginal edge portion 108 of the web 107 when the web 107 is in its normal and proper operating position. This prevents so-called "dead spots" which would occur if the high points or dwells 123 of the serrated marginal edge portion 108 of the web 107 extended over and covered the low pressure Venturi jet air inlet port 76a as the web 107 moves through the web-receiving passage or throat 39a in the sensing head 37a-38a.

MODIFICATION OF THE INVENTION SHOWN IN FIGS. 21 TO 27, INCLUSIVE,

FOR USE AS A BELT-GUIDING APPARATUS AND THE

POSITION-SENSING AND CONTROL UNIT

THEREFOR.

A modification of the invention is illustrated in FIGS. 21 to 27, inclusive of the drawings, for use as a belt-guiding apparatus and position-sensing and control unit therefor. In this form of the invention an endless conveyor belt unit is indicated generally at 124 and comprises an endless conveyor belt 125 which is mounted on and travels around suitable supporting and guide rollers 126 and 127 which are mounted on shafts 130 and 131 which are journaled in upright bearing members 128 and 129, respectively, which are mounted on a suitable supporting frame 132.

The shafts 130 and 131 are driven by suitable power means and power transmission means (not shown).

A position-sensing head 37b, similar to the position-sensing head 37, is mounted at a selected point along one outer marginal edge portion 133 of the upper run 134 of the endless conveyor belt 125 and together with the pneumatic operating control system 41b, is responsive to the proper position and alignment of the endless belt conveyor 125 and senses and corrects any lateral shifting movement of the endless conveyor belt 125 in substantially the same way as lateral shifting movements of the web of paper, plastic resinous film, or like flexible sheet material are sensed and corrected in the use of the form of the invention illustrated in FIGS. 1 to 20, inclusive.

However, in the modification of the invention illustrated in FIGS. 21 to 27, inclusive, the lower run 135 of the endless conveyor belt 125 is guided over and between a pair of idler rollers 136 and 137 which are mounted on horizontally extending shafts 138 and 139, respectively. One outer end portion of the idler roller shaft 138 is journaled in an upright bearing bracket member 140 and the adjacent outer end portion of the other idler roller shaft 139 is journaled in an upright bearing bracket member 141; the two bearing bracket members 140 and 141 being mounted on and attached to a slidable supporting plate member 142 which is slidably mounted in a channel-shaped trackway 143 which is attached to the supporting frame 143 (FIGS. 21, 23 and 24). The slidable supporting plate member 142 is connected by a yoke 144 to the piston rod 53 of the piston-cylinder unit 51b which is similar to the piston-cylinder unit 51 in the form of the invention illustrated in FIGS. 1 to 20, inclusive, so that parts in the modification of the invention shown in FIGS. 21 to 27, inclusive, which are similar or identical to corresponding parts in the form of the invention illustrated in FIGS. 1 to 20, inclusive have been given the same reference numerals followed by the additional and distinguishing reference character "b".

The other or opposite end portions of the idler roller shafts 138 and 139 are journaled in upright bearing brackets 145 and 146, respectively, which are mounted on and fastened to a supporting plate member 147 on a portion 149 of the supporting frame 132.

In the use of the modified form of the invention illustrated in FIGS. 21 to 27, inclusive, the position-sensing head 37b is disposed, as shown in FIG. 21, with one outer marginal edge portion of the upper run 134 of the endless conveyor belt 125 extending through the throat 39b in the sensing head 37b.

In the event that the outer marginal edge portion of the upper run of the endless conveyor belt 125 moves laterally outwardly from its normal operating position, as in FIG. 21, into an inwardly extending and misaligned position, the sensing head 37b will act, through the pneumatic operating and control system 41b (FIG. 21) to actuate the power means (piston-cylinder 51b, piston rod 53b, connecting yoke 144 and related parts, as in FIGS. 1 to 20, inclusive) to move the slidable plate member 142 in the channel-shaped trackway 243 (right to left, FIGS. 21 and 22), and this movement of the slidable plate member 142 acts, through the upright bearing bracket members 140 and 141, carried thereby, to pivot the idler roller shafts 138 and 139 and the idler rollers 136 and 137, respectively, mounted thereon into the angular position in which the idler rollers 136 and 137 are shown in FIG. 26. During this operation the opposite end portions of the idler roller shafts 138 and 139 and the idler rollers 136 and 137, respectively, carried thereby, pivot at 148, on the pivotal mounting plate 147 (FIG. 25), and when the idler rollers 136 and 137 are thus pivoted into the angular position in which they are shown in FIG. 26 they act upon the lower run 135 of the endless belt conveyor 125 to move the endless belt conveyor 125 and its upper run 134 laterally inwardly back into their normal and proper operating position, as in FIG. 21.

In the event that the endless belt conveyor 125 and the outer marginal edge portion of the upper run 134 thereof move laterally inwardly from their normal operating position, as in FIG. 21, (left to right, FIG. 21), the position-sensing head 37b will sense such misalignment of the outer marginal edge portion of the upper run 134 of the endless belt conveyor and will act, through the pneumatic operating and control system 41b, to retract the piston rod 53b inwardly in the piston-cylinder unit 57b (left to right, FIGS. 21 and 22). This motion of the piston rod 53b will, in turn, act through the connecting yoke 144 to move the slidable plate member 142 in the trackway 143 (left to right, FIGS. 21 and 22) thereby causing the idler roller shafts 138 and 139 and the idler rollers 136 and 137, respectively, carried thereby, to pivot on the pivotal mounting plate member 147, at 148, in a direction to move the idler rollers 136 and 137 into the angular position in which they are shown in FIG. 27, and when so disposed the idler rollers 136 and 137 will guide the lower run 135 of the endless conveyor belt 125, and the endless conveyor belt 125 laterally inwardly back into their normal and proper operating position, as in FIG. 21.

It will thus be seen from the foregoing description, considered in conjunction with the drawings, that the present invention provides a new and improved web-guiding apparatus and a new and improved endless belt-guiding apparatus and position-sensing and control unit therefor having the desirable advantages and characteristics and accomplishing its intended objects including those hereinbefore pointed out and others which are inherent in the invention.

We claim:

1. Apparatus for guiding a movable sheet of flexible material having lateral outer marginal edge portions and which is movable lengthwise along the longitudinal axis of the said sheet of flexible material relative to the said lateral outer marginal edge portions thereof, comprising:

- a. first supporting means for supporting the said movable sheet of flexible material for movement lengthwise of its said longitudinal axis;
 - b. second supporting means or movably supporting the said first supporting means and the said sheet of flexible material supported thereby for movement in a direction generally transversely relative to the said longitudinal axis of the said sheet of flexible material;
 - c. pneumatic position-sensing means arranged at a point along one of the said lateral outer marginal edge portions of the said movable sheet of flexible material for sensing lateral movement of the said sheet of flexible material in a direction generally transversely relative to the said longitudinal axis of the sheet of flexible material and in a direction toward or away from the said one lateral outer marginal edge portion of the said movable sheet of flexible material; d. power means for moving the said second supporting means and the said first supporting means and the said sheet of flexible material carried thereby in a direction generally transversely relative to the said longitudinal axis of the said sheet of flexible material; and
 - e. pneumatically operated means under the control of the said position-sensing means for actuating the said power means including
 - 1. first pneumatically operated means for actuating the said power means; and
 - 2. second pneumatically operated means for actuating the said first pneumatically operated actuating means for the said power means;
 - f. the said first pneumatically operated means for actuating the said power means including
 - 1. a first pneumatic system for supplying air under pressure to the said power means including
 - a) a pair of normally closed air flow control valves for selectively controlling the flow of air under pressure through said first pneumatic system to actuate the said first pneumatic system to actuate the said power means at different times in either of two opposite directions; and
 - 2. a second pneumatic system under control of and responsive to the said position-sensing means for selectively controlling the operation of the said normally closed air flow control valves so as to selectively open the said normally closed air flow control valves and thereby actuate the said power means in a direction to move the said second supporting means and the said flexible sheet material carried thereby in a direction transversely relative to the longitudinal axis of the said flexible sheet material to correct the lateral misalignment of the said flexible sheet material to correct lateral misalignment of the said flexible sheet material as sensed by the said position-sensing means.
2. Apparatus as defined in claim 1 in which
- a. the said pneumatic position-sensing means includes
 - 1. a position-sensing head positioned at a point along the said one marginal outer edge portion of the said flexible sheet material and having formed therein
 - a) a throat or passage for the reception and for the movement therethrough of the said one

marginal outer edge portion of the said flexible sheet material.

3. Apparatus as defined in claim 1 in which the said second pneumatic system includes

- a. manually operable air flow valve control means for selectively opening the said normally closed air flow control valves in the said first pneumatic system independently of the said pneumatic position-sensing means.

4. A web-guiding apparatus and position-sensing and control unit therefor for use with a roll of flexible sheet material adapted to be withdrawn from the said roll as a web having lateral outer marginal edge portions extending lengthwise of the longitudinal axis of the said web; comprising

- a. roll-supporting means for supporting a roll of said flexible sheet material to be unwound lengthwise therefrom as a web;
- b. mounting means for mounting the said roll-supporting means for movement transversely of the said web;
- c. power means for moving the said roll-supporting means and the said mounting means and the said roll of flexible sheet material laterally relative to the said lateral outer marginal edge portions of the said web;
- d. pneumatic operating means for operating the said power means; including
 - 1. a pair of normally closed air flow control valves for controlling the flow of air to the said power means so as to move the said power means at different times in opposite directions; and
- e. pneumatic position-sensing and control means arranged at a point along one of the said lateral outer marginal edge portions of the said web and responsive to the position of the said one lateral outer marginal edge portion of the said web for controlling the operation of the said pneumatic operating means; including
 - 1. pneumatic valve control means coacting with the said position-sensing means for selectively opening one or the other of the said pair of normally closed air flow control valves.

5. A web-guiding apparatus and a position-sensing and control unit therefor for use with a web of flexible sheet material adapted to be withdrawn therefrom lengthwise as a web having lateral outer marginal edge portions extending lengthwise of the longitudinal axis of the said web, comprising:

- a. a supporting frame;
- b. roll-supporting means for supporting a roll of said flexible sheet material on the said supporting frame;
- c. mounting means for movably mounting the said roll-supporting means for movement transversely of the said web;
- d. power means for moving the said supporting frame and the said roll-supporting means mounted thereon transversely relative to the said lateral outer marginal edge portions of the said web;
- e. a first pneumatic system for supplying air under pressure to actuate the said power means in a direction to cause the said power means to move the said mounting means and the said roll-supporting means mounted thereon in a direction laterally relative to the said lateral outer marginal edge portions of the said web and its said longitudinal axis;

- f. the said first pneumatic system including
1. air flow valve control means for controlling the supply of air under pressure through the said first pneumatic system; and
- g. a second pneumatic system including
1. pneumatic position-sensing and control means positioned at a selected point along and adjacent to one of the said lateral outer marginal edge portions of the said web and responsive to the lateral movement of the said web toward and away from its normal operating position for controlling the operation of the said air flow control valve means in the said first pneumatic system; the said pneumatic position-sensing and control means including
 - a) control means for preventing the flow of air under pressure from the said position-sensing and control means through the said second pneumatic system to the said air flow control valve means in the said first pneumatic system when the said web is in its normal and proper operating position as sensed by the said position-sensing and control means.
6. Apparatus as defined in claim 5 in which the said second pneumatic system includes
- a. manually operable means for controlling the operation of the said air flow control valve means in the said first pneumatic system independently of the said pneumatic position-sensing and control means.
7. Apparatus as defined in claim 5 which includes
- a. a portable housing; and in which components of the said first pneumatic system and of the said second pneumatic system are arranged in and are movable with the said portable housing.
8. Apparatus as defined in claim 7 in which the said pneumatic position-sensing and control means is disposed exteriorly of the said portable housing.
9. A sheet-guiding and position-sensing and control unit therefor for use with a sheet of flexible material having lateral outer marginal edge portions extending lengthwise of the longitudinal axis of the said sheet, comprising:
- a. sheet-supporting means;
 - b. power means for moving the said sheet-supporting means laterally relative to the said lateral outer marginal edge portions of the said sheet;
 - c. a portable housing;
 - d. a first pneumatic system including
 1. first air-conducting means in the said portable housing;
 2. air flow control valve means in the said first air-conducting means in the said portable housing for controlling a supply of air under pressure to activate the said power means to move the said sheet-supporting means in a direction laterally relative to the said lateral outer marginal edge portions of the said sheet;
 - e. a second pneumatic system for controlling the operation of the first pneumatic system and the said air flow control valve means therein including
 1. second air-conducting means arranged in the said portable housing; and
 2. pneumatic position-sensing and control means arranged externally of the said portable housing and adapted to be positioned at a selected point along and adjacent to one of the said lateral outer

- marginal edge portions of the said sheet and responsive to lateral movement of the said sheet toward and away from its normal operating position for controlling the operation of the said first pneumatic system; the said pneumatic position-sensing and control means including
- a) control means for preventing the flow of air under pressure from the said position-sensing and control means through the said second pneumatic system to the said air flow control valve means in the said first pneumatic system when the said sheet is in its normal and proper operating position as sensed by the said pneumatic position-sensing and control means.
10. A sheet-guiding and position-sensing and control unit therefor as defined in claim 9 in which the said position-sensing and control means includes
- a. a position-sensing and control head having
 1. a sheet-receiving passage therein for the reception and for the travel therethrough of one of the said lateral outer marginal edge portions of the said sheet; and in which the said pneumatic systems include
 - a) flexible air-conducting means disposed exteriorly of the said portable housing and connecting the said position-sensing and control head to the said first air-conducting means and to the said second air-conducting means in the said portable housing.
11. A sheet-guiding and position-sensing and control unit therefor as defined in claim 10 which includes
- a. means for adjustably mounting the said position-sensing and control head and the said flexible air-conducting means relative to the said portable housing at a preselected point along and relative to one of the said lateral and outer marginal edge portions of the said sheet.
12. A sheet-guiding and position-sensing and control unit therefor as defined in claim 9 in which the said second pneumatic system includes
- a. manually operable air flow valve control means for selectively operating the said air flow control valve means in the said first pneumatic system independently of the said pneumatic position-sensing and control means in the said first pneumatic system.
13. A portable sheet-guiding and position-sensing and control unit for use with a sheet of flexible material having lateral outer marginal edge portions extending lengthwise of the longitudinal axis of the said sheet and for use with sheet-supporting means for supporting the said sheet and power means for moving the said sheet-supporting means laterally relative to the said lateral outer marginal edge portions of the said sheet, said portable sheet-guiding and position-sensing and control unit comprising
- a. a portable housing;
 - b. a first pneumatic system including
 1. first air-conducting means in the said portable housing for conducting a supply of air under pressure to activate the said power means to move the said sheet-supporting means in a direction laterally relative to the said lateral outer marginal edge portions of the said sheet; and
 2. air flow control valve means in the said first air-conducting means;
 - c. a second pneumatic system for controlling the operation of the said first pneumatic system and the said air flow control valve means therein including

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1. second air-conducting means arranged in the said portable housing; and
2. pneumatic position-sensing and control means arranged externally of the said portable housing and adapted to be positioned as a selected point along and adjacent to one of the said lateral outer marginal edge portions of the said sheet for sensing movement of the said sheet toward and away from its normal operating position and for controlling the operation of the said first pneumatic system; the said pneumatic position-sensing and control means including
 - a) control means for preventing the flow of air under pressure from the said position-sensing and control means through the said second air-conducting means in the second pneumatic system to the said air flow control valve means in the said first pneumatic system when the said sheet is in its normal and proper operating position as sensed by the said pneumatic position-sensing and control means.
14. A portable sheet-guiding and position-sensing and control unit as defined in claim 13 in which the said position-sensing and control means includes
 - a. a position sensing and control head having
 1. a sheet-receiving passage therein for the reception and for the travel therethrough of one of the

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- said lateral outer marginal edge portions of the said sheet; and in which the said pneumatic systems include
- a) flexible air-conducting means disposed exteriorly of the said portable housing and connecting the said position-sensing and control head to the said first air-conducting means and to the said second air conducting means in the said portable housing.
15. A portable sheet-guiding and position-sensing and control unit as defined in claim 14 which includes
 - a. means for adjustably mounting the said position-sensing and control head and the said flexible air-conducting means relative to the said portable housing at a preselected point along and relative to one of the said lateral and outer marginal edge portions of the said sheet.
16. A portable sheet-guiding and position-sensing and control unit as defined in claim 13 in which the said second pneumatic system includes
 - a. manually operable air flow valve control means for selectively operating the said air flow control valve means in the said first pneumatic system independently of the said pneumatic position-sensing and control means in the said second pneumatic system.

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