United States Patent [19]

Faltot et al.

[11] **3,856,607**

[45] **Dec. 24, 1974**

[54] **APPARATUS FOR AUTOMATICALLY REGISTERING AND COMBINING TWO SHEET MEMBERS**

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[73] Assignee: **NJM, Inc.,** Hoboken, N.J.

[22] Filed: **Aug. 14, 1972**

[21] Appl. No.: **280,673**

[52] **U.S. Cl.** ..... **156/351,** 156/360, 156/364, 198/33 R

[51] **Int. Cl.** **B32b 31/00,** G05g 15/00

[58] **Field of Search** ..... 156/350, 351, 364, 366, 156/368; 198/33 R; 112/2

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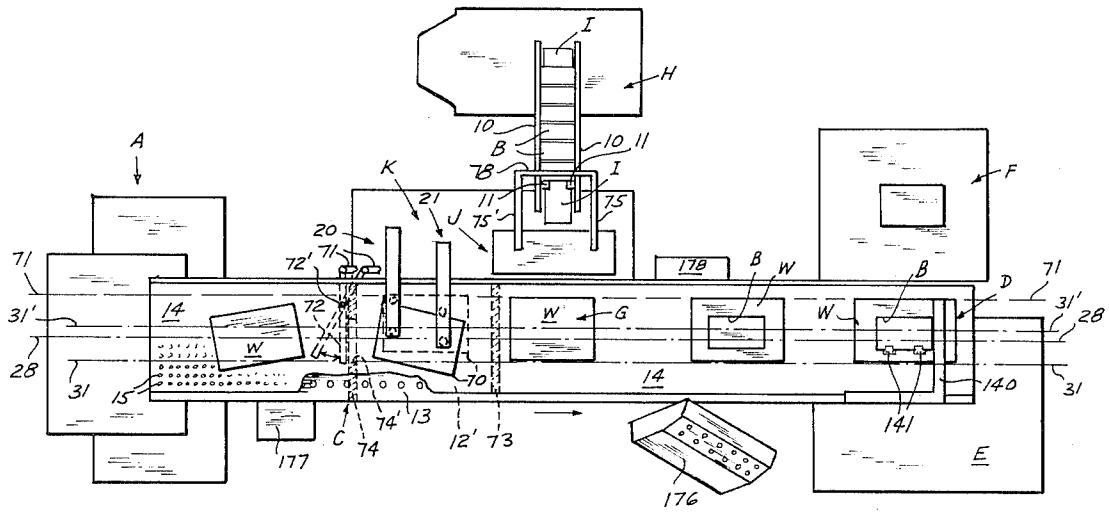
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Primary Examiner—Charles E. Van Horn
Assistant Examiner—David A. Simmons
Attorney, Agent, or Firm—John J. Hart

[57] **ABSTRACT**

The apparatus includes first means for shifting one sheet member deposited askew on a conveyor, transversely of the latter until an edge of such one sheet member extending in the direction of feed of the conveyor is brought into alignment with a reference line offset from but parallel to the longitudinal centerline of the conveyor, and second means for searching in a direction longitudinally of the conveyor for such one sheet member in its shifted position on the conveyor while such one sheet is being conveyed to a place of registration, and for simultaneously transporting a second sheet member to such place of registration, and when said second means has found such one sheet member at the placed of registration and locked it in registration with the second sheet being transported, said second means deposits the second sheet member upon the first sheet member. Photocell units carried by the first and second means control the transverse shifting movements of the first means and search for the shifted first sheet member.

19 Claims, 9 Drawing Figures



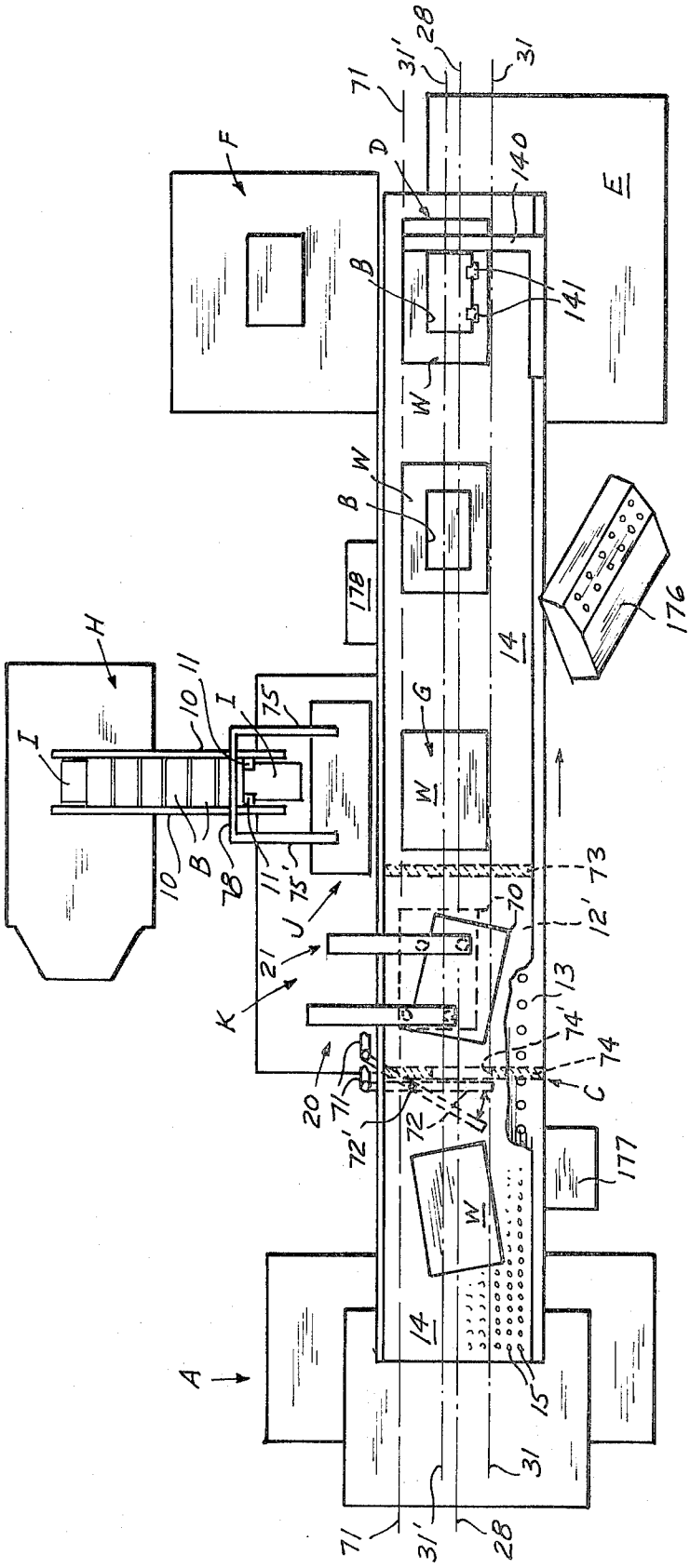

A
B
C
D
E
F
G
H
I
J
K
W
10
11
12'
13
14
15
20
21
28
31
31'
71
72
72'
73
74
74'
75
78
140
141
176
177
178

FIG. 1

FIG. 2

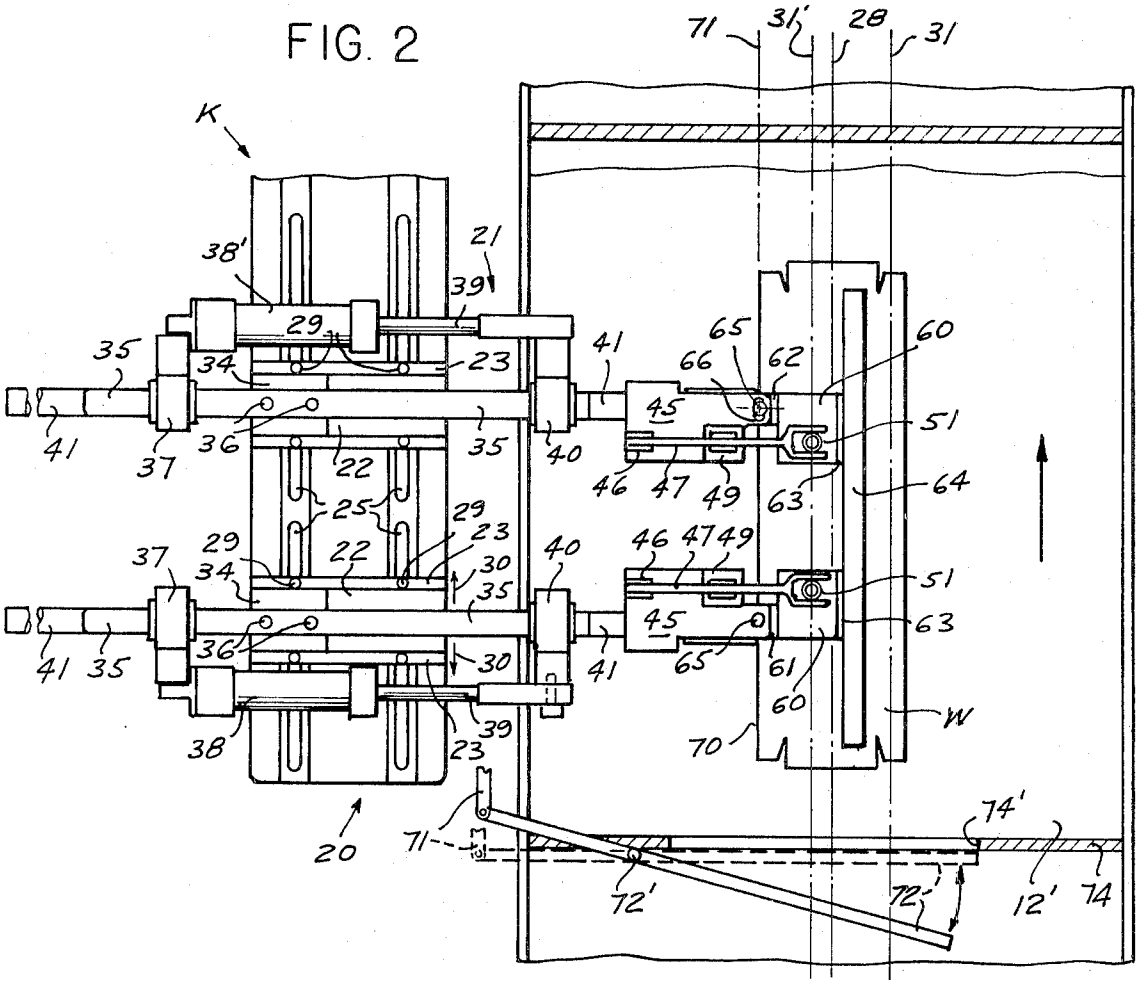
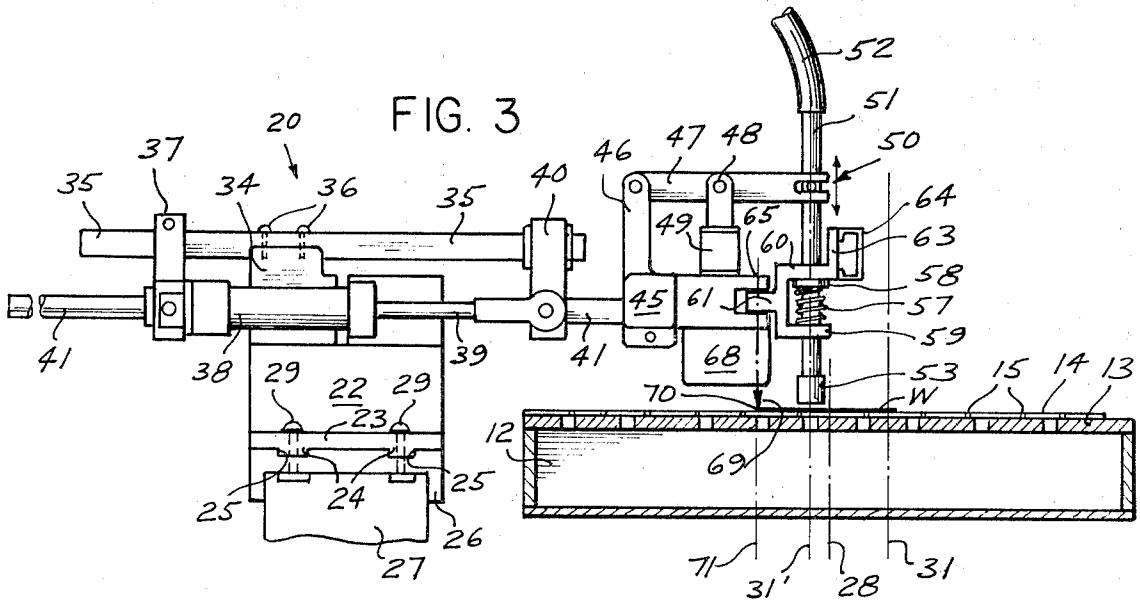

K
71
31'
28
31
38'
21
39'
29
35
34
23
41
65
66
62
60
45
51
36
22
37
40
46
47
49
63
64
25
30
70
W
20
72'
74'
12'
74

FIG. 3


52
51
50
20
37
35
34
36
40
46
47
48
49
65
64
63
60
58
57
59
45
61
68
53
15
14
13
70
W
12
69
41
38
39
29
22
23
24
25
26
27
71
31'
28
31

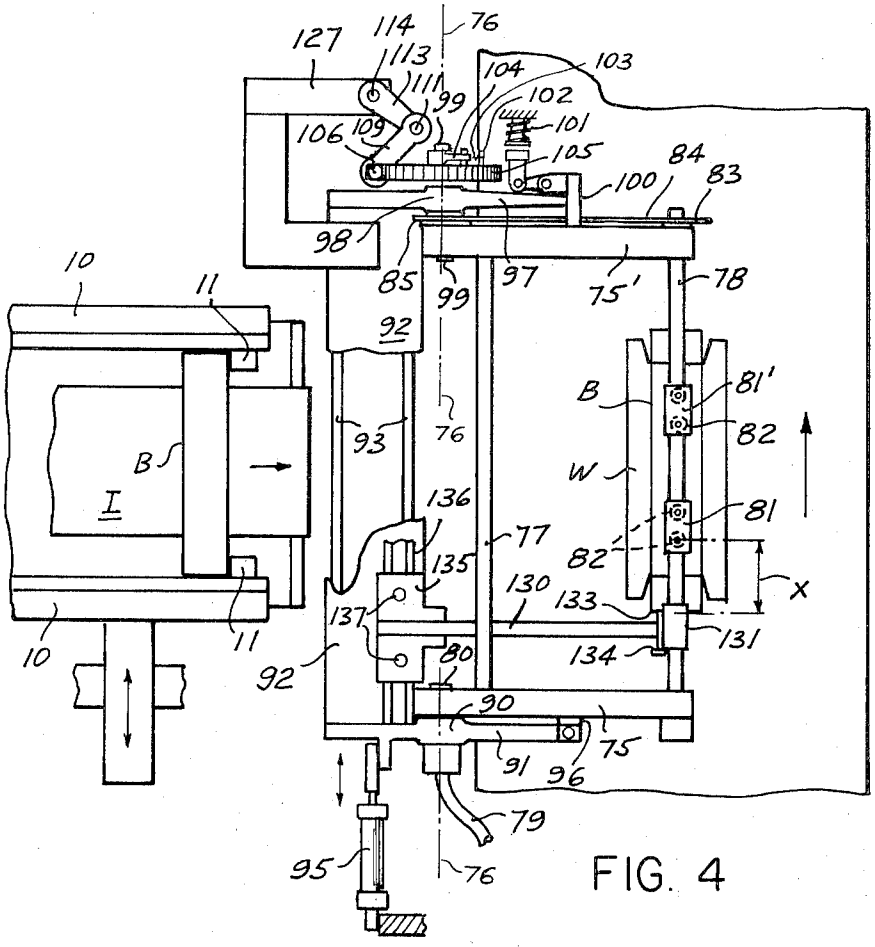

127
114
113
111
76
104
103
102
99
101
106
109
105
84
83
100
98
85
99
97
75'
78
10
11
92
B
81'
82
W
81
82'
X
I
136
77
135
130
133
131
137
134
80
90
75
91
96
79
95
76

FIG. 4

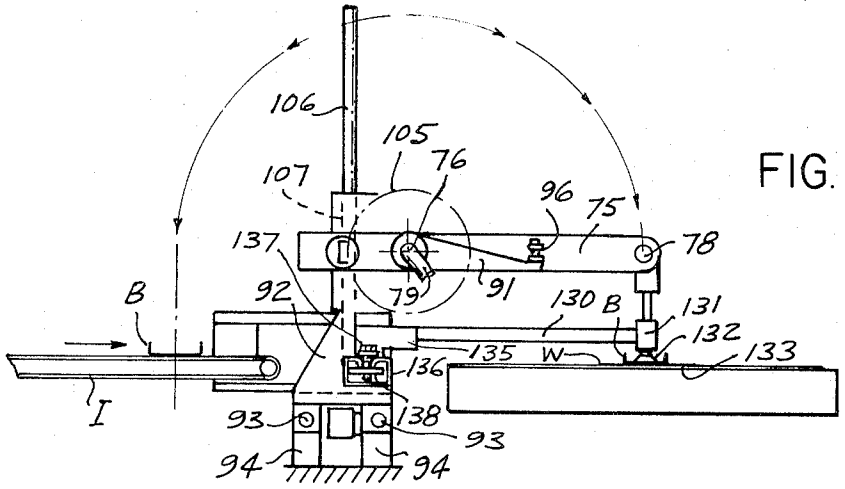

106
105
76
107
96
75
78
137
79
91
92
B
130
B
131
132
135
W
133
136
I
93
138
93
94
94

FIG. 5

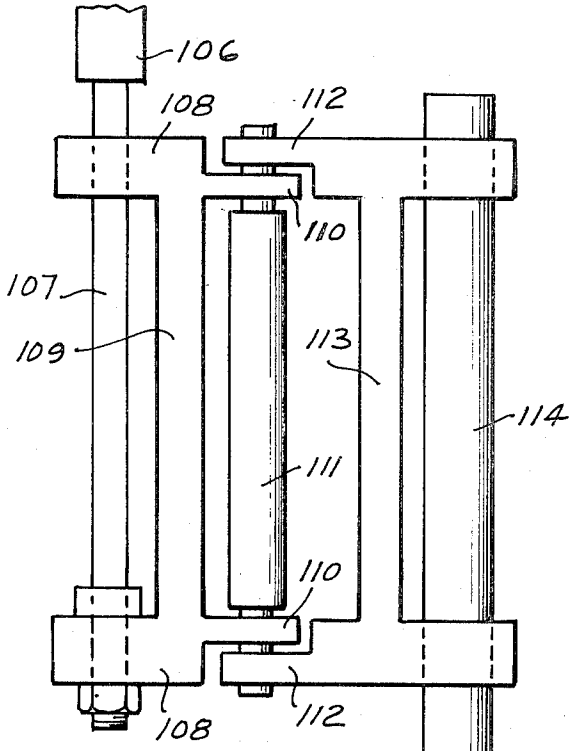

106
108
112
110
107
109
113
114
111
110
108
112

FIG. 6

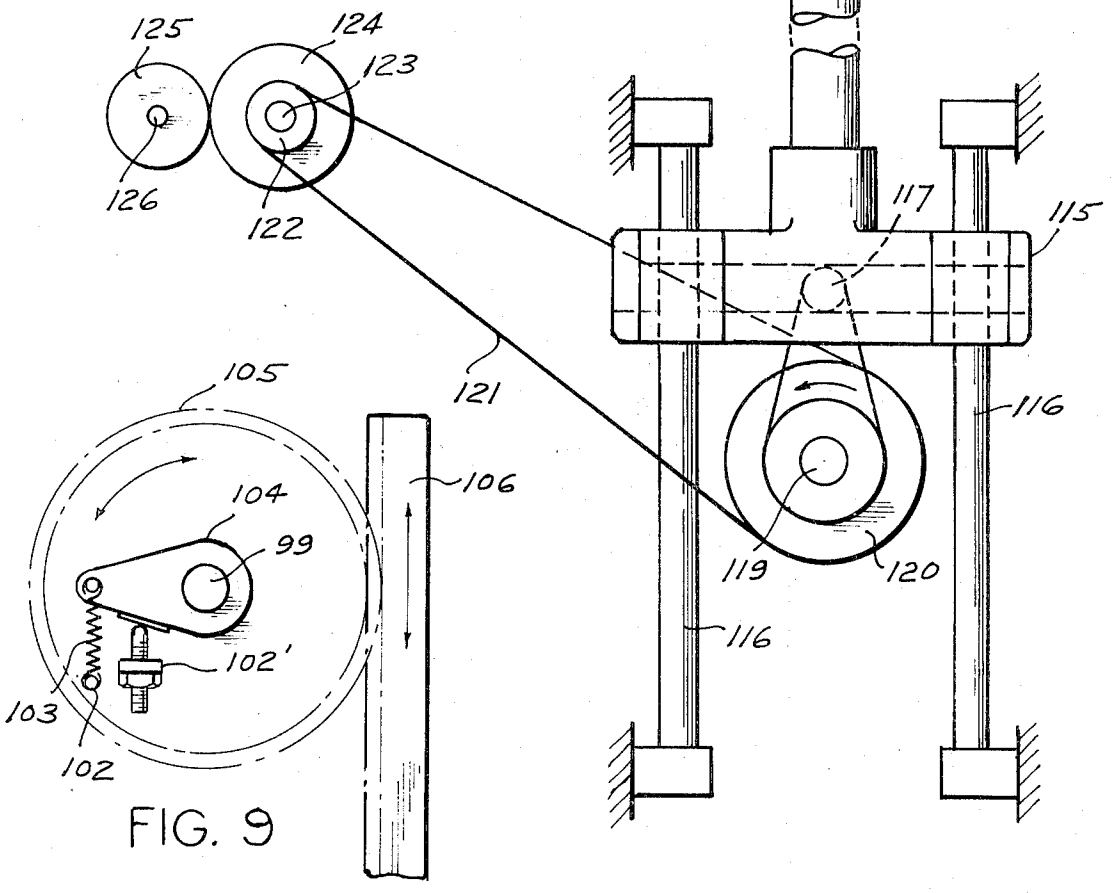
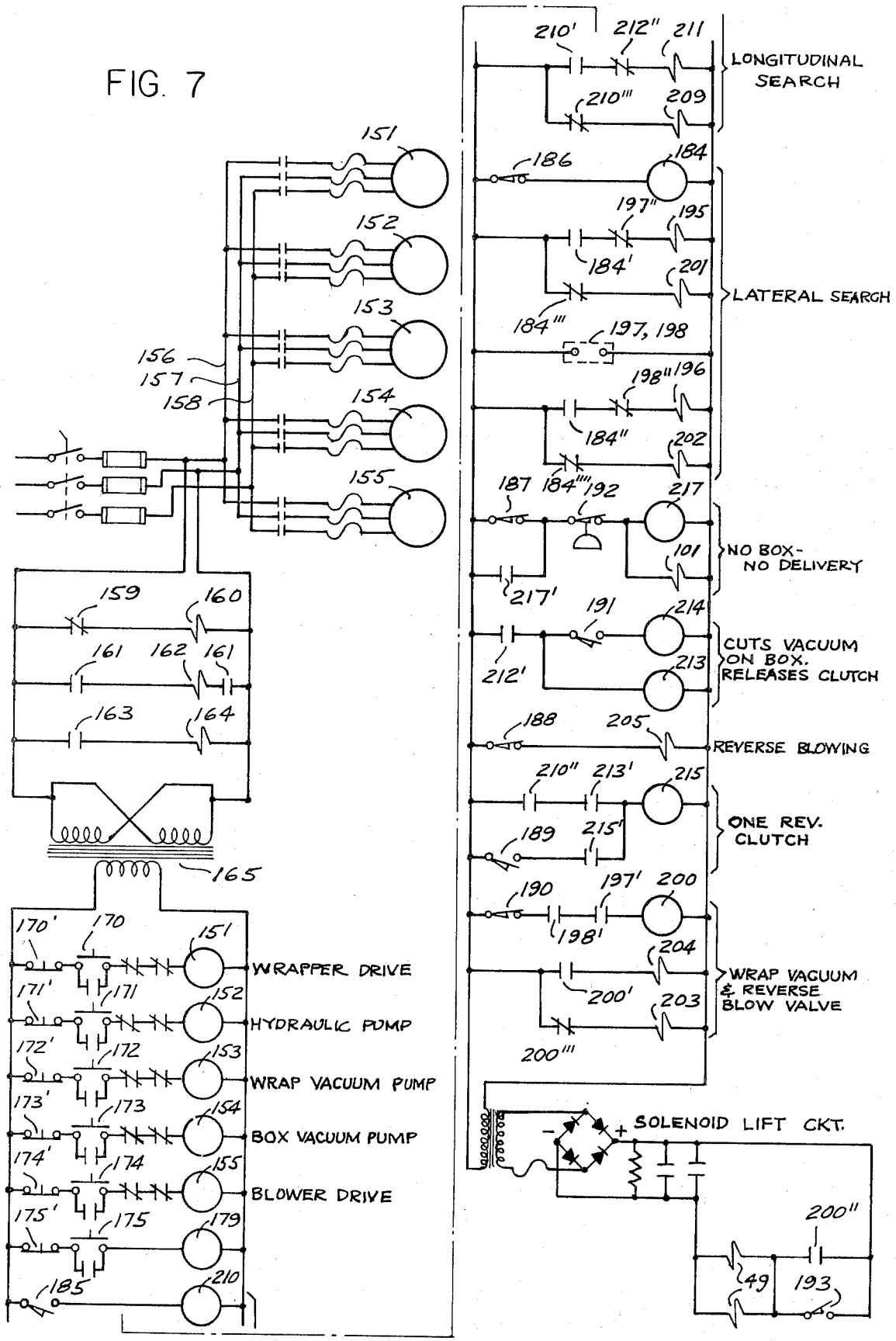

125
124
123
126
122
117
115
121
116
105
106
104
99
119
120
116
102'
103
102

FIG. 9

FIG. 7


LONGITUDINAL SEARCH
LATERAL SEARCH
NO BOX-NO DELIVERY
CUTS VACUUM ON BOX. RELEASES CLUTCH
REVERSE BLOWING
ONE REV. CLUTCH
WRAP VACUUM & REVERSE BLOW VALVE
SOLENOID LIFT CKT.
WRAPPER DRIVE
HYDRAULIC PUMP
WRAP VACUUM PUMP
BOX VACUUM PUMP
BLOWER DRIVE

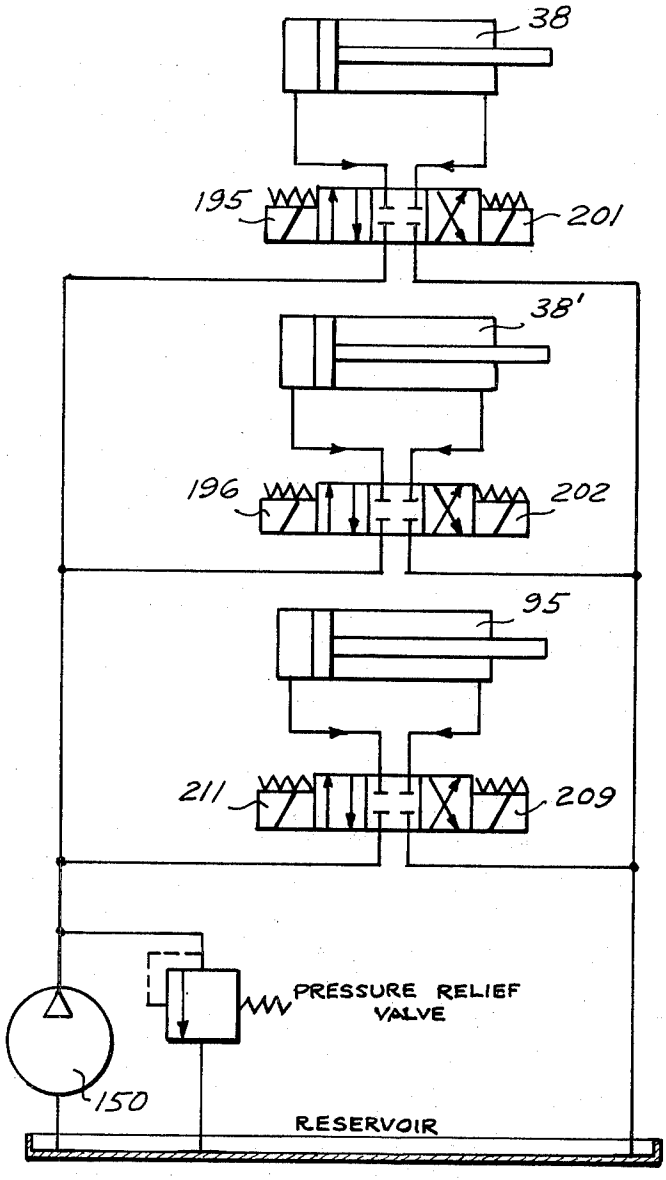

38
195
201
38'
196
202
95
211
209
PRESSURE RELIEF VALVE
150
RESERVOIR

FIG. 8

APPARATUS FOR AUTOMATICALLY REGISTERING AND COMBINING TWO SHEET MEMBERS

THE INVENTION

This invention relates to apparatus for automatically registering and combining two sheet members such as a wrap sheet to the outer surfaces of a cardboard container.

The primary purpose of the invention is to provide an improved apparatus that is capable of automatically and precisely registering two sheet members preparatory to combining them together and of effecting such accurate assembly at relatively high speed.

Another object of the invention is to provide an improved apparatus of the indicated type which is relatively simple in its construction and which can operate reliably for long periods producing accurately registered and combined sheet members.

A further object of the invention is to provide an improved apparatus of the indicated type capable of providing uniform handling and registration of sheet members having widely varying lengths, widths, or depth proportions.

Other objects of the invention, as well as the novel features thereof will become apparent from a perusal of the following description when read in connection with the accompanying drawings, which show by way of example a preferred embodiment of the invention, and in which

FIG. **1** shows in plan view a box wrapping system embodying the invention;

FIG. **2** is a plan view of the mechanism for making a lateral search of the wrappers carried by the system conveyor;

FIG. **3** is a side elevational view of one of the two devices which constitute the mechanism shown in FIG. **2**;

FIG. **4** is a plan view of the mechanism for spotting a stayed box upon a registered wrapper;

FIG. **5** is a side elevational view of the mechanism shown in FIG. **4**;

FIG. **6** is a schematic side elevational view of the apparatus for actuating the box transfer mechanism;

FIG. **7** is a schematic diagram showing the essential elements contained in the electrical control circuit of the system;

FIG. **8** is a schematic diagram of the pertinent elements in the hydraulic circuit of the system; and

FIG. **9** is a detail showing the connection of the apparatus in FIG. **6** to the box transfer mechanism, the view being taken along the right side of the mechanism shown in FIG. **4**.

Referring now more particularly to FIG. **1** of the drawings the box wrapping system depicted therein includes a gluer A of known construction suitable for applying adhesive material to wrappers W for box or container structures B. The gluer A delivers the wrappers W, coated face uppermost, to a conveyor C of known construction which advances the wrappers in a step-by-step fashion to a transfer station D where the wrappers together with the boxes B deposited thereon are successively carried by transfer mechanism E to a wrapping machine F. The boxes are successively deposited on the wrappers at an intermediate spotting station G during the periods of dwell in the step-by-step feed of the conveyor. The boxes B are fabricated in a box staying machine H of any suitable known construction and

having associated therewith a suitable conveyor I for feeding the stayed boxes B toward the spotting station G. The conveyor I is provided with adjustable side guides **10, 10** for the boxes carried thereby and such guides adjacent to the discharge ends thereof are provided with adjustably mounted box stops **11, 11**. The leading boxes successively engaging the stops **11, 11** are successively transferred by box transporting apparatus J to the wrappers successively stopping at spotting station G.

The wrap conveyor C is preferably of the type disclosed in the Wolff et al. Pat. No. 2,958,267, dated Nov. 1, 1960 and generally comprises an elongated suction box or chamber **12**, in FIG. **3**, provided with a flat, perforated upper wall **13** and in communication with any suitable source of suction such as the suction side of a blower. The upper wall **13** supports the upper run **14** of an endless belt provided with perforations **15**. Accordingly, during operative periods of the machine, the suction developed in the suction box **12** will be effective at the wrapper carrying surface of the conveyor through the perforations **15** of the upper run **14** of the conveyor belt as it travels over the perforated supporting wall **13**. The suction so developed at the carrying surface of the upper belt run **14** is a relatively light suction which is sufficient to maintain the wraps in flattened condition and to hold them on the upper run **14** in the positions in which they are placed by the gluer A. Such suction, may be made insufficient to interfere materially with the slidable lateral shifting movement which is successively imparted to the wraps in order to reposition them accurately on the upper run **14** prior to their reaching the spotting station G, as will be presently explained, but preferably in accordance with the invention such suction is sufficient to positively secure the wraps on the conveyor run **14** and is temporarily reduced at the place where such shifting operation takes place as will be hereinafter more fully explained.

As will be noted from FIG. **1** of the drawings, the mechanism K for laterally or transversely shifting the wraps on the upper conveyor run **14** form with the box transporting mechanism J the apparatus for accurately orienting and uniting together the wraps W and the boxes B. The mechanism K is spaced upstream from the mechanism J the distance that a wrap is carried by the conveyor run **14** in one movement of the latter so that in one dwell period a wrap pauses before the mechanism K and in the next successive dwell period pauses before the mechanism J. As will be observed in FIGS. **1–3** of the drawings, the mechanism K is composed of two spaced lateral searching devices generally designated **20** and **21** and of similar construction except in the few particulars hereinafter pointed out. Accordingly, except for such particulars, a detailed description of one of such devices **20** and **21** will suffice as a description of both of them.

Referring now more particularly to the lateral search devices **20** and **21** shown in FIGS. **2** and **3** of the drawings, it will be noted that each of such devices **20** and **21**, comprise a supporting block **22** having side flanges **23** provided with depending guide members **24** that are slidably received in guide slots **25** extending longitudinally in a track member **26** secured to a fixed frame member **27** in any suitable fashion. The track member **26** is positioned on the machine parallel to the longitudinal centerline **28—28** of the conveyor so that the block **22** is adjustable thereon in the direction of such

centerline as indicated by the arrows **30** in FIG. **2.** The block **22** is secured in adjusted position in any suitable fashion as by the bolts **29.** The upper end of the supporting block **22** is provided with a seat **34** to which is fixedly secured by bolts **36,** a rod **35** that is disposed laterally to the longitudinal conveyor centerline **28—28.** Clamped to the end of the fixed rod **35** projecting rearwardly from the seat **34,** as by means of a bracket **37,** is the rear end of a hydraulic cylinder **38** disposed in parallelism to the rod **35** supporting the same. The advanced end of the piston rod **39** of the hydraulic cylinder **38** is clamped to a bracket **40** that is slidably mounted on the other end of the fixed rod **35** projecting forwardly from the seat **34.** The bracket **40** is also secured to a rod **41** which extends through and is slidably supported by the block **22.** The slidable rod **41** is disposed parallelly to the fixed rod **35** and laterally or transversely to the centerline **28—28** of the conveyor. The forward end of the rod **41** extends beyond the bracket **40** and part way over the upper run **14** of the conveyor belt so as to be in spaced parallel relation to such belt run. It will accordingly be understood that as a result of this arrangement, the hydraulic cylinder **38** which is fixed to the frame of the machine through the rod **35,** seat **34** and the block **22,** will when actuated, slidably reciprocate the rod **41** laterally across the upper run **14** of the conveyor belt.

Mounted on the forward end of each slidable rod **41** in the devices **20, 21,** is a block **45** having fixed thereto an upright support member **46,** to the upper end of which is pivotally connected one end of a lever arm **47.** Connected to the arm **47** intermediate its length is the upwardly projecting end of the core **48** of a solenoid **49** mounted on the block **45** and connected in a control circuit so as to pull down the lever arm **47** when energized. Connected to the outer end of the lever arm **47,** as by a pin and slot connection **50,** is a straight vertical rigid tube **51.** The upper end of the tube **51** is connected by flexible tubing **52** to a suitable source of vacuum. The lower end of the tubing has mounted thereon a suction cup **53** made of any suitable material nonadherent to the adhesive on the wrapper W, such as Teflon. The tubing **51** extends freely through openings in the plate-like legs **59** and **60** of a forked member which is designated **61** in the device **20** and **62** in the device **21.** A spring **57** and a collar **58** located between the legs **59** and **60** normally bias the tubing **51** to a raised position. The spring **57** is seated on the lower leg **59** and at its upper end seats against the coller **58** which is secured to the tubing **51.** The upper leg **60** of the forked member, as is shown in FIG. **3,** functions as a stop to the upward biased movement of the collar **58** and consequently of the tubing **51** under the tension of spring **57.** The upper forked legs **60** are provided with integral vertical extensions **63, 63** to which are secured a horizontal strut member **64** which ties the two search devices **20, 21** together. The forked members **61** and **62** are mounted for pivotal movement about vertical axes **65** on the forward ends of the blocks **45.** It will be observed in FIG. **2** of the drawings that the connection of the forked member **61** with its associated block **45** is such that the pivotal axis **65** thereof is a fixed axis, while the pin connecting the forked member **62** with its associated block **45** is mounted in an elongated opening **66** which permits pivotal movement of such member without binding which might otherwise occur because of the connection of the two forked members by the strut **64.** The blocks **45** each also carry a photocell sensing device **68,** the light beam **69** of which is directed vertically toward the upper run **14** of the conveyor belt. The axes of the two light beams **69** coincide with the vertical axes **65** of the forked members **61** and **62** throughout the movements of such forked members, whereby the beams **69** and axes **65** will remain fixed relative to each other and will not move off the edge **70** of such sheet during the relative movements of the two devices **20** and **21.**

It will be understood from the aforesaid description of the lateral searching mechanism K, that the two devices **20, 21** forming such mechanism start from a retracted position in their search for a wrapper W on the upper conveyor run **14.** When the wrapper has been found by the devices **20, 21** and shifted laterally on the conveyor run as they return to retracted condition, the relation of the light beams **69** with the suction cups **53** on these devices is such that in the retracted condition of the devices **20, 21,** the longitudinal edge **70** of a shifted wrap located at the lateral searching station (see FIGS. **1–3**) will have been shifted into aligned registry with a given imaginary reference line **71—71** offset from and parallel to the longitudinal centerline **28—28** of the conveyor C. As indicated in FIG. **1** of the drawings, the wraps supplied to the conveyor belt by the gluer A are not deposited on the conveyor in accurate position for combination with a box B but are deposited thereon in a random askew fashion depending on the conditions prevailing during the deposition thereof. It has been determined from experience that the longitudinal centerlines of such askewed wraps are usually within an inch and a half transverse range starting at the longitudinal centerline **28** of the conveyor and extending forwardly from such centerline so that the longitudinal centerline **31—31** of such range is disposed about three-fourths inch to the right of the conveyor centerline **28—28,** as viewed in FIGS. **1-3.**

In order to provide an adequate distance in which the light beams or eyes **69** may start their search for wraps within such 1½ inch range of search and to enable the eyes to find the edge **70** of any wrap which might be slight beyond the longitudinal edges of such range, the distance through which the eyes make their search is extended transversely about one quarter inch on both sides of such range so that the transverse range of search of the eyes is about 2 inches. Further, the eyes **69** and the suction cups **53** are so located on the devices **20,21** that when the latter are in their retracted positions with the wrap repositioned so that its edge **70** is in registry with the reference line **71—71,** the centerline **31—31** of such searching range will also be shifted to about ¼inch to the left of the conveyor center-line **28—28** as viewed in FIGS. **1–3,** i.e., to the line **31′—31′.** This means that the reference line **71—71** which is set at a distance equal one-half of the wrap width from the line **31′ —31′** will be spaced from the conveyor centerline **28—28** a distance at least greater than 1 inch for wraps 2 inches wide or greater. In other words, the

location of the reference line **71—71** with reference to the centerline **28—28** will depend on the width of the size of wrap which is being registered so that its centerline coincides with line **31′—31′.** As a result of this arrangement, the devices **20, 21** will be able to bring most wraps deposited by the gluer onto the conveyor into proper registration at the searching station.

The few wraps that are deposited on the conveyor by the gluer so as to be outside of the selected range will be advanced past the wrap searching station and the box spotting station G without a box being applied thereto and will be discarded.

When the wrap W that has been deposited in an askew condition on the conveyor by the gluer arrives at the wrap searching station, both devices **20** and **21** are advanced simultaneously from their retracted positions by the hydraulic cylinders **38** and **38'**, respectively. The first beam or eye **69** on such devices that finds the longitudinal edge **70** of the wrap causes the device carrying the photosensor **68** which emits such beam to be stopped in its searching forward movement, while the other device continues to move its beam **69** forwardly in its search for the wrap edge **70.** When both lateral search devices **20** and **21** have completed their search for the wrap edge **70,** vacuum is supplied to the vacuum cups **53** thereof and at the same time the solenoids **49** are energized to lower the vacuum cups to a position just short of contact with the wrap. By stopping the downward movement of the vacuum cups just short of contact with the wrap, allowance is made for any distortions that might be present in the paper material constituting the wrap and which might interfere with the operations of the suction cups if such distortions were contacted by the latter. The suction provided in the suction cups **53** is sufficient to pick up the portions of the wrap underlying the same.

The devices **20** and **21** are now actuated to retract the suction cups **53** laterally of the conveyor run **14** to positions in which the edge **70** of the wrap is brought into aligned registry with the longitudinal reference line **71—71.** In accomplishing this operation the suction cups **53** will remain in their lowered positions in which they are slightly spaced above the carrying surface of the upper conveyor belt run **14** and will merely shift the wrap on the conveyor belt to bring the edge **70** thereof into the said registered position. During such shifting movement of the wrap a damper **72** in the conveyor box **12** comes into operation to reduce the vacuum exercised on the wrap through the belt run **14** and thereby free it sufficiently to enable the suction cups **53** to accomplish such shifting movement of the wrap without changing the relationship of the suction cups **53** to the edge **70** of the wrap gripped thereby.

As is shown in FIGS. **1** and **2** of the drawings, the damper **72** is mounted for pivotal movement about a fixed axis **72'** and is actuated by cam controlled means **71** from the transfer mechanism E. During the step-by-step movements of the conveyor C, the damper **72** is maintained in an opened position to permit a portion **12'** of chamber **12** located in the region of the lateral searching apparatus K to be in communication with the source of suction. The chamber portion **12'** is formed by a downstream partition **73** and an upstream partition **74** extending transversely of the chamber or box **12,** and such chamber portion underlies the portion of the belt run which will be located in the region of the lateral searching apparatus K during the dwell periods of the conveyor C. The partition **74** is provided with a centrally located opening **74'** which is closed by the damper **72** during each dwell period of the conveyor so as to reduce but not eliminate the vacuum in the chamber portion **12'** and thereby to effect a reduction in the hold exercised on the wrap through the belt run **14** during the shifting thereof into registered position. It will be understood that while the partition **73** seals one end of the chamber **12'**, the chamber **12** extending downstream from such partition will still be in communication with a source of vacuum to exercise a control over the registered wrap. When the edge **70** of the wrap is brought into registration with the imaginary reference line **71—71,** the vacuum to the suction cups **53** is broken and compressed air is introduced to blow the wrap back onto the conveyor run **14.** Soon thereafter, the solenoids **49** are deenergized to enable the springs **57** to lift the lever arms **47** to raise the suction cups. The vacuum effected through the upper belt run **14** on the repositioned wrap will retain it in its new position during its travel to the box spotting station G.

The mechanism at the spotting station G for removing a box B from the conveyor **1** of the staying machine **11** and depositing it upon a registered wrap W comprises a frame having two spaced side arms **75, 75'** mounted for pivotal movement about a pivotal axis **76—76.** The frame further includes a rear tie bar **77** located adjacently forward of and parallel to the pivotal axis **76—76** and fixedly secured to the side arms **75, 75'.** Rotatably mounted on the forward free ends of the side arms **75, 75'** is a hollow shaft **78** connected by a passageway provided in arm **75** and communicating with flexible tubing **79** which is attached to the hollow pivotal shaft **80** on which such arm is mounted and which is connected to a suitable source of vacuum. Adjustably mounted on the rotatable shaft **78** and in communication with the interior thereof are two units **81, 81'** each having a pair of depending suction cups **82.** Rotatable movement is imparted to shaft **78** through a sprocket **83** secured to the end of such shaft projecting beyond the arm **75',** a chain **84,** and a sprocket **85** fixed to a hub provided on the bearing support member **98.** It will thus be seen that as the arms **75, 75'** are pivoted about their axis **76, 76,** the sprocket fixed to support member **98** and having an axis common to axis **76, 76** will through chain **84** rotate sprocket **83** and consequently shaft **78.** Therefore, a box B which is being carried by the suction cups provided on shaft **78** will be maintained in a horizontal position as the arms **75, 75'** swing forwardly from the staying conveyor I to the upper run **14** of the conveyor C.

The shaft **80** which rotatably supports arm **75** is mounted in a bearing **90** provided in a forward projecting support member **91** attached at its rear end to one end of a slide **92** slidably mounted on rails **93** for movement parallel to the longitudinal centerline **28—28** of the conveyor C. As shown more clearly in FIG. **5,** the slide rails or rods **93** are supported at their ends by members **94** secured to the frame of the machine. Longitudinal sliding movement is imparted to the slide **92** by a hydraulic cylinder **95** secured to the frame of the machine and having its piston rod connected to a suitable ear provided on the slide **92.** The forward end of the member **91** also coacts with an adjustable stop **96** provided on arm **75** to limit the forward swinging movement of the frame toward the upper belt run **14** and thereby to control the position of the suction cups **82** relative to such belt run at the end of the forward swinging movement of such frame.

Attached to the other end of the slide **92** is a second forwardly projecting support member **97** provided with a bearing support **98** for the shaft **99** pivotally supporting the slide frame arm **75'.** The member **97** is provided at its forward end with a latch member **100** adapted to

be moved under the arm 75' to prevent the latter from completing its forward swing in the event a registered wrap is not found at station G. The operation of the latch member 100 is controlled by a solenoid 101 the core of which is connected to latch member 100 and moves the latter across the path of movement of the arm 75' when the solenoid 101 is energized.

The swinging movements of the frame are effected through mechanism associated with the frame arm 75'. Such mechanism comprises a segmented gear wheel 105 engaged by a vertically disposed rack 106 and secured to shaft 99 by spring loaded means which may constitute at least one lever 104 secured to shaft 99 and connected by a spring 103 to a pin 102 provided on gear wheel 105, the rotational movement of the lever 104 and consequently of shaft 99, relative to gear wheel 105 being restricted by a stop 102' provided on gear wheel 105. The arrangement of such spring loaded means is such that when the rack 106 is in its upward stroke, i.e., rising, it positively drives shaft 99 through gear wheel 105, stop 102' and lever 104, with the spring 103 in its normal condition. When the forward stroke or travel of arm 75' is restrained by the solenoid latch 100 is previously explained, the spring 103 is stretched and permits an overstroke of gear wheel 105 thereby enabling the rack 99 to continue its upward movement to complete its stroke, without damage resulting from such stoppage of the arm 75. As is shown more clearly in FIG. 6 of the drawings, the rack 106 is secured to the upper end of a bar 107 to which is pivotally connected by suitable bearings provided in the spaced bearing arms 108, 108 of a hinge member 109 which forms part of an articulated or universal joint. The hinge member 108 is also pivotally connected by bearings in the spaced bearing arms 110, 110 thereof to the ends of a coupling or hinge pin 111 carried by the arms 112, 112 of a hinge member 113 secured to the upper end of a cam rod 114. The cam rod is guided in its vertical movements by a guide 127 in FIG. i4, secured to the frame of the machine. The cam rod 114 is provided at its lower end with a crosshead 115 slidably connected to two parallelly spaced guide rods 116, 116 secured to the frame of the machine. Engaged with the transverse slot of the crosshead 115 is a slide block 117 provided on the outer end of a crank arm 118 secured to one end of a shaft 119. Also secured to shaft 119 is a gear wheel 120 which is connected by a chain 121 to a gear wheel 122 secured to a driven shaft 123. Shaft 123 is driven through a gear 124 secured thereto and meshing with a gear 125 mounted on a constantly rotating shaft 126. The gears 125,124 are designed to provide a 2:1 reduction, while the gear wheel 122, chain 121 and gear wheel provide a 3:1 reduction. Thus, while shaft 125 rotates at six revolutions per cycle of operation of the machine, shaft 119 will rotate at one revolution per cycle. During this one cycle revolution of shaft 119, the cam rod 114 will be raised and lowered to raise and lower, respectively, the rack 106 and thereby through gear wheel 105 and shaft 99 to advance and retract, respectively, the side arms 75, 75 of the spotter frame. Due to the crosshead connection of the cam rod 114 with the crank arm 118, and the articulated joint connection between such crank arm 118 and the rack 106, the rack will be provided with a constant straight vertical movement throughout the entire revolution of the crank arm 118 and the longitudinal movement of slide 94 parallel to the longitudinal centerline 28—28 of the conveyor C. As a result of this arrangement the stroke of the rack 106 will at all times be constant and accurate.

It will be noted more clearly in FIG. 4 of the drawings, that the slide 92 also carries a forwardly projecting bar 130 on the outer or forward end of which is mounted a photo-electric sensor unit 131 having a beam 132, in FIG. 5, which searches for the upstream edge 133 of a registered wrap W. The bar 130 is located between the frame side arm 75 and the frame vacuum unit 81 so that the beam 132 of the sensor unit 81 will be positioned a given distance X upstream from the upstream vacuum cup of such unit 81. The sensor unit 131 is movably connected to the bar 130 by a micrometer adjustment device 134 so that such given distance X can be determined with great exactness. A course adjustment of the sensor beam 132 with relation to the upstream vacuum cup of unit 81 is made by adjustment of the bar 130 with relation to the slide 92. As is shown in FIGS. 3 and 4 of the drawings, the bar 130 is mounted on a slide 135 mounted on a tubular beam 136 of rectangular shape secured to the slide 92. The top wall of the beam 136 is slotted longitudinally to provide rails for the slide 135 which is secured in an adjusted position on such rails by bolts 137 extending through such longitudinal slot and threadedly engaged with a plate 138 located within the beam 136.

It will be understood from the foregoing that as a wrap W registered by the lateral searching apparatus K moves downstream from such apparatus toward the box spotting station G, the frame side arms 75, 75' will be in a retracted position with the vacuum cups 82 located within the foremost box B on the staying machine conveyor I and accurately positioned thereon for receipt of such cups by the adjustable stops 11 in the previous cycle of the machine. During such downstream movement of the wrapper, vacuum will be furnished to the cups 82 enabling them to pick up the box, and the rack 106 will be raised in the manner previously explained to swing the frame arms 75, 75' forwardly. During such swinging movement of the arms, the shaft 78 will be correspondingly rotated in the manner previously explained so that the bottom of the box is maintained in a horizontal plane throughout the extent of such movement. The swinging movement of the arms will be continued until the bottom of the box is placed on the wrap under pressure provided the wrap is there in properly registered position to receive the box. Due to the fact that the box is held by suction cups 82 acting on the inside bottom of the box during the pick-up and delivery thereof, the entire box is under a positive, firm control while it is being picked up, transported and delivered, and the bottom of the box will be adhered to the wrap evenly and firmly to provide a uniform adherence thereof to the wrap throughout its entire area.

During the forward swinging movement of the side frame arms 75, 75', the slide 92 will be moved by hydraulic cylinder 95 in a direction downstream and parallel to the conveyor travel. In so doing the frame arms 75, 75' and the parts associated therewith will be moved downstream and the beam 132 of the photosensor 131 will start to look for the trailing edge 133 of the registered wrap. It will be understood that the timing is such that the wrap will have moved downstream past, the point where the photosensor can start its searching operation and will shortly come to a stop at the spotting station G. As a result of this coordination of wrap

search and box transfer and delivery it has been found the operation of a machine embodying the invention is materially faster than the operation of prior known machines. It is when the movement of the wrap has ceased that the beam **132** of the photosensor will locate the trailing edge **133** thereof. When this occurs, the arms **75, 75'** move the vacuum cups down the remainder of the distance to the belt surface to press the bottom of the box carried thereby against the glued side of the registered wrap. During this pressing operation the vacuum to the cups **82** is cut off enabling them to release the box as they are swung back by the arms **75, 75'** to a position enabling them to pick up the next box registered in pick-up position on the conveyor I. In the event that the beam **132** of the photosensor does not find the wrap by the time it comes to the end of its downstream range of movement either because the wrap is missing, or so far out of register that something is wrong, the solenoid latch **100** comes into operation to prevent the completion of the forward stroke or swinging movement of the frame arms **75, 75.** When this occurs the box will be held in raised position above the belt run **14** until on a later cycle of the machine a properly registered wrap moves under the box and the photosensor looks for it in the manner above described and finds such wrap. In such a situation the staying machine H will be prevented from making another box until the box held by the vacuum cups **82** has been deposited on a registered wrap.

The box and wrap then proceed to the wrapping station D where a box stop **130** engages the box and stops the box and wrap in proper position to be transferred to the wrapping machine. This may be accomplished by clamps **141** constructed and operating in the manner disclosed in said Wolff et al. Pat. No. 2,958,267 to shift the gripped box assembly across the upper conveyor run **14** and into proper position in the wrapping machine F.

Considering now the electrical and hydraulic circuits shown in FIGS. **7** and **8** of the drawings, it will be understood that the wrapping machine F, the hydraulic pump **150** for supplying hydraulic fluid to the lateral search cylinder **38** and the longitudinal search cylinder **95,** the vacuum pump (not shown) for supplying vacuum to the box holding suction cups **82,** the vacuum pump (not shown) for supplying vacuum to the chamber or box **12** in the manner disclosed in said Wolf et al. Pat. No. 2,958,267 and a compressor (not shown) for supplying air under pressure to the wrap registering cups **53,** are driven by separate motors **151–155,** respectively, connected in the manner indicated through lines **156, 157** and **158** to a source of 220 voltage, 60 cycle, three phase alternating current. Also connected to such source through the lines **156, 157** and **158** is the normally closed relay **159** for controlling a one revolution clutch solenoid **160** that controls the operation of the machine or system. So long as control relay **159** is not engaged, it keeps the one revolution clutch engaged to prevent the machine from stopping. Lines **156, 157** and **158** also connect to such source a normally open relay **161** for controlling the vacuum release solenoid **162** that normally enables vacuum to be furnished to the box vacuum cups **82.** When control relay **161** is closed to energize solenoid **162,** the vacuum to the cups **82** is broken. Further connected to the source through lines **156, 157** and **158** is a normally open relay **163** that controls a wrapper trip solenoid **164.** When control relay **163** is closed to energize solenoid **164** the cyle of operation of the wrapping machine F is started. Since the transfer mechanism E and the box transporting apparatus J are all run by the same motor **151** for the wrapping machine F, when the latter is thus started up, the transfer mechanism E and the box transporting apparatus J will also start their cycles of operation. The current supplied to the circuit containing the control relays **159, 161** and **163** and their associated solenoids **160, 162** and **164,** respectively, is passed through a control voltage transformer **165** which transforms the current supplied by the source into a 110 voltage, 60 cycle, single phase current which is utilized to operate the circuits containing the other controls.

The portions of the control circuit operating on **110** voltage current comprises the push button switches for controlling the operations of the motors **151–155,** the control relays for the lateral and longitudinal wrap searches, the control relay which comes into operation when the box transporting apparatus J fails to pick up a box for delivery to a registered wrap, and the relays for controlling the pneumatic system. The push button switches **170–174** for closing the circuits and starting the motors **151–155,** respectively, are normally open switches of the interlock contact type which when the buttons thereof are pushed to closed position maintain the circuits controlled thereby closed even though the buttons are released The push button switch **175** for controlling the engagement of the clutch associated with the wrapping mechanism F is of a type similar to the switches **170–174.** Associated with the push button switches **170–175** are normally closed or stop push button switches **170'–175',** respectively. These push button switches **170–175** are mounted in a housing **176** located at the front end of the machine, in front of the conveyor C, as is shown in FIG. **1.** Provided in a second housing **177** also located in front of the conveyor C is the programming mechanism. The hydraulic unit comprising pump, tank and three spring centered hydraulic valves is enclosed in a housing **178** located just to the rear of the conveyor C.

It will be understood from the foregoing that when it is desired to put the machine or system into operation, the push button switches **170–174** are temporarily closed to start, respectively, the motor **151** for the wrapper drive, the motor **152** for the hydraulic pump, the motor **153** for the wrap vacuum pump, the motors **154** for the box vacuum pump, and the motor **155** for the blower drive. At the same time the push button switch **175** is closed to energize a control relay **179** thereby actuating the clutch (not shown) to start the drives for operating the transfer mechanism E, the wrapping machine F, the staying machine H and the box transporting apparatus J. Prior to the actuation of the push button switches **170–175,** a push button switch (not shown) is actuated to start the gluer A which causes the conveyor C to start its intermittent advancing movement of the belt run **14.** The start of the box transporting apparatus J also starts the rotation of a shaft in the programmer **177** provided with cams for controlling the operation of a number of programming switches **185–193.** At zero degrees cam shaft time, the belt run **14** in each cycle of the machine starts the travel of its set distance and then comes to a dwell at a certain camshaft time. When the belt run **14** stops in each period of dwell, the programming switch **186** is

actuated to close a control relay 184 and thereby start the previously described lateral search by the photosensors 68 on the searching devices 20 and 21. The start of this search by the two devices 20 and 21 is initiated with the closing of control relay 184 having normally open contacts 184' and 184'', and normally closed contacts 184''' and 184''''. When relay 184 is closed, it energizes the solenoid values 195 and 196 controlling the hydraulic cylinders 38,38' to cause the latter to commence the advancing strokes of the slidable rods 41. When the eyes or light beams 69 of the photosensors 68 find the edge 70 of the wrap W the contacts 197', 197'' and 198' and 198'', respectively of two double pole relays 197 and 198 associated with the photosensors 68 are opened to deenergize the hydraulic solenoid valves 195 and 196. This centers the valves, that is, blocks both sides of such valves, so that the hydraulic cylinders 38,38' cannot be moved forward or backward. When the solenoid valves 195 and 196 are deenergized, solenoid valve 196 closes to energize a control relay 200 having two normally open contacts 200' and 200'' and a normally closed contact 200''', to cause the opening of a path enabling vacuum to reach the vacuum suction cups 53 of the devices 20 and 21. At the same time the energization of control relay 200 also causes the closing of solenoid valves 201 and 202 thereby energizing their associated solenoids 49,49 on the devices 20 and 21 to bring the suction cups 53 down to positions enabling them to grip the wrap. Switch 186 then opens, deenergizing control relay 184 which reverses its contacts to cause the energization of the solenoid valves 201 and 202, thereby causing the lateral search hydraulic cylinders to return to retracted position in which the edge 70 of the wrap W will be aligned with the reference line 71—71. Switch 190 then opens to deenergize control relay 200 which causes the energization of vacuum control switch 203 and the deenergization of vacuum control switch 204 thereby cutting the supply of vacuum to the cups 53 holding the wrap. At the same time switch 188 closes and causes the energization of the compressed air solenoid valve 205 to introduce air under pressure to the suction cups 53 and thereby blow the registered wrap W down against the conveyor run 14 where it will be retained in registered position on such run by the vacuum exercised through the conveyor belt. Switch 193 which has remained closed while suction is provided in the cups 53 prevents the solenoids 49,49 from being deenergized. However, as soon as compressed air is delivered to the cups 53, switch 193 opens, causing the deenergization of solenoids 49,49 so that the cups 53 are biased upwardly by the springs 57,57 mounted on the tubes 51,51 supporting such cups. The wrap which has thus been shifted by the devices 20,21 is repositioned in registered condition on the conveyor run 14.

In the next cycle of the machine the wrap so registered on the conveyor run 14 is moved by the latter toward the adjacent spotting station G. As the registered wrap is moving into the spotting station G, but before the conveyor and such wrap has come to a complete stop in the next dwell period of the conveyor, and after the crank operated arms 75,75' have commenced their forward stroke to bring a box over such arriving registered wrap, the switch 185 closes to energize a control relay 210 having normally open contacts 210' and 210'' and a normally closed contact 210''', thereby causing control relay 210 to be actuated to energize the solenoid valve 211 controlling the longitudinal search hydraulic cylinder 95 attached to the slide 92. The energization of valve 211 causes cylinder 95 to start the longitudinal search for the edge 133 of the registered wrap W which has passed the eye or beam 132 of the photosensor 131. When the eye 132 finds the edge 133 of the registered wrap, which occurs during the beginning of the next successive dwell period of the conveyor and while the wrap is in a stationary condition at station G, contacts 212'' of a double poled relay are actuated to deenergize the solenoid valve 211 and thereby lock the longitudinal search cylinder 95 and immobilize it. This causes contacts 212' of such double poled relay to close thereby immediately energizing a control relay 213 having a normally open contacts 213' and when switch 191 closes energizing control relay 214. When control relay 214 is energized the vacuum provided in the suction cups 82 holding the box B being delivered to station G is cut off and releases the box to the wrap. As previously explained, this occurs immediately after the cups 82,82 have pressed the bottom of the box into adhering relation with the registered wrap at station G. When control relays 210 and 213 are both energized, control relay 215 having a normally open contact 215' becomes energized to prevent the drive clutch of the machine from becoming disengaged and permitting the machine to continue with its cycle and complete the operation of the box spotting apparatus J. When control relay 215 is closed it creates a holding circuit through switch 189. The closed holding switch 189 opens momentarily to determined if the registered wrap has been found. If such is the case nothing happens. But if the wrap has not been found by the longitudinal search mechanism, a one revolution clutch solenoid 160 is deenergized thereby releasing the clutch trip and brining the main clutch shaft of the machine to a stop. This stops the operation of the crank arm 114 and the frame arms 75,75' will not swing back, but will hold the box B in a raised condition, approximately one-half inch above the conveyor run 14, until the machine makes its next cycle. If a wrap is then found in the next cycle the machine will continue its operation in that cycle and deliver the box so held during the previous cycle. Switch 185 then opens, deenergizing control relay 210 to cause the deenergization of solenoid valve 209, thereby causing the longitudinal search cylinder 95 to return to retracted position, in position to start the next search.

It will be understood from the foregoing that prior to being picked up by the transport arms 75,75', the box is properly aligned by stop 11, 11 which are so constructed and arranged that they engage the box at its front corners and low down adjacent to the score lines which form the junctures between the bottom and sides of the box, to assure as accurate alignment as possible.

In the event a box is not picked up from the staying machine conveyor I by the vacuum cups 82, because no box has come into registration against the stops 11,11, the resulting loss of vacuum through the open cups 82 as the arms 75,75' start their forward stroke will cause the normally closed vacuum switch 192 to remain closed. Meanwhile, and shortly after the arms 75,75' have started their forward movement, switch 187 has closed thereby energizing control relay 217 having a normally open contact 217' and solenoid 101 in FIG. 4. This causes solenoid 101 to move the latch 100 into

blocking position to stop the forward stroke of the arm 75' and thereby prevent the cups 82 from coming into contact with the adhesive on the wrap W at station G. When switch 187 closes it also closes contacts on control relay 217 to keep the solenoid 101 energized until a box is picked up in a succeeding cycle of the machine, whereupon vacuum switch 192 will open to deenergize control relay 217 and remove the latch 100 thereby permitting the box so picked up to be delivered to a wrap at station G.

What is claimed is:

1. Apparatus for automatically registering and combining two sheet members, comprising means for carrying a plurality of first sheets having adhesive thereon in spaced apart relation along a given path, means for successively repositioning said first sheets on said carrying means so that a given line extending lengthwise of said path on the sheet shifted is brought into registered alignment with a reference line located to one side of and in spaced parallel relation to the longitudinal centerline of said carrying means, said repositioning means comprising a plurality of sensing means movable transversely of said carrying means and each capable of developing a signal when sensing said given lengthwise line on a first sheet, means for moving said sensing means independently until each has found such given lengthwise line, said sensing means each having associated therewith means for gripping a first sheet at different locations thereof when such given lengthwise line has been found, and means for moving in coactive relation the gripping means associated with the sensing means to shift the gripped sheet until said given lengthwise line thereof is brought into alignment with said reference line, and means for searching in a direction longitudinally of said path for a given line disposed transversely of said path on such repositioned sheet and for depositing on such sheet when found a second sheet so as to bring both of such sheets into adhesive face-to-face relation.

2. Apparatus as defined in claim 1, in which said repositioning means is located at one station along the path of movement of said carrying means and said searching and depositing means is located at a following station along such path, and including means for depositing said first sheets on said carrying means in an askew fashion with their longitudinal centerlines contained in a longitudinal area of given width and having a longitudinal centerline located to the other side of and in spaced parallel relation to said longitudinal centerline of said carrying means, said first sheet when repositioned by said repositioning means having their longitudinal centerlines located to said one side of and in spaced parallel relation to said longitudinal centerline of said carrying means during their travel on said carrying means from said one station to said following station.

3. Apparatus for automatically registering and combining two sheet members, comprising means for carrying a plurality of first sheets having adhesive thereon in spaced apart relation along a given path, said carrying means including an endless perforated sheet carrier, and means for providing a suction condition at the sheet carrying surfce of said carrier sufficient to hold the sheets adhered thereto, means for successively repositioning said first sheets on said carrying means so that a given line extending lengthwise of said path on the sheet being shifted is brought into registered alignment with a reference line located to one side of and in spaced parallel relation to the longitudinal centerline of said carrying means, means for reducing such suction condition at the sheet carrying surface of said carrier in the localized region of action of said repositioning means sufficient to enable the latter to shift said first sheets relative to such carrier surface to their repositioned locations, and means for searching in a direction longitudinally of said path for a given line disposed transversely of said path on such repositioned sheet and for depositing on such sheet when found a second sheet so as to bring both of such sheets into adhesive face-to-face relation.

4. Apparatus for automatically registering and combining two sheet members, comprising means for carrying a plurality of first sheets having adhesive thereon in spaced apart relation along a given path, means for successively repositioning said first sheets on said carrying means so that a given line extending lengthwise of said path on the sheet being shifted is brought into registered alignment with a reference line located to one side of and in spaced parallel relation to the longitudinal centerline of said carrying means, said repositioning means comprising a plurality of devices movable transversely of said carrying means and each provided with means for sensing and given lengthwise line on a first sheet and means for gripping such sheet when such line has been found, first means for moving said devices independently until the sensing means of each has found such given lengthwise line, second means for rendering said gripping means operable to grip the sheet when said sensing means have completed their search, and third means for moving said devices to shift the gripped sheet until said given lengthwise line thereof is brought into alignment with said reference line, and means for searching in a direction longitudinally of said path for a given line disposed transversely of said path on such repositioned sheet and for depositing on such sheet when found a second sheet so as to bring both of such sheets into adhesive face-to-face relation.

5. Apparatus as defined in claim 4, in which said gripping means on said devices comprise suction cups, means operable to advance said suction cups from a retracted raised position to a position just above a first sheet found by said sensing means and for providing a sufficient suction in said cups to enable them to suck up and grip portions of the found sheet.

6. Apparatus as defined in claim 5, including means for providing a positive air pressure in said suction cups to free the gripped first sheet therefrom when said sheet has become registered with said reference line.

7. Apparatus as defined in claim 4, including means operable to lock said first means as soon as the sensing means thereof has found said given lengthwise line, said third means controlling said first means and rendering the latter operable to move said devices simultaneously when the sensing means of both have found such line.

8. Apparatus for automatically registering and combining two sheet members, comprising means for carrying a plurality of first sheets having adhesive thereon in spaced apart relation along a given path, means for successively repositioning said first sheets on said carrying means so that a given line extending lengthwise of said path on the sheet being shifted is brought into registered alignment with a reference line located to one side of and in spaced relation to the longitudinal centerline of said carrying means, and means for searching

in a direction longitudinally of said path for a given line disposed transversely of said path on such repositioned sheet and for depositing on such sheet when found a second sheet as as to bring both of such sheets into adhesive face-to-face relation, said searching and depositing means including means movable longitudinally of said path in the direction of travel of said first repositioned sheet and provided with means for sensing said given transverse line on such repositioned sheet, and means for transporting a second sheet from a pick-up source thereof to such first repositioned sheet and positively depositing such second sheet on a first repositioned sheet found by said longitudinally movable means.

9. Apparatus as defined in claim **8,** including means for simultaneously moving said longitudinally movable means and said transporting means so that the searching of such first repositioned sheet and the transporting of said second sheet occur simultaneously.

10. Apparatus as defined in claim **8,** in which said carrying means advances said first sheet with a step-by-step movement, and includng means controlling the searching movement of said longitudinally movable so that the sensing carried thereby finds a repositioned first sheet at the place for deposition of said second sheet during a dwell period in the movement of said carrying means, and means operative to prevent the deposition of a second sheet by said transporting means in he event said longitudinally movable means does not find a repositioned first sheet.

11. Apparatus as defined in claim **8,** in which said longitudinally movable means comprises a slide carrying said sensing means and means for reciprocating said slide in directions parallel to said given path, and in which said transporting means is carried by said slide and is mounted for pivotal movement about an axis parallel to said path, and means for pivotally moving said transporting means relative to said slide.

12. Apparatus as defined in claim **11,** in which said pivotally moving means comprises a gear wheel connected to said transporting means and movable about the pivotal axis of the latter, a vertically disposed rack engaging said gear wheel, means for vertically reciprocating said rack, and a universal connection between said rack and reciprocating means.

13. Apparatus as defined in claim **12,** in which said reciprocating means comprises a vertically disposed cam rod offset from said rack, a guided, vertically slidable member connected to the lower end of said cam rod, and means for reciprocating said slidable member, and in which said universal connection comprises a member connected to the upper end of said cam rod and projecting laterally therefrom, a member connected to the lower end of sid rack and projecting laterally therefrom, and means hingedly connecting the projecting ends of said members together to provide for swinging movement of said rack about a vertical axis.

14. Apparatus as defined in claim **11,** in which said pivotally moving means comprises a first member connected to said transporting means and movable about the pivotal axis of the latter, a reciprocating member operatively connected to said first member, means for actuating said reciprocating member to pivotally move said first member, and a universal connection between said reciprocating member and said actuating means.

15. Apparatus as defined in claim **14,** including means operative to interrupt the pivotal movement of said transporting means, and lost motion coupling means connecting said first member to said transporting means to permit an overstroke of said first member by said reciprocating member on interruption of said transporting means.

16. Apparatus as defined in claim **8,** including means for registering said second sheets at a place to be picked-up by said searching and depositing means, and in which said transporting means comprises means for gripping a registered second sheet at said place of pick-up at a localized area thereof within the area defined by the edges of such second sheet and for positively pressing the gripped second sheet into engagement with a registered first sheet at the place of deposition thereof.

17. Apparatus as defined in claim **16,** including a box-staying machine, and conveyor means for successively delivering boxes from said machine to said place of pick-up, and in which said registering means includes stops at the delivery end of said conveyor means to properly align the leading box for pick-up and being constructed and arranged to engage the aligned box at its front corners adjacent to the bottom of such box, and in which said gripping means engages the inside surface of the box bottom to transport and deposit the same.

18. Apparatus as defined in claim **16,** in which said gripping means comprise suction cups connected to a source of suction, said transporting means comprising pivotal means, vacuum cup supporting means provided on said pivotal means, means for oscillating said pivotal means foom said place of pick-up to said place of deposition, and means for rotating said vacuum cup supporting means during the advancing stroke of said pivotal means to maintain a second sheet carried by said suction cups substantially parallel to a first registered sheet on said carrying means throughout the extent of such stroke.

19. Apparatus as defined in claim **18,** including means controlled by the vacuum condition in said suction cups for interrupting the advancing movement of said pivotal means and preventing the suction cups from engaging with a registered first sheet in the event such suction cups are not griping a second sheet.

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