Jan. 14, 1964 S. S. DAVIS 3,117,462

WEB ALIGNING MEANS

Original Filed Aug. 1, 1959 8 Sheets-Sheet 1

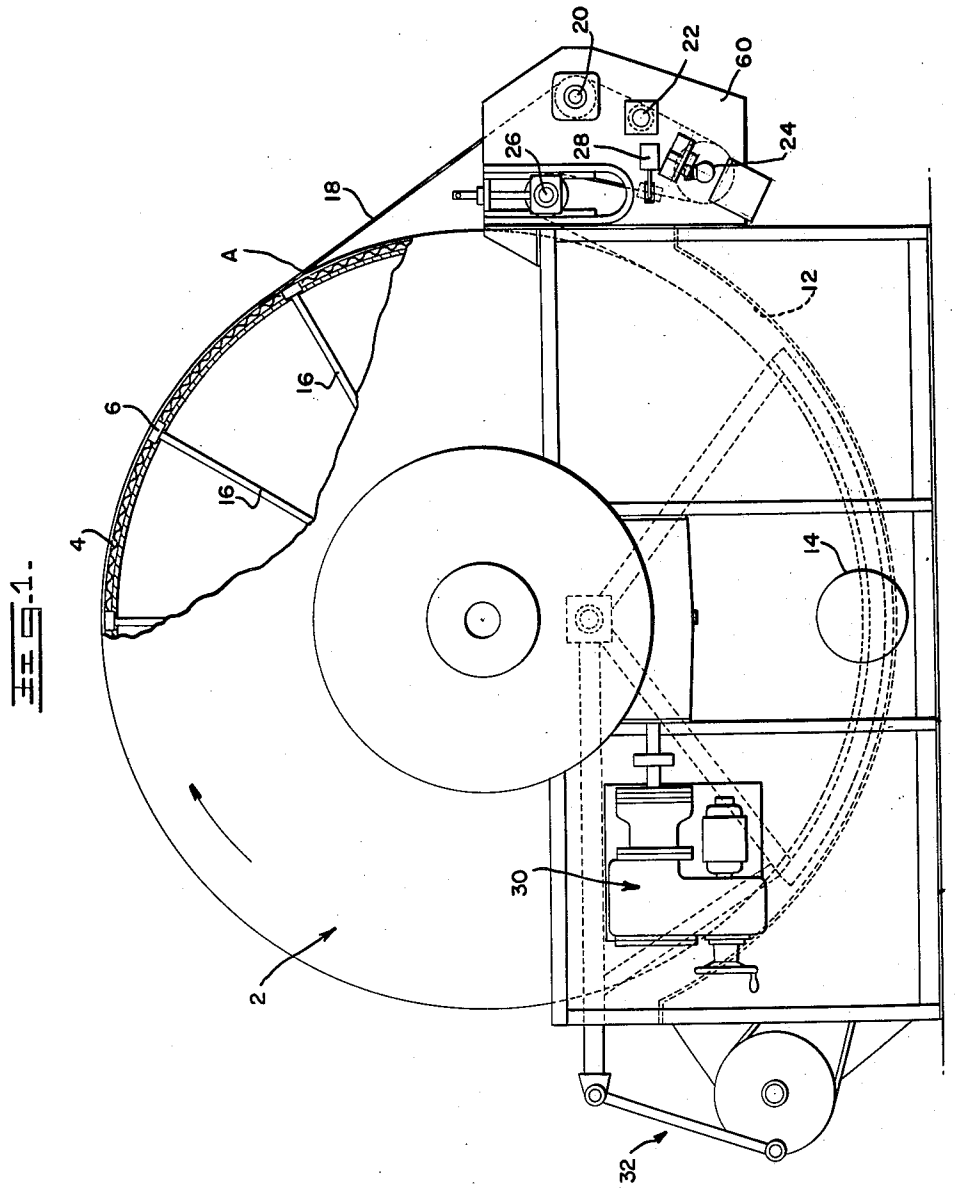


FIG. 1.

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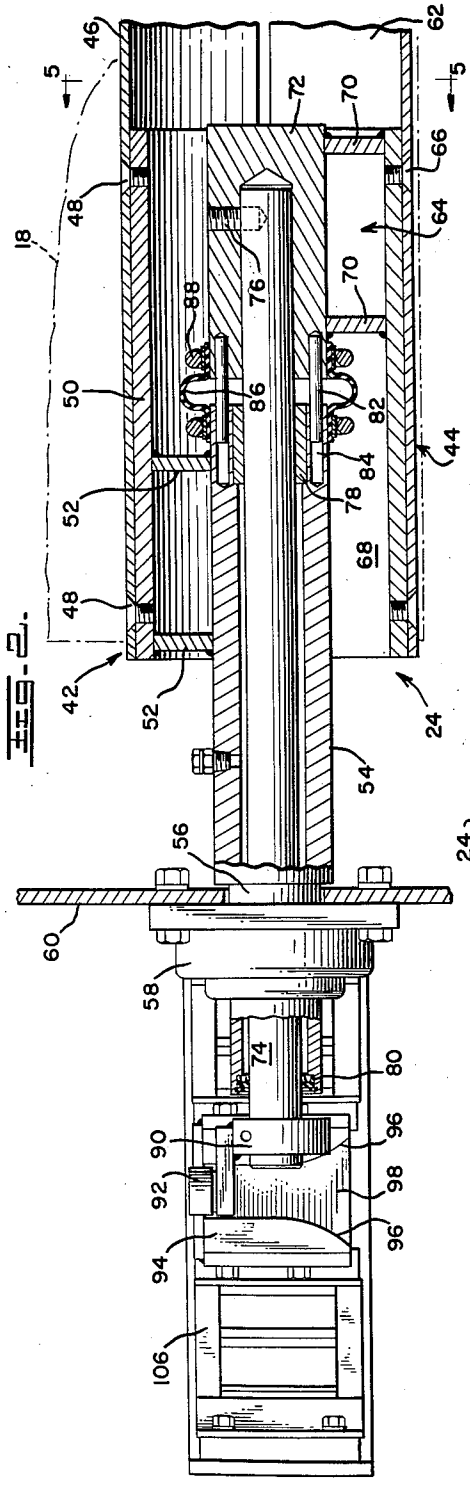


FIG. 2.

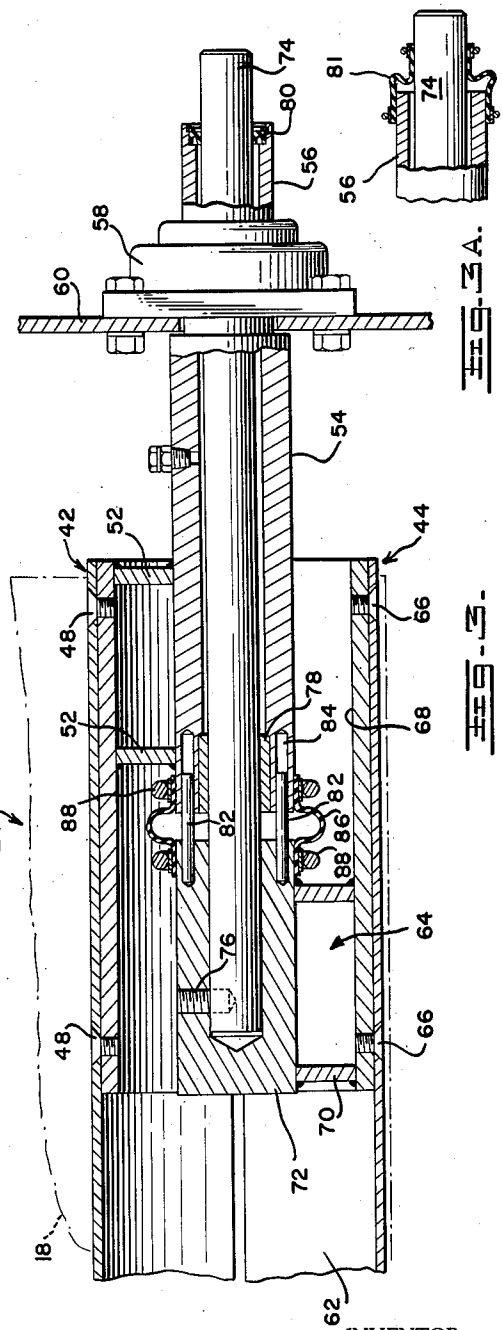


FIG. 3.

FIG. 3A.

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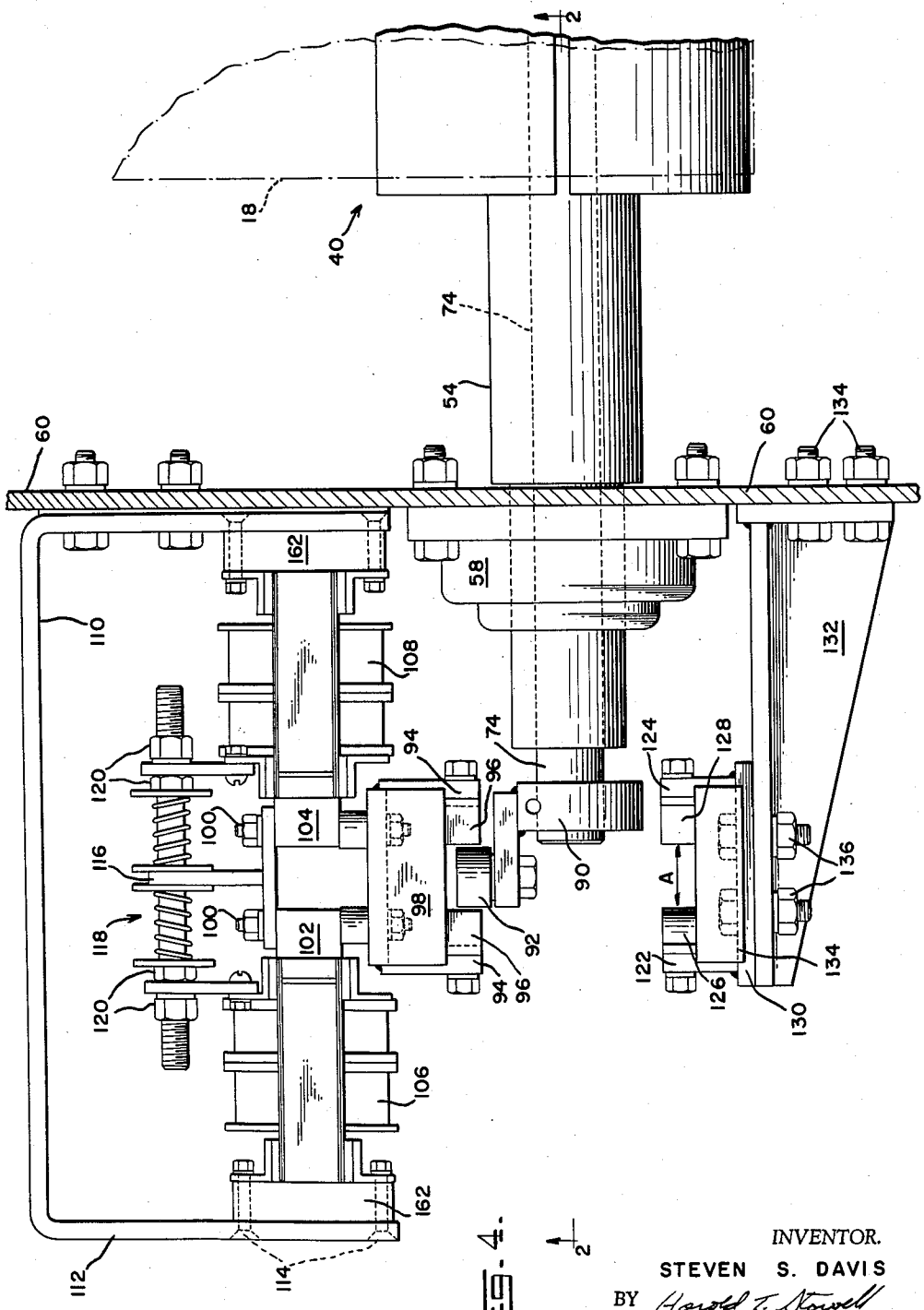


FIG. 4.

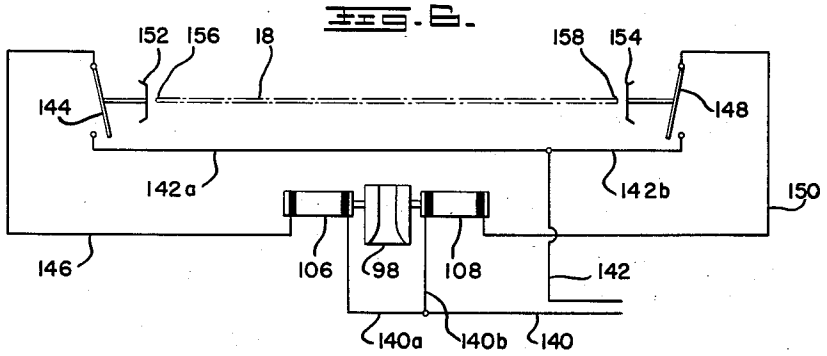
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FIG. 6.



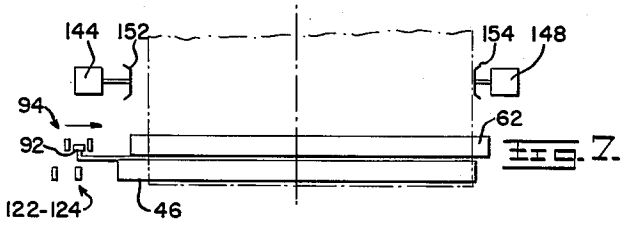


FIG. 7.

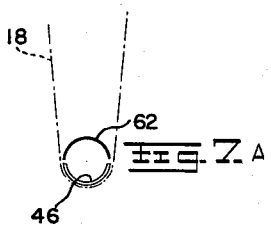


FIG. 7A

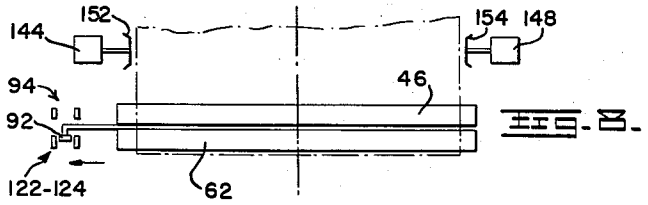


FIG. 8.

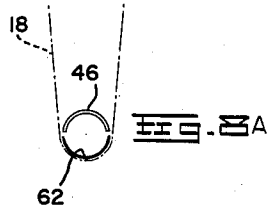


FIG. 8A

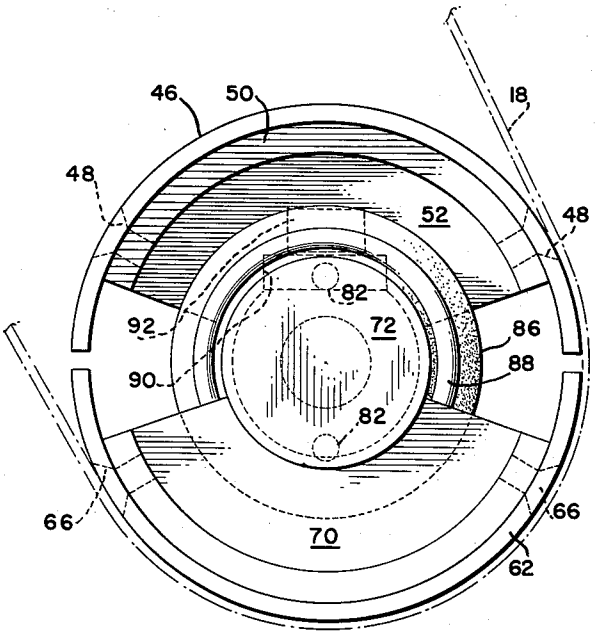


FIG. 5.

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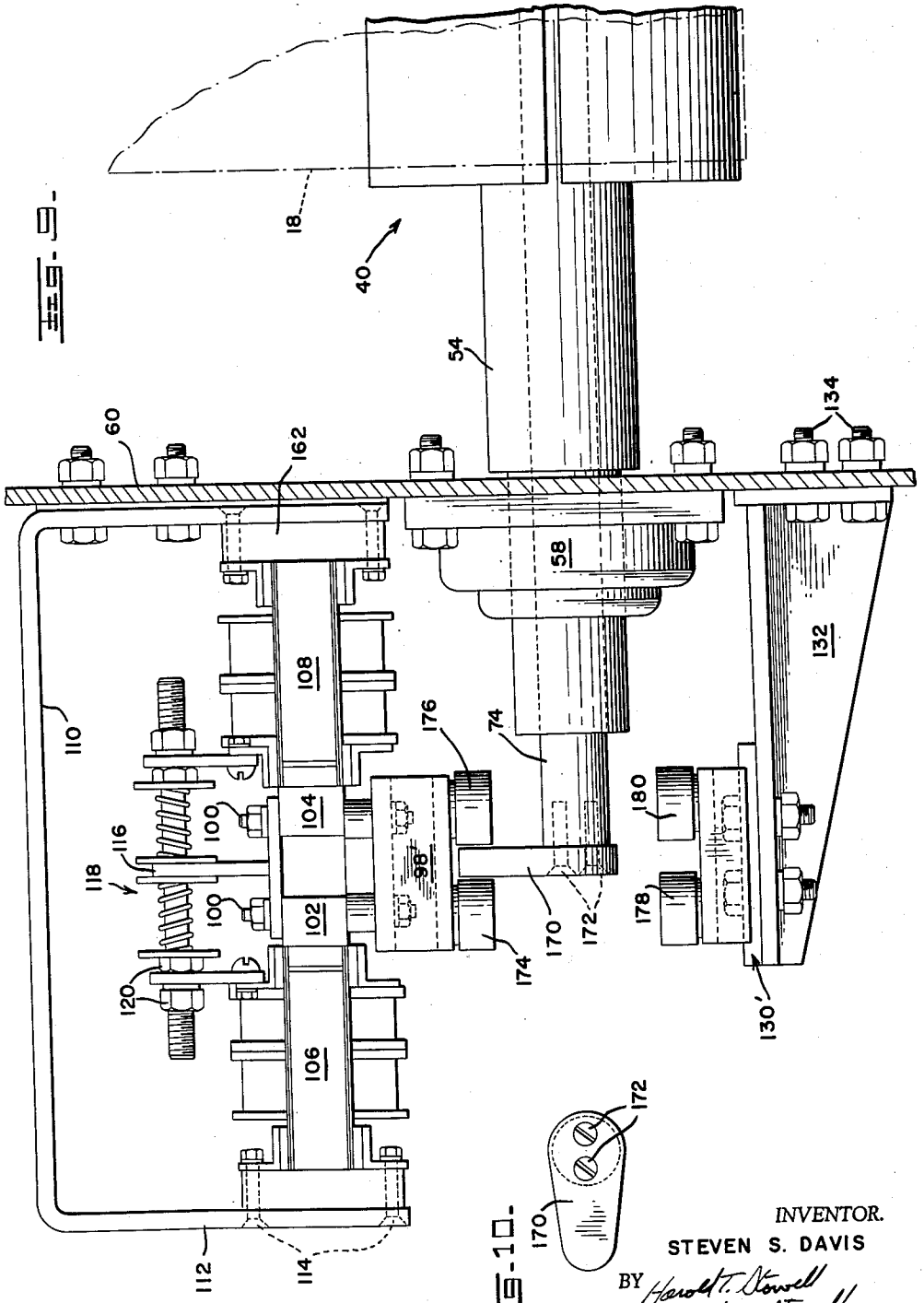


FIG. 9.

FIG. 10.

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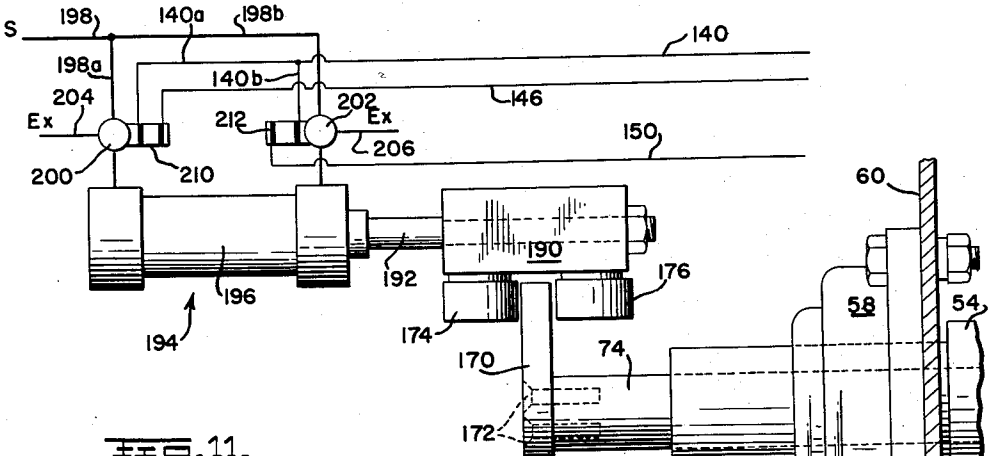


FIG. 11.

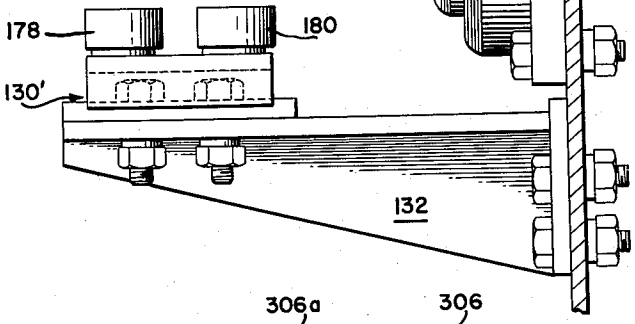


FIG. 14.

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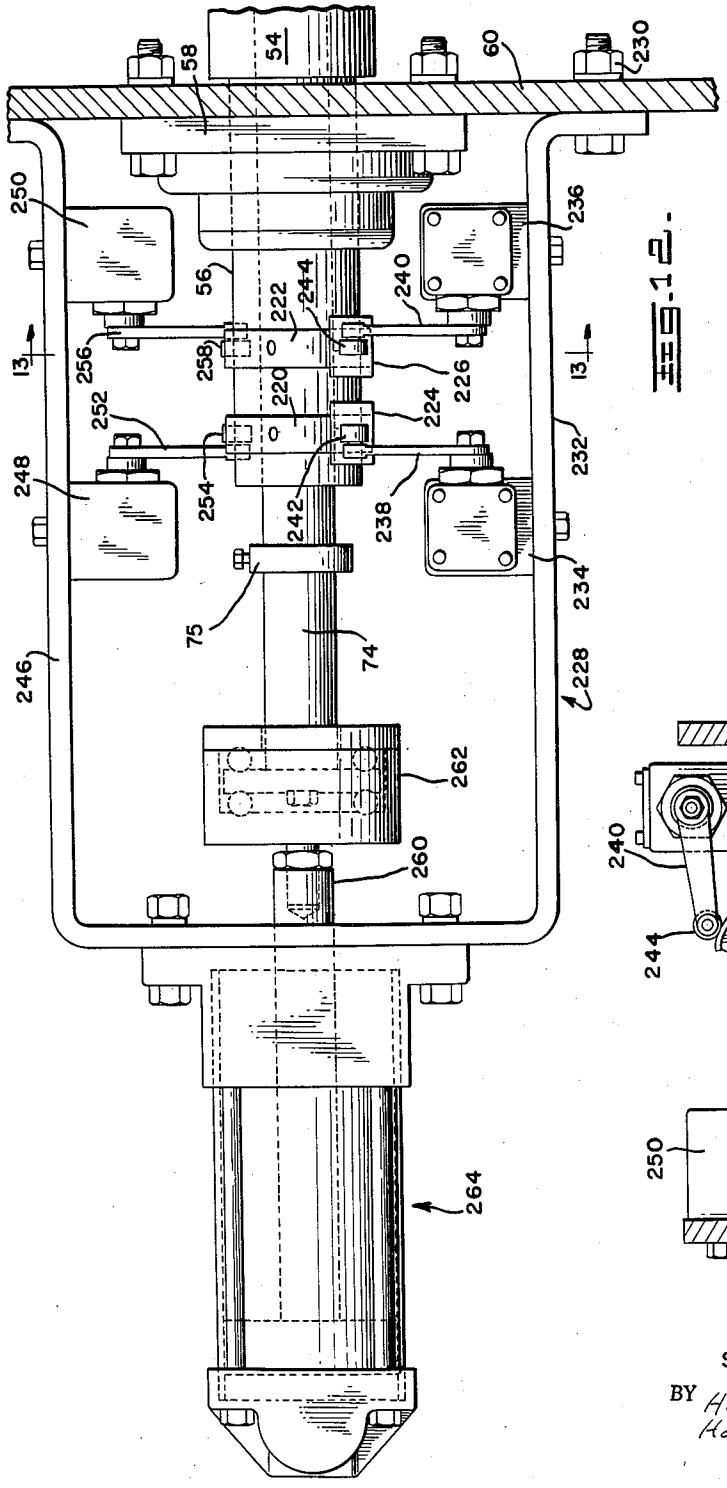


FIG. 12.

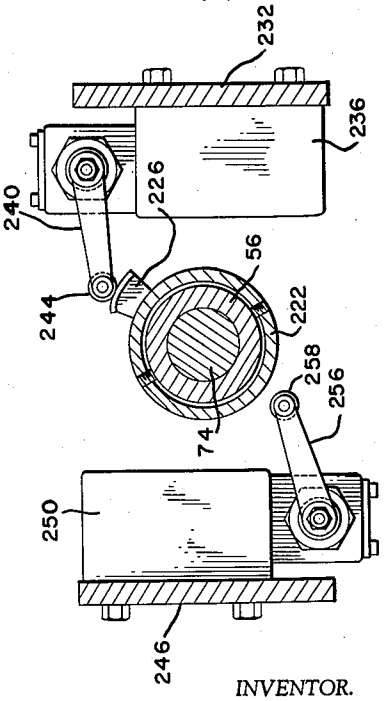


FIG. 13.

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WEB ALIGNING MEANS

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FIG. 15.

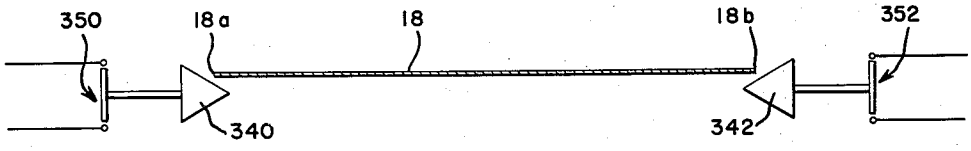
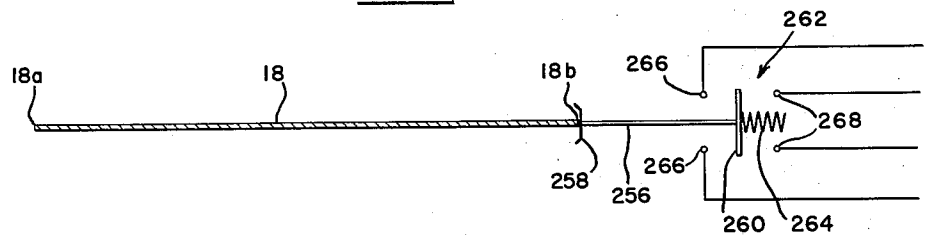


FIG. 16.



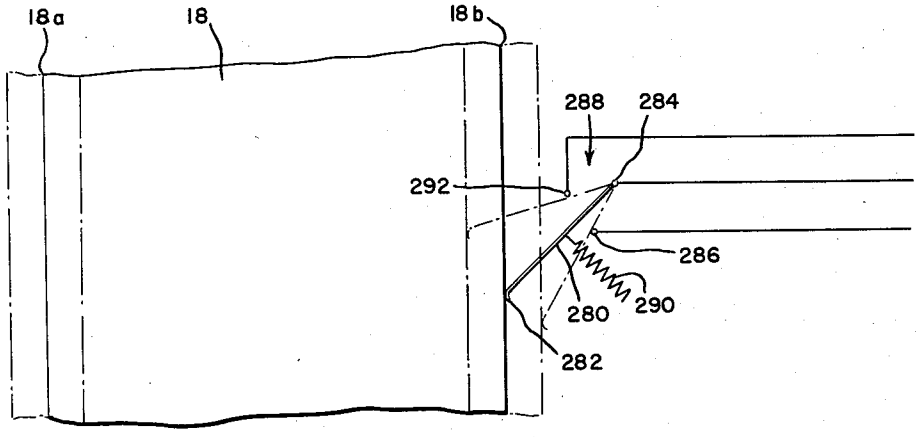


FIG. 17.

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United States Patent Office 3,117,462 Patented Jan. 14, 1964

3,117,462
WEB ALIGNING MEANS

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Continuation of application Ser. No. 752,459, Aug. 1, 1959. This application Dec. 31, 1962, Ser. No. 248,309
17 Claims. (Cl. 74—241)

This invention relates to new and improved aligning roller means for use in web handling equipment in general and, in particular, for maintaining alignment of endless filter media on continuous filter apparatus.

This application is a continuation of my pending Application Serial No. 752,459 filed August 1, 1959, now abandoned, for Web Aligning Means.

It is an object of the invention to provide automatic aligning means for a roller, pulley or the like which may be associated with a belt, a line, an apron, or a screen to be wound or unwound, or associated with an endless belt, line, apron, or screen which hereinafter will be referred to as a "web."

It is a further object to provide such a device that is simple in structure, rugged, easy to maintain, and relatively inexpensive to manufacture.

It is a further object of the invention to provide such an aligning means including an aligning pulley structure which may comprise a driver member, a driven member, or an idler member of a web handling assembly.

These and other objects and advantages are provided by the new and improved web aligning roller of the present invention having a substantially continuous cylindrical web supporting surface, the web supporting surface comprising a plurality of arcuate web supporting members, hub means mounting the arcuate members for rotation about an axis normal to the direction of travel of the web, the hub means including an axially shiftable portion, means connecting one of the arcuate web supporting members to the axially shiftable portion whereby upon reciprocation of the axially shiftable portion the one web supporting member is reciprocated relative to the other arcuate web supporting members, web position sensing means, and means responsive to the sensing means for moving the axially shiftable portion of the hub means to shift the one web supporting member and the web in contact therewith in a direction to align the web.

The invention will be more particularly described with reference to the illustrative embodiments of the invention shown in the accompanying drawings wherein:

FIG. 1 is a side elevational view of an endless filter media type industrial filter including the structures of the present invention;

FIG. 2 is an enlarged fragmentary sectional view of one end of the new and improved aligning roller of the invention substantially on line 2—2 of FIG. 4 with the roller rotated 90°;

FIG. 3 is an enlarged fragmentary sectional view of the other end of the structures shown in FIG. 2;

FIG. 3*a* is a fragmentary view of a modified seal for the ends of the shafts shown in FIGS. 2 and 3;

FIG. 4 is an enlarged fragmentary plan view of the structures shown in FIG. 2;

FIG. 5 is a section substantially on line 5—5 of FIG. 2;

FIG. 6 is a diagrammatic view of means interconnecting the web sensing means and the roller actuating structures shown in FIGS. 1 through 5;

FIGS. 7, 7*a*, 8 and 8*a* are diagrammatic views illustrating the principle of operation of the aligning means of the present invention illustrated in FIGS. 1 through 6;

FIG. 9 is a fragmentary plan view, similar to FIG. 4, of a modified form of the invention;

FIG. 10 is an end elevational view of the cam member shown in FIG. 9;

FIG. 11 is an enlarged fragmentary plan view of a further form of aligner roller actuating mechanism;

FIG. 12 is a fragmentary top plan view of a further form of the present invention;

FIG. 13 is a section substantially on line 13—13 of FIG. 12;

FIG. 14 is a schematic view of the inter-relationship between the plural switches, the source of pressure fluid and the power source for the structures shown in FIGS. 12 and 13; and

FIGS. 15, 16 and 17 are diagrammatic views of different types of sensing means which may be employed with the web aligning structures of the present invention.

Referring to the drawings and, in particular, to FIG. 1 thereof, 2 is a rotary drum having a conventional filter deck 4 divided into a plurality of segments by longitudinally extending division strips 6. The drum is mounted adjacent its ends for rotation in a trough 12 adapted to receive a slurry through slurry inlet 14.

At one end of the drum a conventional filter valve, not shown, is provided. The valve is connected to a source of vacuum and to a plurality of conduits 16 which, in turn, connect the source of vacuum with the various segments of the drum as is well known in the art.

Extending about the cylindrical filter deck is an endless belt filter medium generally designated 18. The filter medium comprises an endless web or belt of woven fabric or metallic screen or other suitable permeable web or sheet which filter medium extends across the entire width of the filter drum.

The filter assembly also includes a discharge roller 20 about which the endless filter web 18 passes after leaving the drum deck. The endless filter medium then comes in contact with a belt spreading roller 22 and thence the filter medium passes about an aligning roller 24 of the present invention. The filter medium subsequent to leaving the aligning roller 24, passes upwardly about an adjustable filter medium tensioning roller 26 and thence passes back to the drum deck. Positioned between the aligning roller 24 and the tensioning roller 26 are belt position sensing devices generally designated 28.

As illustrated in the drawing, an electric motor including a variable speed drive 30 is connected to the drum 2 for rotating the drum which, in turn, causes the endless filter medium trained thereabout to rotate the plural rollers 20, 22, 24 and 26. However, where desired, one or more of the rollers 20, 22, 24 or 26 may also be driven. The rotary drum filter shown in FIG. 1 includes a conventional agitator generally designated 32 to prevent the slurry to be filtered from stratifying or settling out in the slurry receiving tank 12.

In operation of the filter shown in FIG. 1, a slurry to be filtered is fed to the trough 12 and the drum 2 is rotated in the direction of the directional arrow, whereby the filter web 18 and the drum deck pass into the slurry to be filtered. Vacuum is applied to the filter sections within the trough 12 and a filter cake is built up on the outer surface of the filter medium 18 which filter cake is further dewatered as it passes out of the trough 12 as drum 2 continues to rotate.

At line A, FIG. 1, the filter medium 18 carrying the filter cake on its external surface leaves the drum to pass around the discharge roller 20 where the filter cake separates from the filter medium and falls into a suitable hopper for further treatment or disposal. The filter medium is then passed to the belt spreading roller 22, then about the aligning roller 24, the belt tensioning roller 26, and thence to the periphery of the drum 2 to complete the filtration cycle. In order for the filtration cycle,

as hereinabove described, to function properly, it is necessary that the web 18 be positioned centrally on the drum 2, the discharge roller, and the return roller 26. For example, if the web moves to one side of the filter drum, open spaces will occur at an edge of web 18 between the atmosphere or the slurry in the tank 12 and the filter deck which will destroy the operating efficiency of the filter and, further, if the misalignment becomes too great, wrinkling and tearing of the filter medium may occur. Uneven tracking of the filter medium occurs particularly on installations where the rotary drum is larger than, for example, one foot in diameter and it has also been found that misalignment is increased as the speed of rotation of the drum increases. Providing flanges on the drum and on the various rollers of the assembly have been found not to be effective to maintain the filter web 18 in its centered position as often the filter medium rides up over the flanges, leaving open spaces adjacent the other side of the filter drum.

Very satisfactory results are obtained by providing means for sensing the lateral movement of the filter medium and providing means responsive to the sensing means for maintaining the filter medium automatically centered on the filter drum and the discharge and return rollers. One form of the improved means for maintaining the filter medium centered on the filter drum will be described with reference to FIGS. 2 through 8*a*. Referring to these drawings, the aligning roller unit generally designated 24 includes a longitudinally fixed hemi-cylindrical portion 42. The fixed half 42 of the roller is comprised of a roll sleeve 46 having a length preferably slightly greater than the maximum width of the endless web to be aligned. The roll sleeve 46 is secured in fixed assembly to axially fixed end assemblies by screws 48. Each axially fixed end assembly is preferably fabricated as an integral unit with a metal arc member 50 mounted by two arcuate rib members 52 on a tubular shaft end member 54 forming one portion of the hub of the roller. Each of the shafts 54 is provided with an extension 56 with a reduced diameter shank for the bearings 58 mounting the fixed end assemblies and the entire aligning roller unit to side elements 60 of, for example, a rotary drum filter as illustrated in FIG. 1. Where desired, one or both of the reduced end portions 56 may be provided with suitable drive means such as a sprocket connected to a suitable motor for driving the aligning roller; however, very satisfactory aligning is provided by the structure of the apparatus when it functions as an idler roller as illustrated in FIGS. 2 through 8*a*.

The longitudinally movable half 44 of the aligning roller 24 is comprised of a hemi-cylindrical sleeve 62 which is fastened, to floating end assemblies generally designated 64, adjacent each of the ends of the aligner roller units by screws 66. Each floating end assembly 64 is fabricated as an integral unit with a metal arc member 68 mounted by two arcuate rib members 70 on a cylindrical floating member 72 which member is provided with a bore received floating rod 74. The inner ends of floating rods or shafts 74 are locked in place in the bores in their respective floating members 72 as by a screw 76 and extends outward through a bearing 78 in the respective tubular shaft end members 54 for longitudinal or axial movement relative thereto. A sealing ring 80 or flexible boot 81 (see FIG. 3*a*) may be provided between the end of the reduced portion 56 of each of the tubular shafts 54 and the extended ends of each of the shafts 74 which permit relative axial movement between respective shafts 54 and 74.

A plurality of dowel pins 82, which are mounted in the floating member 72, are slidably received in bores for relative longitudinal movement while maintaining alignment between the longitudinally fixed half 42 and the longitudinally movable half 44 of the improved roller. A resilient boot 86, which may be constructed of neoprene, rubber or the like, is so shaped and mounted on the tubular shaft 54 and on the respective floating cylinder members 72 by sealing band assemblies 88 as to permit a relative axial displacement of the floating cylinder member 72 and the floating longitudinally movable hemi-cylindrical surface member 62 relative to the tubular shaft end member 54 and longtiudinally fixed hemi-cylindrical member 46 while retaining lubricant and at the same time preventing entrance of foreign matter to the sliding pin assembly and bearing areas.

From the foregoing description, it will be seen that hemi-cylindrical members 46 and 62 are so carried on the hub members of the roller that they form a substantially cylindrical web-carrying surface. It will be further seen that the hemi-cylindrical surface members 46 and 62 are mounted on shaft member 54, which is mounted in bearings 58 for rotation about an axis concentric to the roller halves. It will be further appreciated that by means of the floating members 72 and their interconnection to the shaft 74 at each end and to the hemi-cylindrical surface member 62 upon a reciprocating impulse through one or both of the shafts 74, hemi-cylindrical member 62 may be axially or longitudinally moved relative to the fixed hemi-cylindrical member 46.

Referring now, particularly to FIGS. 2, 4, 6, 7, 7*a*, 8 and 8*a*, one form of shaft reciprocating means and sensing means for activating the reciprocating means will be described. The extended end of one of the floating shafts 74 has secured thereon a bracket 90 rotatably carrying a cam roller 92. The bracket 90 and the cam roller 92 rotate with the shafts 54 and 74 and reciprocate with the shaft 74. In one position during the rotation of shafts 54 and 74, the cam roller 92 comes in contact with a pair of spaced members 94 having cam shaped opposed faces 96. Each of the members 94 is secured to a cam support block 98 secured by bolt assemblies 100 to the extended ends of a pair of cores 102 and 104 of electric solenoids 106 and 108, respectively. Solenoid 108 is mounted to one side of a U-shaped bracket 110 which bracket is secured to the external face of one of the side members 60 supporting the bearings 58 for the aligning roller. The other end 112 of the U-shaped bracket 110 has secured thereto by bolts 114 the other electric solenoid 106. Each of the cores 102 and 104 of solenoids 106 and 108 is interconnected by bracket means 116 to spring urged centering elements 118 provided with spring tension adjusting bolts 120.

A second pair of members 122 and 124 having cam surfaces 126 and 128 are secured to a cam support bracket 130 which, in turn, is carried by arm member 132 secured by bolt means 134 to the side plate 60 carrying the U-shaped bracket 110. The cam members 122 and 124 are displaced substantially 180° from the movable cam blocks 94 and are so positioned that during a portion of the rotational travel of the cam roller 92, the roller passes between and when displaced makes contact with one or the other of the cam surfaces 126 and 128 of said cam blocks. The cam block support means 130 is adjustably positioned by slideways 134 and adjusting bolts 136 so that when the roller 92 has passed through the narrowest point A between the opposed cam faces 126 and 128, hemicylindrical member 62 is moved into alignment with the fixed hemicylindrical member 46 from a position of displacement which may have been brought about by actuation of solenoid 106 or 108 as to be more fully described hereinafter.

Referring to FIGS. 6, 7, 7*a*, 8 and 8*a*, one terminal of solenoids 106 and 108 is connected to a source of electrical energy through conductors 140, 140*a*, and 140*b*, respectively. The other terminal of solenoid 106 is connected to the other conductor 142 through line 142*a*, switch 144, and conductor 146. The other terminal of solenoid 108 is connected to conductors 142, 142*b*, switch 148 and conductor 150. Switches 144 and 148 are normally "open" switches and are provided with switch actuators 152 and 154, respectively. Switch actuator 152

is positioned a predetermined distance away from one of the lateral edges 156 of the web 18 to be aligned while the other switch actuator 154 is positioned a predetermined distance from the other lateral edge 158 of the web 18. With this arrangement, movement of the web 18 from its center position toward either switch 152 or 154 closes the circuit to its respective solenoid 106 or 108 bringing about longitudinal movement relative to the axis of the aligning roller 24 of the cam block 98 in a direction toward the belt misalignment as illustrated in FIGS. 7 and 7*a*. It will be noted from the phased position of the movable cam members 94 relative to the cam roller 92, that once the movable cam block 98 is moved in one direction or the other the cam roller does not bring about a corresponding movement of the movable hemi-cylindrical member 62 until the rollers are in the position shown in FIG. 7*a* with the belt or web member 18 trained about the fixed hemi-cylindrical member 46. Substantially 180° from the initial movement of roller half 62, the cam roller 92 comes in contact with one of the cam surfaces 126 or 128 of the cam members 122 or 124 carried by bracket 132. As the cam roller passes through the fixed cam elements the movable hemi-cylindrical surface member 62 having trained thereabout the web 18 is returned to its initial position of alignment with the fixed roller half 46 as illustrated in FIGS. 8 and 8*a*, thus correcting the misalignment of the web during its travel about the improved web aligning roller means.

The amount of correction of the web to be aligned is determined by the stroke of the cores 102 and 104 of the solenoids 106 and 108. And within limits this may be varied on any particular installation by adjusting nuts 120 and by means of shim blocks 162 positioned between the solenoids 106 and 108 and the bracket 110.

A modified form of the means for shifting the axially movable hemi-cylindrical member of the aligning roller is illustrated in FIGS. 9 and 10 with like elements designated with identical reference numerals. In FIGS. 9 and 10, the floating shaft 74 has secured to the end thereof a cam arm 170 by screws 172; the cam arm being illustrated in plan in FIG. 10.

The solenoids 106 and 108, having movable core elements 102 and 104, have secured thereto a modified block member 98' which block member rotatably supports a pair of spaced cam rollers 174 and 176. The bracket 132 carried by the side plate 60 is provided with a modified fixed block member 130' which block member rotatably supports a pair of spaced cam rollers 178 and 180. The roller supporting blocks 98' and 130' are positioned relative to the cam arm 170 so that the extended end of the cam arm passes between longitudinally movable cam rollers 174 and 176, when the longitudinally movable cam rollers 174 and 176, when the longitudinally movable hemi-cylindrical surface member 62 of the aligning roller is out of contact with the web to be aligned and the cam arm 170 passes between the fixed cam rollers 178 and 180 when the web 18 is in contact with said longitudinally movable hemi-cylindrical member 62 as illustrated in FIGS. 7, 7*a*, 8 and 8*a* previously described.

It is to be pointed out, however, that in both of these forms of the present invention this particular phasing of the unit may be reversed and the movable cam members or cam rollers may bring about the initial movement of the movable hemi-cylindrical member 62 when the belt is in contact therewith and the hemi-cylindrical member 62 may be returned to a position of alignment with the fixed surface member by the fixed cam blocks or cam rollers 178 or 180.

Operation of the modified form of the invention shown in FIGS. 9 and 10 is substantially identical to that previously described with reference to FIGS. 6 through 8*a*, with the solenoids 106 and 108 electrically connected to the switches 144 and 148 which switches are actuated by the web 18 through actuators 152 and 154.

Referring to FIG. 11, another form of actuating means for the floating shaft 74 and the floating roller half 62 is illustrated. In this form of the invention, the shaft 74 has secured thereto a cam arm 170 by bolts 172. The cam arm 170 cooperates with cam rollers 174 and 176 carried by a movable roller block 190 and the cam arm 170 also cooperates with fixed rollers 178 and 180 carried by cam roller block 130' secured to bracket 132 which, in turn, is carried by the side wall 60 supporting one of the bearings 58 for the aligning roller. The movable roller block 190 is secured to the extended end of piston rod 192 of a fluid pressure actuated ram assembly 194. The cylinder 196 of the pressure fluid actuated ram 194 is connected at each end to a source S of pressure fluid such as compressed air through conduit 198, 198*a*, valve 200, conduit 198*b* and valve 202, respectively. A return line or exhaust port 204 and 206 is provided for each of the valves 200 and 202, respectively, to remove pressure fluid from the respective sides of the double acting piston of the ram during actuation thereof. Valve 200 is provided with a solenoid actuator 210 while valve 202 is provided with a similar solenoid actuator 212.

Solenoid 210 is connected to a source of electric current through lines 140 and 140*a* while the other terminal of the solenoid is connected to the source of current through conductor 146 which has interposed therein a switch, such as switch 144, illustrated in FIG. 6 to be actuated by the lateral movement of the web to be aligned. The solenoid 212 of valve 202 is connected to the source of electric current by conductor 140 and 140*b* while the other terminal of the solenoid is connected to said source of current through conductor 150 having interposed therein a switch, such as switch 148, illustrated in FIG. 6 and actuated by movement of the web 18 to be aligned. In this form of the invention movement of the web to be aligned to close the switch 144 directs electric current to solenoid 210 permitting pressure fluid to flow from the source S through conduits 198 and 198*a* to the rear end of the pressure fluid ram causing the piston rod 192 to move to the right which, in turn, moves the block 190 and the rollers 174 and 176 attached thereto in said direction. Pressure fluid to the right of the piston of the ram exhausts to atmosphere or to a sump through the valve 202 and exhaust conduit 206. Movement of the cam roller block 190 brings about relative movement of the cam arm 170, the rod 74 attached thereto and the longitudinally movable roller half 62 when the cam arm 170 passes between the rollers 174 and 176 carried by the movable roller block 190. In this form of the invention, as in the forms described with reference to FIGS. 2 through 10, the web to be aligned at the time of movement of the shaft 74 by movable cam rollers 174, 176 may be trained thereabout or the hemi-cylindrical member 62 may be moved while the belt is trained about the fixed half of the aligning roller. In either case, as the cam arm 170 continued to rotate to a point substantially 180° out of phase with the movable rollers 174 and 176, the cam engages the fixed roller 178 or 180 returning either the movable half 44 of the roller 24 or the movable half 44 of the roller 24 and the web to be aligned as the case may be.

The ram 194 may be of the self-centering type. However, where the ram is not of the self-centering type with the valves 200 and 202 open to exhaust the relatively low inertia of the piston, piston rod 192, cam roller block 190 and rollers 174 and 176 as compared to the inertia of the movable half 44 of the roller 24 insures that the cam roller block 190 and rollers 174 and 176 move to neutral position as the cam arm passes between the rollers 174 and 176.

Referring to FIGS. 12, 13 and 14, a further embodiment of the means for axially moving floating rod assembly 74 and the movable roller half is illustrated. In FIGS. 12 through 14, the extended end 56 of tubular end mem-

ber 54 externally of the bearing 58, supporting the aligning roller and to the plate 60, is provided with a pair of ring elements 220 and 222. Each of the ring elements has secured thereto a switch actuating segment 224 and 226, respectively. A substantially U-shaped bracket 228 is secured by, for example, nuts and bolts 230 to the side plate 60. Leg 232 of bracket 228 has secured thereto a pair of electrical swtiches 234 and 236, each of which is provided with a switch actuating arm 238 and 240, respectively. The end of each of the switch actuating arms is provided with a roller 242 and 244. The other arm 246 of the bracket 228 also has secured thereto a pair of switches 248 and 250. Switch 248 carries a switch actuating arm 252 having at its extended end a roller element 254. Switch 250 has a switch actuating arm 256 carrying at its extended end a roller 258. The rollers 242, and 254 engage the external surface of segment 226 as the segments are caused to rotate upon rotation of shaft extension 56. The switches 234, 236, 248 and 250 are normally "open" switches.

The extended end of shaft 74 is secured to the extended end of a piston rod 260 through a coupling 262 which permits relative rotative movement between the end of shaft 74 and the piston rod 260.

Piston rod 260 forms the movable element of a pressure fluid actuated ram generally designated 264. The ram 264 is of the double acting type such as described with reference to unit 194 illustrated in FIG. 11 of the drawings and a stroke limiting collar 75 may be adjustably secured to shaft 74. The electrical connections between the various switches and the connection between a source of pressure fluid and the ram 264 are illustrated in FIG. 14.

Referring to FIG. 14, a source S of pressure fluid, such as compressed air, is directed to end 268 of the pressure fluid ram through conduit 270, 270*a*, valve 272, and conduit 274. The exhaust from said end 268 is through conduit 276 connected to normally closed valve 272. The valve 272 is provided with an electrical actuator 278. The other end 280 of the pressure fluid ram 264 is connected to the source S of pressure fluid through conduit 270, 270*b*, valve 282 and conduit 284. Pressure fluid exhausts from said end of the ram through conduit 286. Valve 282 is also provided with an electrical actuator 288 and each of the electrical actuators for the valves 272 and 282 is connected to a source of electric current through conductors 290, 290*a* and 290*b*, respectively.

The other terminal 292 of solenoid 278 is connected to one terminal of switch 250 through conductors 294 and 294*a*. Said terminal 292 is also connected to switch 234 by means of conductor 294*b*. Switch 296, which is actuated by movement of the web to be aligned, is connected to switch 250; to the other terminal 298 of the source of electric current, and to one terminal of the switch 236. Terminal 300 of solenoid actuator 288 is connected to switch 248 by conductor 302 and 302*a*. Electrical actuator 288 is also connected to one of the terminals of switch 236 by conductor 302*b*. The remaining terminal of switch 248 is connected to web actuated switch 304 through conductor 306 and 306*a*. Switch 304 is also connected to the remaining terminal of switch 234 through conductors 306 and 306*b*.

In operation of this form of the invention, the switch actuators 224 and 226, upon rotation of the hollow end shaft 56, are effective in passing through one portion of their rotational cycle to move the arms 252 and 256 of the phase switches 248 and 250 simultaneously and then approximately 180° further in rotation of the switch actuators 224 and 226 to simultaneously trip switch arms 240 and 238 of phase switches 234 and 236. If the web moves to close switch 296, then as the switch actuators 224 and 226 close the switches 248 and 250, the power supply circuit is completed through switch 250 and through solenoid actuator 278, opening valve 272 to actuate ram 264 as the web 18 is trained about the longitudinally movable roller half 44. This moves rod 74, the longitudinally movable half 44 of the aligning roller and web 18 toward the right as seen in FIG. 14. The positioning of the switch actuators 224 and 226 is such, with switch 296 closed by web 18, that as the piston rod 260 moves to the right, the aligning roller half 44 is engaging web 18. As the switch actuators 224 and 226 continue to rotate approximately 180° from their point of contact with the switch arms 252 and 256, the switch actuators simultanoeusly close normally open phasing switches 234 and 236. Closing of switch 236 as the web 18 is trained about the longitudinally fixed roller half 42 is effected to complete an electrical circuit through electrical actuator 288 of valve 282 to thereby open said valve and actuate the double acting hydraulic ram 264 in the opposite direction which, in turn, moves shaft 74 and the movable half of the aligning roller to the left as illustrated in FIG. 14. If the belt or web moves in the opposite direction closing switch 304, the opposite cycle would result.

It will be apparent that various forms of sensing means may be satisfactorily employed to determine the sense and direction of a correction required in the path of travel of the web 18. One such sensing and switch means was illustrated with reference to the form of the invention described with reference to FIG. 6. Other forms of sensing means, such as photo-electric cells positioned adjacent the lateral edges of the web 18 may be conveniently and effectively employed with each of the form of the invention hereinabove described. Other types of sensing means are illustrated in FIGS. 15, 16 and 17.

Referring to FIG. 15, the web 18 to be aligned having lateral edges 18*a* and 18*b* travels between a pair of sensing cones 340 and 342. Sensing cone 340 is a resiliently biased to open rotary switch 350. Sensing cone 342 is resiliently biased to open rotary switch 352. If the web 18 moves toward and comes in contact with sensing cone 340, it causes the cone to rotate, closing normally open switch 350 which, in turn, is connected to one of the plural means hereinbefore described for actuating the movable roller half 44. Movement of the web 18 from and out of contact with cone 340 permits the switch to return to the "open" position by the resilient biasing means. Continued movement in said direction brings the edge 18*b* into contact with sensing cone 342 closing the normally open rotary switch 252.

In FIG. 16 a web position sensing arm 256 carrying sensing element 258 is positioned adjacent only one edge 18*b* of the web 18. The other end of sensing arm 256 is secured to movable contact element 260 of the double pole switch 262. The arm 256 is biased into engagement with the lateral edge 18*b* of the web 18 by, for example, a spring 264. If the web 18 moves toward the left in FIG. 16, contact element 260 bridges switch portions 266 whereas if the web 18 moved in the opposite direction, switch contacts 268 would be bridged by movable switch element 269 permitting electric current to flow in the plural conductors connetced to one of the electrical actuators of the web aligning mechanism of the invention.

Referring specifically to FIG. 17, there is schematically illustrated a pivotal arm type sensing means which includes arm 280 having an element 282 on its extended end which is adapted to remain in contact with the lateral edge 18*b* of web 18. The pivot arm 280 is normally biased toward web edge 18*b* by spring 290 and upon movement of the web 18 toward the right, the arm 280 closes one of the switch elements through common terminal 284 and the lower terminal 286 of the switch 288. Movement of the web 18 in the opposite direction permits the biasing spring 290 to move arm 280 to close a circuit between the common terminal 284 and terminal 292 whereby electric current is directed to an opposite actuator for the movable half of the plural aligning rollers illustrated in the drawings.

From the foregoing description, it will be seen that

the present invention provides a very satisfactory web aligning roller system including a substantially continuous cylindrical web supporting surface, the web supporting surface comprising a plurality of web supporting members, hub means mounting the arcuate members for rotation about an axis normal to the direction of the travel of the web, the hub means including an axially shiftable portion, means connecting one of the arcuate web supporting members to the axially shiftable portion whereby upon reciprocation of the axially shiftable portion that one web supporting member is reciprocated relative to the other of the arcuate web supporting members, web position sensing means, and means responsive to the sensing means for moving the axially shiftable portion to shift the one web supporting member and the web in contact therewith in a direction to align the web on the other of the arcuate web supporting members, whereby the aims, objects and advantages of the invention are fully accomplished.

I claim:

1. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including a portion shiftable in only an axial direction, said axially shiftable portion of said mounting means including a shaft, an end portion of which projects axially beyond the web supporting surfaces of the aligning roller, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is axially reciprocated relative to the other of said hemi-cylindrical members, web position sensing means, power actuated means energizable in response to signals from said sensing means, said power actuated means having connection to said end portion of said shaft for axially moving said axially shiftable portion to shift axially said one web supporting member and the web in contact therewith in a direction to align the web with respect to said other hemi-cylindrical member.

2. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including an axially shiftable portion, said axially shiftable portion of said mounting means including a shaft, an end portion of which projects axially beyond the web supporting surfaces of the aligning roller, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is axially reciprocated relative to the other of hemi-cylindrical members, web position sensing means, and means responsive to said sensing means including a pressure fluid actuated piston and cylinder unit, means connecting the piston of said unit to said end portion of said shaft, separate conduit means connecting each end of the cylinder of the piston-cylinder unit to a source of pressure fluid, valve means in each of said conduit means, and means connecting said sensing means to actuators for said valves for axially moving said axially shiftable portion to shift axially said one web supporting member and the web in contact therewith in a direction to align the web with respect to said other hemi-cylindrical member.

3. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including an axially shiftable portion, said axially shiftable portion of said mounting means including a shaft, an end portion of which projects axially beyond the web supporting surfaces of the aligning roller, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is axially reciprocated relative to the other of said hemi-cylindrical members, web position sensing means, and means responsive to said sensing means including a pair of opposed solenoids, movable cores for said solenoids, a first pair of spaced members having cam surfaces secured to said cores, a cam roller carried by the end portion of said shaft and adapted to engage the first pair of said cam members when the web is in contact with the other of said hemi-cylindrical members, separate conductor means electrically connecting said pair of opposed solenoids to said sensing means, a second pair of spaced members having cam surfaces displaced 180° from said first pair of spaced members and adapted to be engaged by said cam roller when the web is in contact with said one of said hemi-cylindrical members, said second pair of members having cam surfaces adapted to shift axially said one hemi-cylindrical member into alignment with the other of said hemi-cylindrical members.

4. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including an axially shiftable portion, said axially shiftable portion of said mounting means including a shaft, an end portion of which projects axially beyond the web supporting surfaces of the aligning roller, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is axially reciprocated relative to the other of said hemi-cylindrical members, web position sensing means, and means responsive to said sensing means including a pair of opposed solenoids, movable cores for said solenoids, a first pair of spaced cam rollers secured to said cores, an arm carried by the end portion of said shaft and adapted to engage the first pair of cam rollers when the web is in contact with said one of said hemi-cylindrical members, separate conductor means electrically connecting said pair of opposed solenoids to said sensing means, a second pair of spaced rollers displaced 180° from said first pair of spaced rollers and adapted to be engaged by said arm when the web is in contact with the other of said hemi-cylindrical members, said second pair of rollers adapted to shift axially said one hemi-cylindrical member into alignment with the other of said hemi-cylindrical member.

5. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including an axially shiftable portion, said axially shiftable portion of said mounting means including a shaft, an end portion of which projects axially beyond the web supporting surfaces of the aligning roller, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is axially reciprocated relative to the other of said hemi-cylindrical members, web position sensing means, and means responsive to said sensing means including a double acting pressure fluid piston-cylinder unit, a first pair of spaced members having cam surfaces secured to the piston of said piston-cylinder unit, a cam roller carried

by the end portion of said shaft and adapted to engage a first pair of said cam members when the web is in contact with the other of said hemi-cylindrical members, separate conduit means connecting each end of the cylinder of the piston-cylinder unit to a source of pressure fluid, valve means in each of said conduits, means connecting said sensing means to actuators for said valves, a second pair of spaced members having cam surfaces displaced 180° from said first pair of spaced members and adapted to be engaged by said cam roller when the web is in contact with said one of said hemi-cylindrical members, said second pair of members having cam surfaces adapted to shift axially said one hemi-cylindrical member into alignment with the other of said hemi-cylindrical members.

6. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including an axially shiftable portion, said axially shiftable portion of said mounting means including a shaft, an end portion of which projects axially beyond the web supporting surfaces of the aligning roller, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is axially reciprocated relative to the other of said hemi-cylindrical members, web position sensing means, and means responsive to said sensing means including a pressure fluid actuated piston-cylinder unit, a first pair of spaced rollers secured to the piston of said piston-cylinder unit, a cam arm carried by the end portion of said shaft and adapted to engage the first pair of rollers when the web is in contact with said one of said hemi-cylindrical members, separate conduit means connecting each end of the cylinder of the piston-cylinder unit to a source of pressure fluid, valve means in each of said conduit means, and means connecting said sensing means to actuators for said valves, a second pair of spaced rollers displaced 180° from said first pair of spaced rollers and adapted to be engaged by said cam arm when the web is in contact with said other of said hemi-cylindrical members, said second pair of rollers adapted to shift axially said one hemi-cylindrical member into alignment with the other of said hemi-cylindrical members.

7. A web aligning roller comprising a pair of hemi-cylindrical members, means mounting said hemi-cylindrical members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounting means including an axially shiftable portion, means connecting one of said hemi-cylindrical members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one hemi-cylindrical member is reciprocated relative to the other of said hemi-cylindrical members, web position sensing means positioned adjacent one of the lateral edges of a web to be aligned, said sensing means including an arm adapted to be engaged by the web, said arm having an attachment to a double pole switch, and means responsive to said sensing means for axially moving said axially shiftable portion to shift axially said one web supporting member and the web in contact therewith in a direction to align the web with respect to said other hemi-cylindrical member.

8. A web aligning roller having a substantially continuous cylindrical web supporting surface, said web supporting surface comprising a plurality of arcuate web supporting members, hub means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of the web traveling thereon, said hub means including an axially shiftable portion comprising a shift, an end portion of which projects axially beyond the web supporting surface of the aligning roller, means connecting one of said arcuate web supporting members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one web supporting member is axially reciprocated relative to said other of said arcuate web supporting members, web position sensing means, and means responsive to said sensing means including a pressure fluid actuated piston-cylinder unit, means connecting the piston of said unit to said end portion of said shaft, separate conduit means connecting each end of the cylinder of the piston-cylinder unit to a source of pressure fluid, valve means in each of said conduit means, and means connecting said sensing means to actuators for said valves for axially moving said axially shiftable portion to shift axially said one web supporting member and the web in contact therewith in a direction to align the web with respect to said other of said arcuate web supporting members.

9. A web aligning roller having a substantially continuous cylindrical web supporting surface, said web supporting surface comprising a plurality of arcuate web supporting members, hub means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of the web traveling thereon, said hub means including an axially shiftable portion comprising a shaft, an end portion of which projects axially beyond the web supporting surface of the aligning roller, means connecting one of said arcuate web supporting members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one web supporting member is axially reciprocated relative to said other of said arcuate web supporting members, web position sensing means, and means responsive to said sensing means including a pair of opposed solenoids, movable cores for said solenoids, a first pair of spaced members having cam surfaces secured to said cores, a cam roller carried by the end portion of said shaft and adapted to engage the first pair of said cam members when the web is in contact with the other of said web supporting members, separate conduit means electrically connecting said pair of opposed solenoids to said sensing means, a second pair of spaced members having cam surfaces circumferentially displaced from said first pair of spaced members and adapted to be engaged by said cam roller when the web is in contact with said one web supporting member, said second pair of members having cam surfaces adapted to shift axially said one web supporting member into alignment with the other of said web supporting members.

10. A web aligning roller having a substantially continuous cylindrical web supporting surface, said web supporting surface comprising a plurality of arcuate web supporting members, hub means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of the web traveling thereon, said hub means including an axially shiftable portion comprising a shaft, an end portion of which projects axially beyond the web supporting surface of the aligning roller, means connecting one of said arcuate web supporting members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one web supporting member is axially reciprocated relative to said other of said arcuate web supporting members, web position sensing means, and means responsive to said sensing means including a pair of opposed solenoids, movable cores for said solenoids, a first pair of spaced cam rollers secured to said core, an arm carried by the end portion of said shaft and adapted to engage the first pair of cam rollers when the web is in contact with said one of said web supporting members, separate conductor means electrically connecting said pair of opposed solenoids to said sensing means, a second pair of spaced rollers circumferentially displaced from said first pair of spaced rollers and adapted to be engaged by said arm when the web is in contact with the other of said web supporting members, said second pair of rollers adapted

to shift axially said one web supporting member into alignment with the other of said web supporting members.

11. A web aligning roller having a substantially continuous cylindrical web supporting surface, said web supporting surface comprising a plurality of arcuate web supporting members, hub means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of the web traveling thereon, said hub means including an axialiy shiftable portion comprising a shaft, an end portion of which projects axially beyond the web supporting surface of the aligning roller, means connecting one of said arcuate web supporting members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one web supporting member is axially reciprocated relative to said other of said arcuate web supporting members, web position sensing means, and means responsive to said sensing means including a double acting pressure fluid actuated piston-cylinder unit, a first pair of spaced members having cam surfaces secured to the piston of said piston-cylinder unit, a cam roller carried by the end portion of said shaft and adapted to engage the first pair of said cam members when the web is in contact with the other of said web supporting members, separate conduit means connecting each end of the cylinder of the piston-cylinder unit to a source of pressure fluid, valve means in each of said conduits, means connecting said sensing means to actuators for said valves, a second pair of spaced members having cam surfaces circumferentially displaced from said first pair of spaced members and adapted to be engaged by said cam roller when the web is in contact with said one of said web supporting members, said second pair of members having cam surfaces adapted to shift axially said one web supporting member into alignment with the other of said web supporting members.

12. A web aligning roller having a substantially continuous cylindrical web supporting surface, said web supporting surface comprising a plurality of arcuate web supporting members, hub means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of the web traveling thereon, said hub means including an axially shiftable portion comprising a shaft, an end portion of which projects axially beyond the web supporting surface of the aligning roller, means connecting one of said arcuate web supporting members to said axially shiftable portion whereby upon reciprocation of the axially shiftable portion said one web supporting member is axially reciprocated relative to said other of said arcuae web supporting members, web position sensing means, and means responsive to said sensing means including a pressure fluid actuated piston-cylinder unit, a first pair of spaced rollers secured to the piston of said piston-cylinder unit, a cam arm carried by the end portion of said shaft and adapted to engage the first pair of rollers when the web is in contact with said one of said web supporting members, separate conduit means connecting each end of the cylinder of the piston-cylinder unit to a source of pressure fluid, valve means in each of said conduit means, and means connecting said sensing means to actuators for said valves, a second pair of spaced rollers circumferentially displaced from said first pair of spaced rollers and adapted to be engaged by said cam arm when the web is in contact with said other of said web supporting members, said second pair of rollers adapted to shift axially said one web supporting member into alignment with the other of said web supporting members.

13. A web aligning roller comprising a pair of hemi-cylindrical members positioned to form a substantially continuous cylindrical web supporting surface, a pair of axially spaced tubular hub members, means rotatably mounting said hub members, means securing one of said hemi-cylindrical members to each of said tubular hub members, a shaft slidable in each of said tubular hub members, an end member secured to the inner end of each of said shafts, means securing the other of said hemi-cylindrical members to said end members, means connecting the respective hub members and end members for relative axial movement, flexible sealing means constructed to provide a sealed chamber at each end of said web aligning roller, and a flexible boot means connected to and spanning the space between each respective end member and tubular hub pair and flexible seal means between each respective tubular hub and shaft.

14. In the web aligning roller defined in claim 13 said flexible seal means comprising a sealing ring between respective tubular hubs and shafts.

15. In the web aligning roller defined in claim 13 said flexible seal means being a second flexible boot means mounted on respective tubular hubs and shafts and spanning the space between respective tubular hubs and shafts.

16. A web aligning roller comprising a plurality of arcuate members, means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, said mounitng means including at least one portion shiftable in only an axial direction, said axially shiftable portion of said mounting means including a portion projecting axially beyond said web supporting surface, means connecting at least one of said arcuate members to an axially shiftable portion of said mounting means whereby upon reciprocation of the axially shiftable portion said arcuate member connected thereto is axially reciprocated relative to the remainder of said arcuate members, web position sensing means, power actuated means energizable in response to signals from said sensing means, said power actuated means having connection to said axially projecting portion of said mounting means for axially moving said axially shiftable portion to shift axially said arcuate member and the web in contact therewith in a direction to align the web with respect to the remainder of said arcuate members.

17. A web aligning device comprising a plurality of arcuate members, means mounting said arcuate members for rotation about an axis extending transversely of and parallel to the direction of travel of a web traveling thereon to provide a substantially continuous cylindrical web supporting surface, at least one of said arcuate members being shiftable in only an axial direction whereby to be axially reciprocable relative to the remainder of said arcuate members, web position sensing means, power actuated means energizable in response to signals from said sensing means, said power actuated means having functional connection to said axially shiftable arcuate member for axially moving the same to thereby shift axially the web in contact therewith with respect to the remainder of said arcuate members.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,117,462 January 14, 1964

Steven S. Davis

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the sheets of drawings, Sheets 1 to 8, in the heading, line 3 thereof, in the heading to the printed specification, line 7, and column 1, line 15, for "1959", each occurrence, read -- 1958 --; column 13, line 49, for "arcuae" read -- arcuate --.

Signed and sealed this 16th day of June 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents