Oct. 16, 1956 S. W. WARNER 2,766,949

AUTOMATIC SHEET GUIDE

Filed June 29, 1953 3 Sheets-Sheet 1

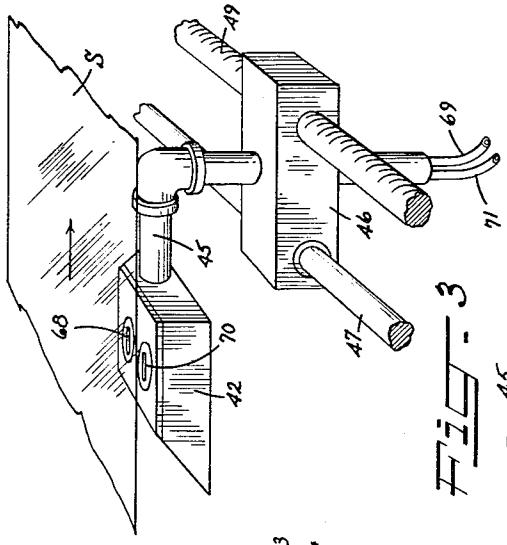


Fig. 3

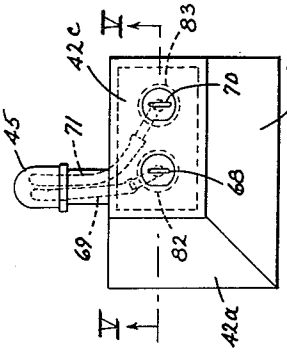


Fig. 4

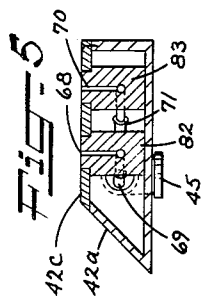


Fig. 5

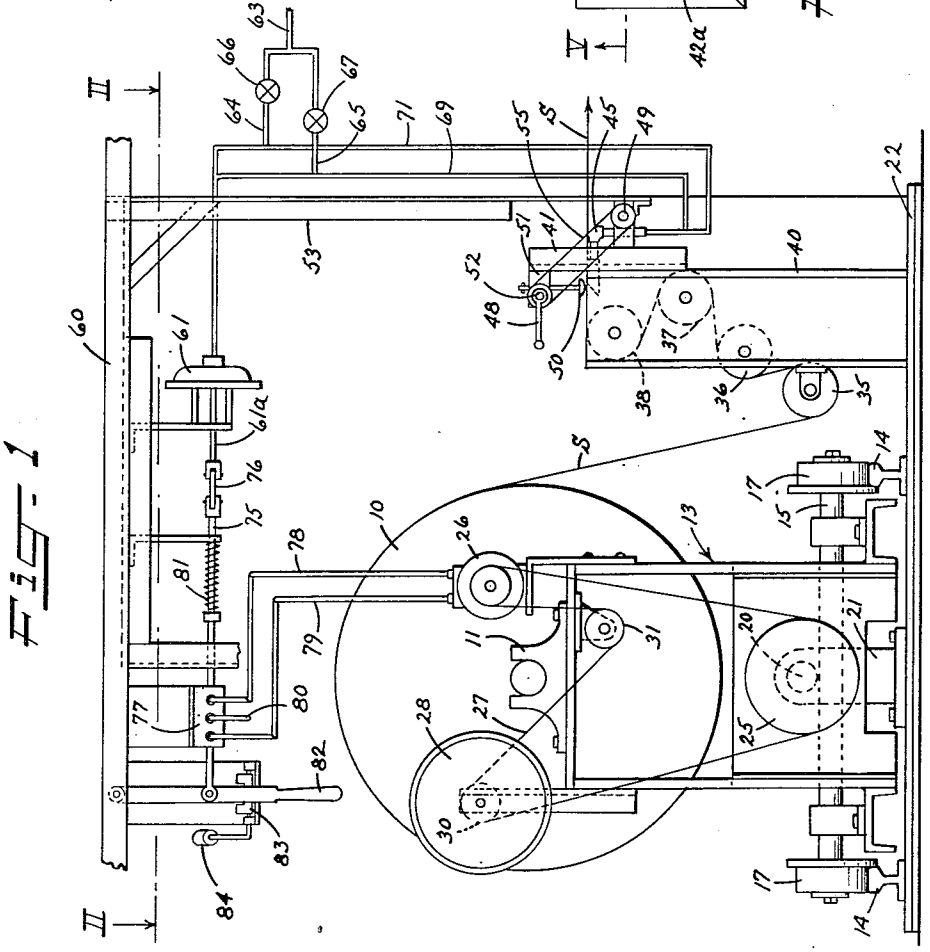


Fig. 1

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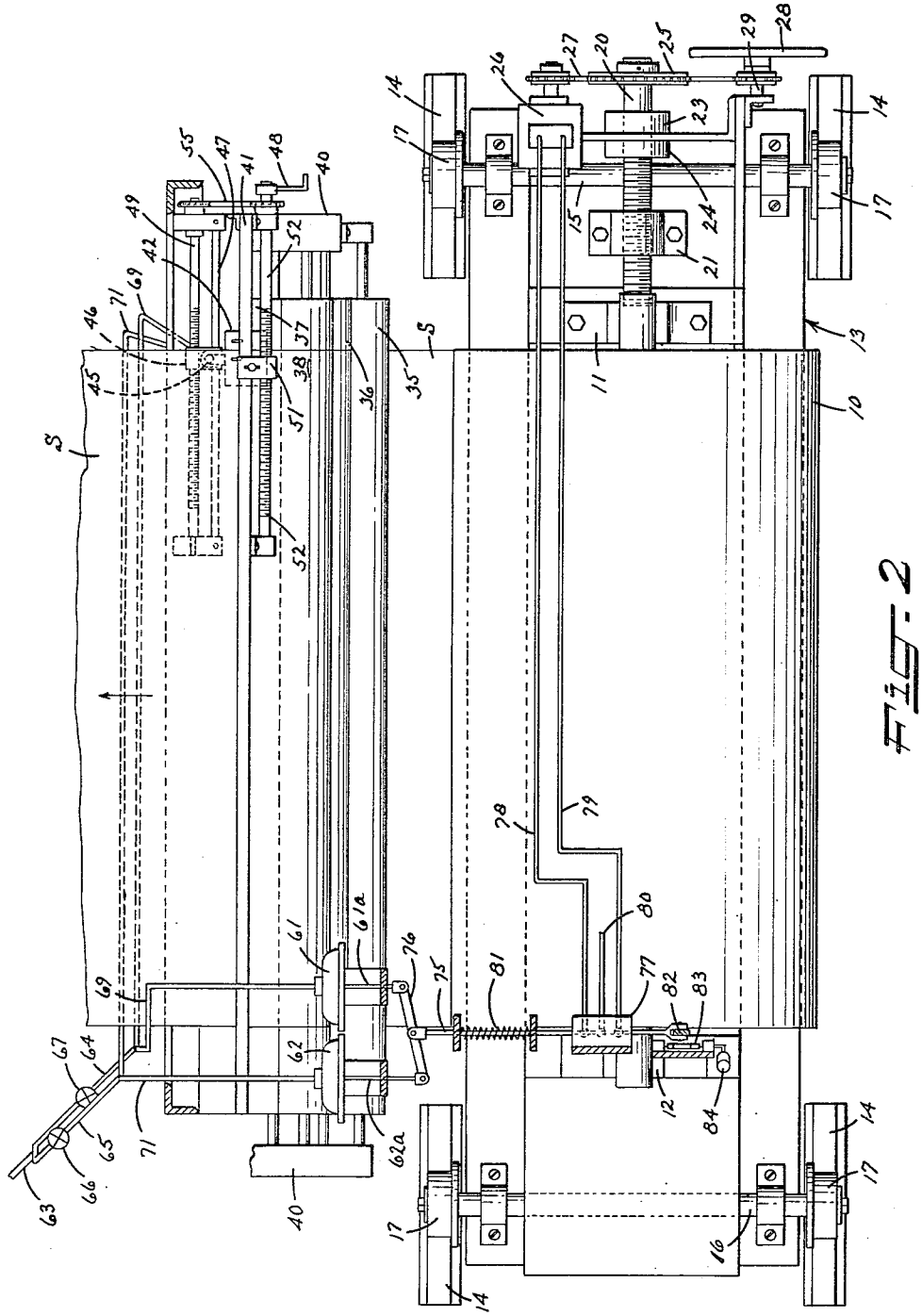


FIG. 2

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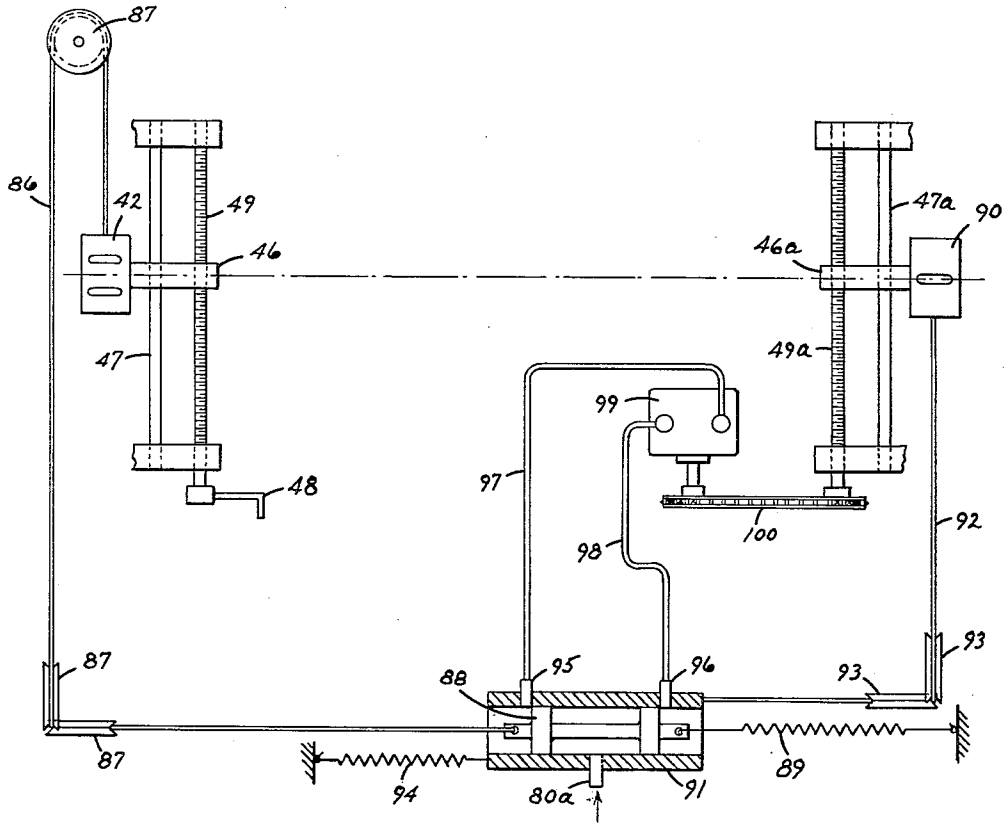


Fig. 6

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AUTOMATIC SHEET GUIDE

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6 Claims. (Cl. 242—76)

This invention relates to web-control apparatus and, more particularly, to an improved device which more accurately controls the register of a travelling sheet or web.

The primary object of the present invention is to provide a relatively simple, inexpensive mechanism for accurately controlling the lateral position of a travelling web of material, for example, a sheet of cellophane.

A further object of the invention is to provide a combined vacuum and air travelling sheet control mechanism which is highly sensitive and quick-acting.

A further object of the invention is to provide a completely pneumatic control system for edge registry of travelling sheets.

Further objects will be apparent from the specification and drawings in which

Figure 1 is a side view of a sheet-feeding apparatus incorporating the improved control system of the present invention;

Figure 2 is a top sectional view of the structure of Figure 1 as seen at II—II.

Figure 3 is a perspective showing the sheet edge detector;

Figure 4 is a top view of the detector head as shown in Figure 3;

Figure 5 is a section as seen at V—V of Figure 4; and

Figure 6 is a diagrammatic view showing how the present invention is employed with synchronizing means to control the registry at the unwind and rewind positions of a single machine.

The present invention comprises essentially the provision of an edge-detecting head or shoe having two slots therein which are spaced in accordance with desired limits within which the travelling sheet must be controlled. A vacuum connection is made to each of the slots in the shoe, and any change in the normal vacuum condition in each vacuum line actuates a vacuum diaphragm which is connected to a valve in an air pressure line. The main web-feeding carriage is moved transversely to the path of web travel by means of a reversible air motor connected to the two-way valve. This system eliminates all electrical connections and is extremely sensitive and simple to install.

Referring now more particularly to the drawings, a roll 10 of sheet material S is mounted in trunnions 11 and 12 which are in turn supported on carriage 13. The carriage is movable transversely of the path of sheet feed on rails 14, 14, which support the carriage through axles 15 and 16 and flanged wheels 17, 17. A control shaft 20 is journaled in carriage 13 and has a threaded section which engages a stationary pillow block 21 secured to lower frame structure 22. Axial movement of shaft 20 in carriage 13 is prevented by means of thrust collars 23 and 24 so that upon rotation of the shaft the carriage 13 is caused to roll in either direction along rails 14, 14. The outboard end of shaft 20 carries a sprocket 25 which is connected to an air motor 26 on the carriage by means of a chain 27. So that suitable manual adjustment of the carriage position can be made, a hand wheel 28 on stub

shaft 29 is capable of turning shaft 20 through a small sprocket 30 and chain 27. An idler take-up 31 for the chain may be mounted on the carriage between motor 26 and sprocket 30 as may be needed.

The sheet S, as it unwinds from supply roll 10, feeds over a plurality of tensioning rolls 35, 36, 37 and 38. All of these rolls are mounted in frame members 40, 40 which likewise support a bracket 41 for the detecting shoe assembly. This shoe or plate 42 is provided with beveled side faces 42*a* and 42*b* facing across the sheet and into the sheet as shown in Figures 3 and 4. The shoe is carried by a pipe 45 mounted in slide block 46 which is supported on a stationary shaft 47. To provide for variations in the width of sheets being run, lateral adjustment of the shoe 42 is effected by turning crank 48 which controls a shaft 49 threaded into slide block 46. A presser foot 50 is mounted in a bracket 51 which is in turn in threaded engagement with a shaft 52 (Figure 2) so that the presser foot moves simultaneously with the shoe 42. Crank 48 is directly mounted on the shaft 52 and controls shaft 49 through chain 53.

The intermediate control mechanism mounted on the upper frame member 60 comprises a pair of vacuum diaphragms 61 and 62, both of which are connected to a source of vacuum 63 through conduits 64, 65 and needle valves 66, 67. Vacuum chamber 61 connects with the inside slot 68 in shoe 42 through vacuum conduit 69, and vacuum chamber 62 connects with the outer slot 70 through vacuum conduit 71. The diaphragm rods 61*a* and 62*a* of vacuum chambers 61 and 62 actuate a valve rod 75 through a walking beam 76. A two-way pressure valve 77 directs air under pressure selectively to conduits 78 and 79 connected to the air motor 26. Conduit 80 is connected to a suitable source of air under pressure, not shown herein. Valve rod 75 is spring-biased at 81 and extends through the valve so that it can be manually actuated by means of a lever 82 pivoted to the upper frame member 60. When it is desired to dispense with the automatic operation of carriage 13, a latch 83 is swung to retain lever 82 midway of its throw. A counterweight 84 on the latch-operating handle serves to maintain the latch in either a locked or unlocked position.

As shown in Figure 2, the sheet S is travelling across shoe 42 approximately midway between the slots 68 and 70. Under these circumstances the vacuum in line 69 is retained so that the piston rod 61*a* of chamber 61 is retracted. Since slot 70 is open, there is no vacuum in line 71. Therefore, the diaphragm in chamber 62 is not actuated. Under these conditions the valve 77 does not permit air to flow from conduit 80 into either conduit 78 or 79. Should the sheet S move to the left, as seen in Figure 2, the slot 68 will also be exposed thereby breaking the vacuum in conduit 69 and permitting spring 81 to move valve rod 75 downward as seen in Figure 2. This throws valve 77 to start air motor 26 in the proper direction to move carriage 13 to the right. As soon as slot 68 is covered by the sheet the vacuum in chamber 61 returns valve rod 75 to the closed position, thus stopping motor 26.

Should the sheet travel to the right, as seen in Figure 2, beyond the predetermined spacing between slots 68 and 70, then slot 70 will be covered and vacuum built up in conduit 71 and chamber 62. This retracts rod 62*a* to move valve rod 75 from the neutral position and introduce air from conduit 80 into conduit 78, thus starting motor 26 to move carriage 13 to the left. As soon as slot 70 is uncovered, the vacuum in line 71 is broken, thus releasing rod 62*a* and returning the valve rod 75 to the neutral position.

Should the sheet be nicked along its edge or should it travel too far towards the left, as seen in Figure 2, the beveled edges 42*a* and 42*b* of the shoe assist in returning

the sheet to its proper position over the shoe without further damage. The construction of the shoe is seen more clearly in Figure 5 which shows the upper plate **42***c* retaining a pair of plugs **82** and **83** in place within the shoe. These plugs are shouldered to insure proper registry in the shoe and are connected internally with their respective conduits **69** and **71** as shown in Figures 4 and 5.

When the apparatus of the present invention is employed in a single sheet-treating machine having a roll unwind mechanism at one end and a roll rewind mechanism at the opposite end, it is advantageous to synchronize the position of the detector shoes at the unwind and rewind ends of the machine. In a cellophane-coating machine, for example, the distance between the unwind and the rewind roll is on the order of 40 ft. so that it is necessary to accurately guide the paper onto the rewind roll. For this purpose an edge detector mechanism at the rewind end of the machine is synchronized with the unwind roll carriage. As shown in Figure 6, a cord or cable **86** is secured to the detector shoe **42** which after passing over pulleys **87**, **87** is fastened to one end of a piston-type valve **88**. The opposite end of the valve is anchored to a stationary part of the frame through an extension spring **89**. The detector mechanism at the rewind end of the machine may be of conventional construction and may include a single port shoe such as shown at **90**. This shoe **90** is used to control the edge alignment of the rewind roll, in a manner well known in the art, as the web is received thereon. This detector shoe **90**, at the rewind end of the machine, is controlled laterally by means of a threaded shaft **49***a* and slide block **46***a* mounted on shaft **47***a* in the same manner as previously described. The detector shoe **90**, however, is connected to valve housing **91** by means of a chain or cable **92** passing over suitably arranged pulleys **93**, **93**. The opposite end of the valve housing **91** is secured to a stationary part of the frame by an extension spring **94** so that the housing is spring-loaded to be responsive to any laterally adjusted position of the detector shoe **90**, and the valve **88** in the housing is likewise spring-loaded to be responsive to a laterally adjusted position of detector shoe **42**. Air under pressure is admitted to the central part of the sleeve-like housing **91** through conduit **80***a*. When the position of detector shoe **42** is moved by turning crank **48**, the valve will be displaced accordingly to open one of the ports **95** or **96** in accordance with the direction in which the shoe is moved. This admits air under pressure to one of the conduits **97** or **98** which in turn operates a reversible air motor **99** to turn shaft **49***a* through chain **100**. This adjusts the position of detector shoe **90** at the rewind end of the machine in accordance with the adjusted position of shoe **42**, but the movement of shoe **90** also controls the position of valve housing **91** so that when the detector shoe **90** has moved an increment equal to the movement of shoe **42** the relative positions of the valve housing **91** and the valve **88** will be such that both ports **95** and **96** are closed with respect to conduit **80***a*.

A particular advantage of the present control system resides in the ability to utilize separate actuating means for the carriage as opposed to previous systems in which the carriage was actuated directly from the vacuum system associated with the edge-register device. The relatively low vacuum in shoe **42** can be on the order of seven inches of mercury, thus avoiding damage to the delicate sheet as well as the likelihood of inducing rupture of the sheet. With relatively high pressure air on the order of 40 p. s. i., it is entirely possible to obtain quick and effective movement of carriage **13** without using excessively large or complicated control structure.

Having thus described my invention, I claim:

1. In edge registry control mechanism for travelling sheets, a pair of relatively low pressure pneumatic chambers, means associated with each of said chambers and movable in resonse to pressure fluctuations in said chambers, a walking beam connected to each of said means, a valve rod pivoted to said walking beam, a two-way high pressure valve actuated by said valve rod, means for moving a supply roll of sheet material transversely of the path of sheet material feed, a reversible pneumatic motor for operating said last-named means, a pair of high pressure conduits connecting the valve and the pneumatic motor, a detector shoe positioned adjacent the edge of the travelling sheet and having a pair of slots therein, one of said slots being normally covered by the sheet and the other being normally uncovered by the sheet, a low pressure conduit connecting said normally covered slot to one of the chambers, a low pressure conduit connecting the normally uncovered slot to the other of said chambers, and a low pressure pneumatic connection to each of said conduits.

2. Apparatus in accordance with claim 1 in which the detector shoe is laterally adjustable with respect to the edge of the travelling sheet.

3. Apparatus in accordance with claim 1 in which the valve rod is spring-loaded.

4. Apparatus in accordance with claim 3 having means for locking the valve rod in a neutral position.

5. Web-feeding mechanism having a web unwind station, a web rewind station, edge detector means at the unwind station for sensing the lateral position of the web, edge detector means at the rewind station for sensing the lateral position of the web, each of said detector means including a detector shoe adjacent the edge of the web, means for adjusting the lateral position of the detector shoe at the rewind station, a sring-biased fluid cylinder, means operatively connecting said spring-biased cylinder and one of said shoes, a spring-biased piston in said cylinder, means operatively connecting said spring-biased piston with the other of said shoes, and fluid conduits connecting the cylinder and the adjusting means whereby the detector shoe at the rewind station is automatically adjusted in accordance with the movement of the detector shoe at the unwind station.

6. Apparatus in accordance with claim 5 having a manual adjustment for laterally controlling the position of the detector shoe at the unwind station.

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