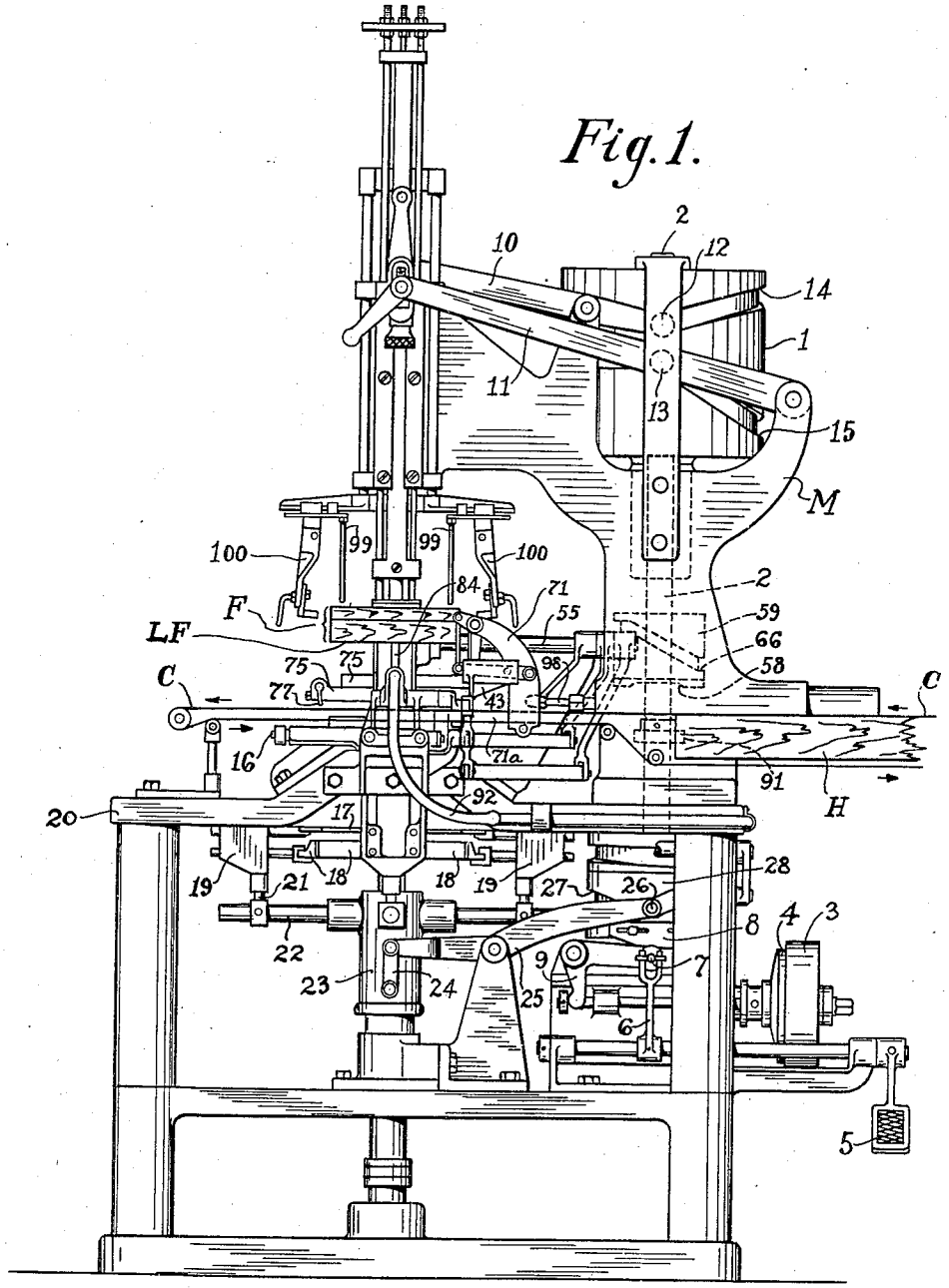
Jan. 24, 1939. L. H. LANGE ET AL 2,144,764

BOX FORMING SYSTEM

Filed Sept. 29, 1937 5 Sheets-Sheet 1

Fig. 1.



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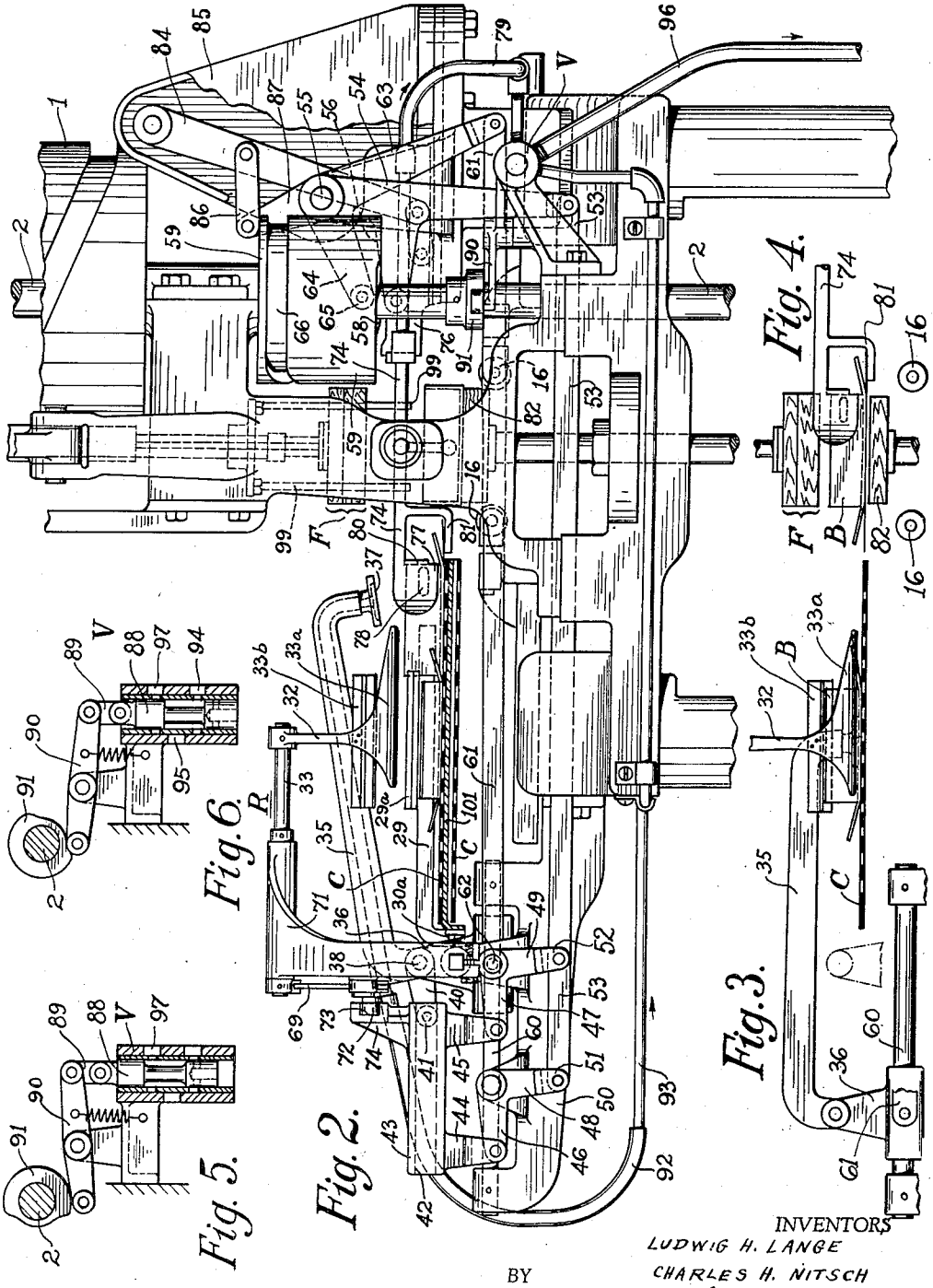


Fig. 2.

Fig. 6.

Fig. 5.

Fig. 3.

Fig. 4.

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BOX FORMING SYSTEM

Filed Sept. 29, 1937 5 Sheets-Sheet 3

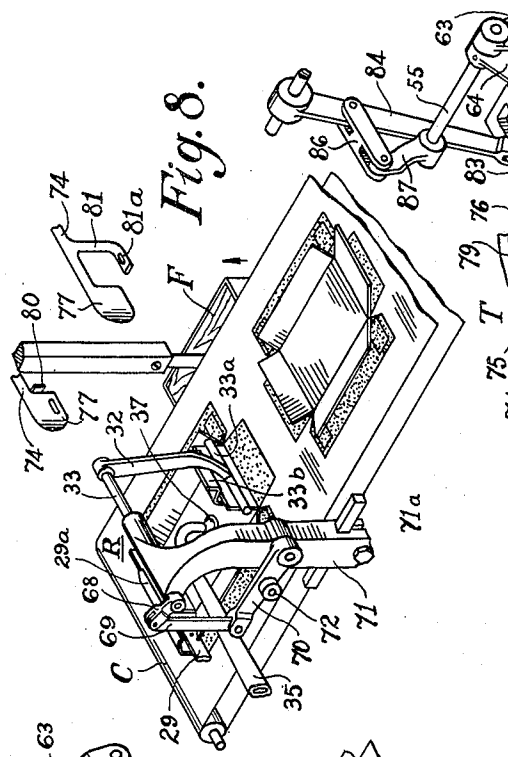


Fig. 8.

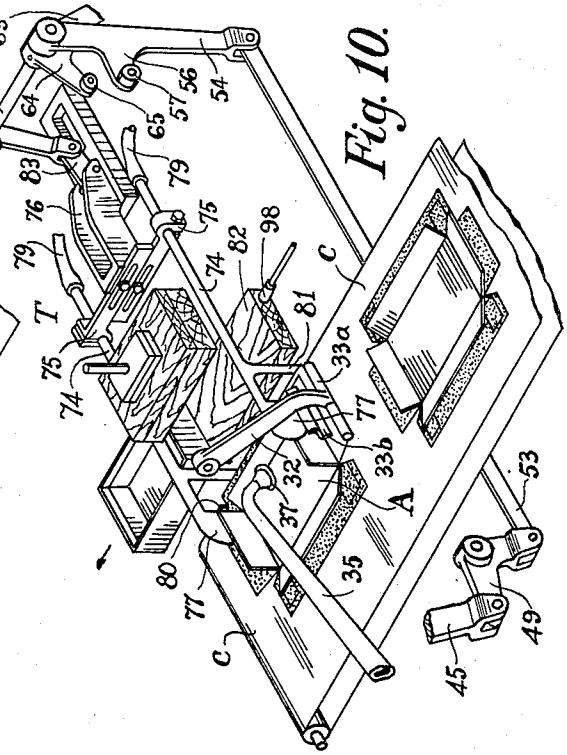


Fig. 10.

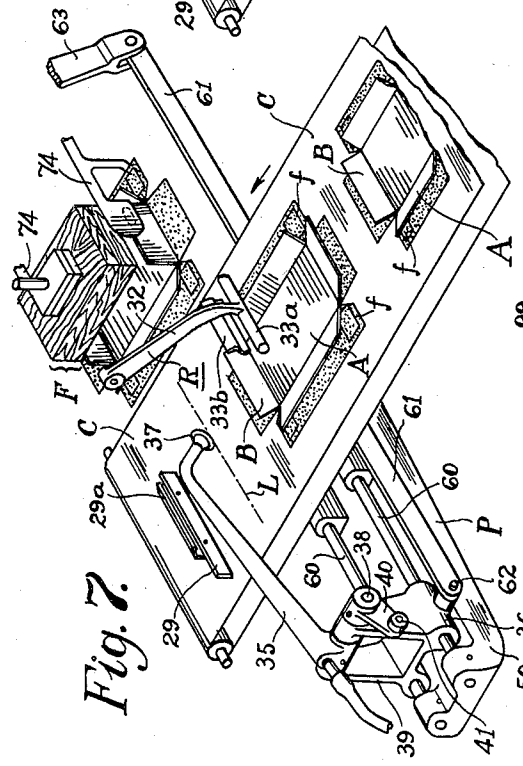


Fig. 7.

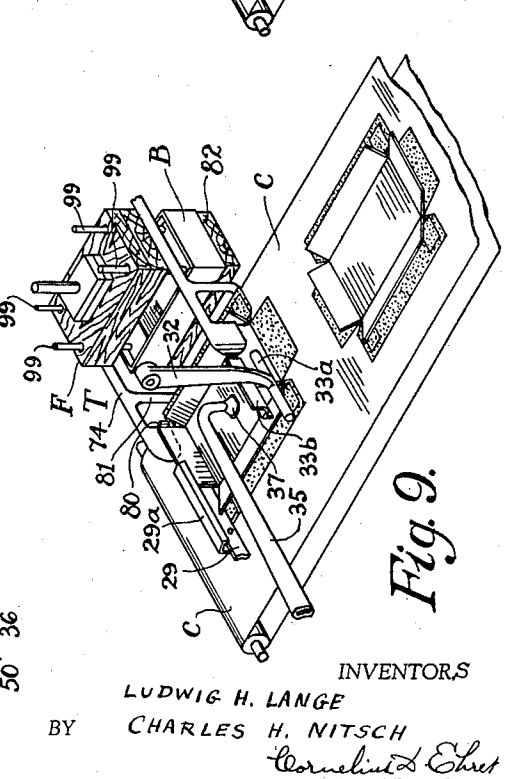


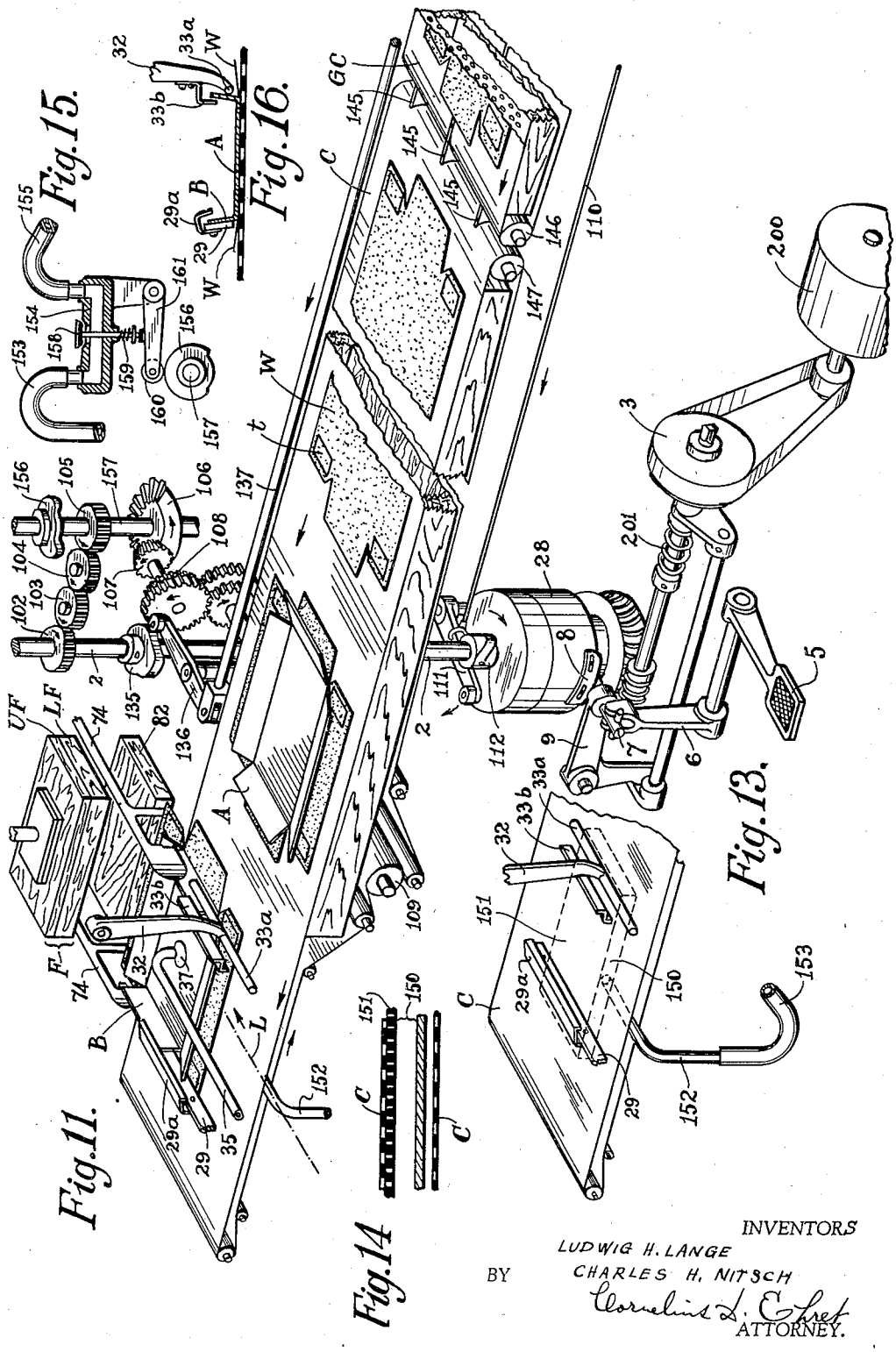
Fig. 9.

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BOX FORMING SYSTEM

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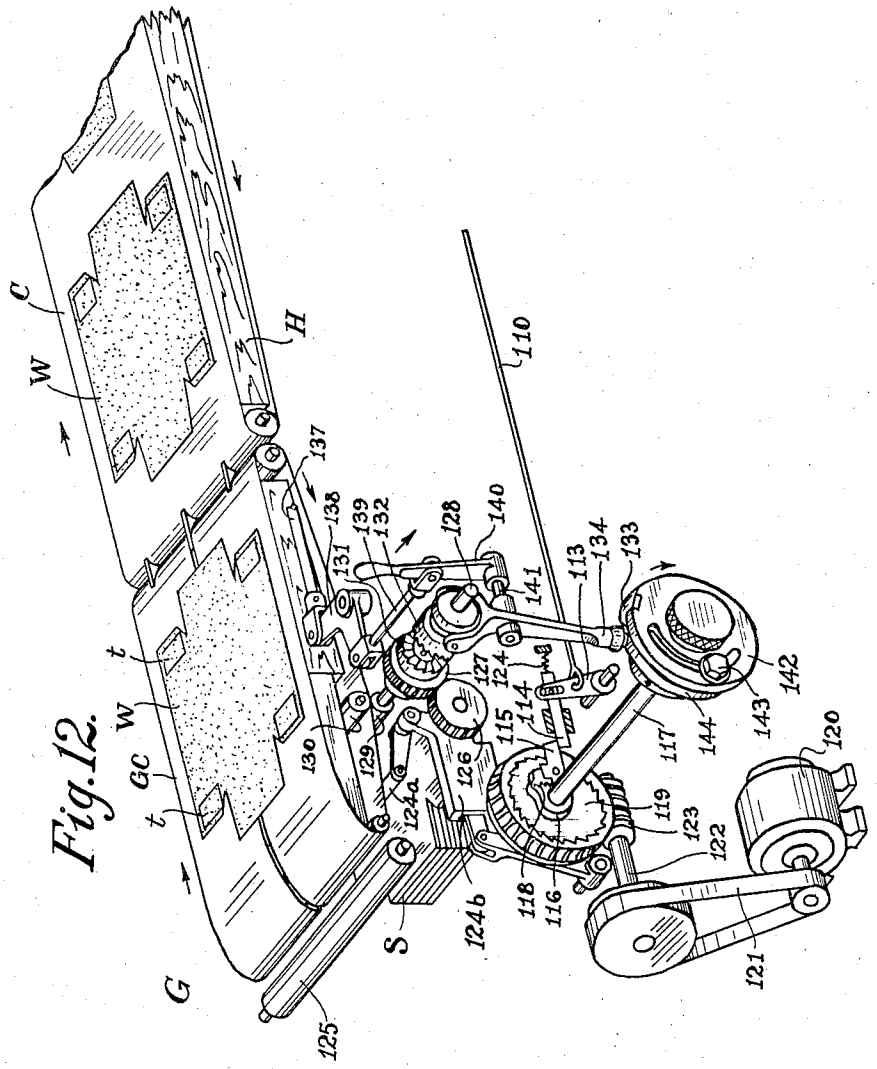


Fig. 12.

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2,144,764

UNITED STATES PATENT OFFICE

2,144,764

BOX FORMING SYSTEM

Ludwig H. Lange and Charles H. Nitsch, Philadelphia, Pa., assignors to Stokes and Smith Company, Philadelphia, Pa., a corporation of Pennsylvania

Application September 29, 1937, Serial No. 166,280

26 Claims. (Cl. 93—54.2)

Our invention relates to sheet-feeding systems and particularly to arrangements for feeding wrappers, labels, tabs or the like, generically termed sheets, toward a box machine.

In accordance with our invention, movement of a conveyor for transporting sheets toward one mechanism, specifically a box machine, from another mechanism, specifically mechanism for feeding wrappers or tabs from a supply thereof and coating them with adhesive, is initiated by one of the mechanisms, specifically the box machine, and is terminated by the other mechanism; more particularly, the conveyor so controlled delivers the sheets to a second conveyor, the beginning and termination of whose movement are controlled by one of the mechanisms, specifically the box machine.

Further in accordance with our invention, the second conveyor is operated to move for a predetermined fixed fraction of the cycle of the box machine, and to adapt the system for sheets of different sizes, the duration of movement of the first conveyor is varied to provide for delivery of the sheets by the first conveyor at a predetermined fixed region, more specifically, at a transfer station adjacent the path of the form-block structure of the box machine.

Our invention further resides in the features of construction, combination and arrangement hereinafter described and claimed.

For an understanding of our invention and for illustration of a preferred form thereof, reference is to be had to the accompanying drawings in which:

Figure 1 is a front elevational view of a box machine and a portion of a conveying system therefor;

Fig. 2 is an end elevational view, on enlarged scale, showing parts appearing in Fig. 1;

Fig. 3 is a detail view showing one of the transfer devices in position different from that of Fig. 2;

Fig. 4 is a detail view showing another transfer device of Fig. 2 in a different stage of operation or in different operating condition;

Figs. 5 and 6 are sectional plan views of valve mechanism shown in Fig. 2;

Figs. 7 to 10, in perspective, show the transfer devices of Fig. 2 in various operating positions;

Figs. 11 and 12, in perspective, show the essential elements of the mechanisms which control the feeding of sheets to the box machine;

Fig. 13, in perspective, shows a vacuum housing at the transfer station at the delivery end of one of the conveyors of Fig. 11;

Fig. 14 is a cross-sectional view on enlarged scale of the vacuum housing of Fig. 13;

Fig. 15 is a plan view of valve mechanism for controlling the vacuum in the housing of Figs. 13 and 14;

Fig. 16 is a detail view in end elevation of stop and registering devices shown in preceding figures.

Referring to Fig. 1, the box machine M is generally of the type shown in Smith U. S. Patent #691,329, and more specifically of the type shown in Rider et al., U. S. Patent #2,074,561. The main cam 1 attached to shaft 2 is driven from a motor 200 (Fig. 11) through the clutch comprising the driving element 3 and the driven element 4. The operator, to initiate operation of the machine, depresses the pedal 5 causing the arm 6 to withdraw a pin 7 from engagement with the adjustable cam 8 rotatable with shaft 2; a spring 201 (Fig. 11) is thereupon effective to move the driven clutch element 4 into driving engagement with the driven clutch member 3; at the end of one revolution of shaft 2 the cam 8 through pin 7 rocks the bell-crank lever 9 in clockwise direction to withdraw the driven clutch member 4 and so interrupt operation of the machine, provided the operator does not hold the pedal 5 depressed, in which event the cycle repeats.

During a revolution of the cam 1, the form block F, comprising the upper form UF and the lower form LF is moved from the position shown in Fig. 1 downwardly in a path adjacent various sheet-applying tools and thence back to its original position shown in Fig. 1. This movement of the form block and relative movements with respect to each other of the form-block components UF and LF are effected by the levers 10 and 11 provided, respectively, with cam followers 12 and 13 which ride in the cam grooves 14 and 15 of cam 1. As well understood in the art, the size of the form block is selected to suit the particular boxes to be made or wrapped by the machine.

The various sheet-applying tools, including the side rolls 16, end rolls not shown, marginal turn-in tools 17 and presser blocks 18 are carried by four tool slides 19 adjustably secured to the table 20 of the machine and each provided with an operating member 21 adjustably secured to a bar 22 extending from a slidable sleeve 23 connected by link 24 to a lever 25 carrying a cam follower 26 received by groove 27 of cam 28 disposed on the one-time shaft 2 of the machine. During the cycle of the machine, the sleeve 23 is reciprocated to effect the various sheet-applying

operations of the tools, all as more fully shown and described in the aforesaid Rider patent.

The conveyor C is intermittently operated, as hereinafter more specifically described, making one step for each cycle of the box machine M, to transport adjacent to the form-block structure F box structures, wrappers, groups of tabs, or specifically assemblies, such as shown, for example, in Stokes U. S. Patent #2,015,202, each comprising an unstayed box or component of a multi-piece box to which is attached partially applied sheet material. The sheet material partially applied to an unstayed box may simply be tabs, or a wrapper having tabs thereon, or an untabbed wrapper. Alternatively, each of the assemblies may comprise a previously stayed box and a partially applied tabbed or untabbed wrapper. Conveyor C, preferably of the suction type as in Davis U. S. Patent #1,818,198, may transport the wrappers from a gluing machine G, Fig. 11, such as shown in Rider U. S. Patent #1,857,260 or Federwitz U. S. Patent #1,772,344, and at an intermediate point between the gluing machine and the wrapping machine an operator may manually register boxes on the wrappers to form the assemblies, or this operation of forming assemblies may be performed automatically, as by mechanism disclosed in Stokes Patent #2,018,237.

For purposes of explaining the operation of the machine, the assemblies operated upon each comprises a one-piece unstayed box B, and a one-piece wrapper W to which tabs *t* are previously applied as by mechanism of the aforesaid Rider patent. The conveyor C is preferably of the suction type so that the wrappers are held flat by suction at least until they pass the assembly station at suitable point along the suction housing H.

As each assembly A in turn arrives in position adjacent the form block, the leading edge or end of the box structure B is engaged by an adjustable stop member **29** extending transversely of the conveyor belt C and held in position slightly above it by the bolt **30***a*, Fig. 2, which clamps stop **29** to the plate **101** for supporting conveyor belt C. The spacing of the stop **29** above the conveyor permits the leading end of the wrapper to pass below it without obstruction, yet permits the stop **29** to engage the forward end of the stayed or unstayed box. The stop **29**, as appears in Fig. 11, is in alignment or registry with one end of the form-block structure F. This element of itself is not sufficient to provide for registry of the box or unstayed box with the form block because of the tendency of the box structure to rebound from or ride over the stop; further, when the box structure is an unstayed blank, the end wall is not erected and, therefore, although the forward edge of the blank might remain against the stop **29** upon termination of the conveyor movement, the blank, if moved transversely of the conveyor into the path of the form block, would not be in alignment or registry with the form block.

To preclude the possibility of a box, particularly an unstayed box, from riding up and possibly over stop **29**, there is attached thereto or made part thereof, an auxiliary stop member **29***a*, Fig. 16, preferably having a horizontal section extending from the top of stop **29** toward the receiving end of conveyor C and a vertical section extending downwardly to suitable extent from the forward end of member **29***a*.

To prevent bounding of the box, or unstayed blank, away from stop **29**, there is provided the housing **150**, Fig. 13, whose upper wall **151** is perforated to permit application of suction through conveyor belt C upon an assembly approaching stop **29**. The interior of housing **150** is connected to a suction pump, by pipe **152**, hose **153**, valve housing **154**, Fig. 15, and hose **155**. The suction or vacuum is reduced or broken at suitable time in the cycle of the system to avoid hindrance to movement, by mechanism hereinafter described, of the assembly from position above the suction housing transversely of belt C. The timing of the application of suction is controlled by cam **156**, Figs. 11 and 15, on shaft **157** of the box machine which makes one revolution for each shaft of the machine. As shown in Fig. 15, the bleeder valve **158** is biased to its closed position by spring **159** which maintains engagement of cam follower **160** on arm **161** with the suction control cam **157**.

To insure proper alignment of the box structure with the form block, and additionally in the case of the unstayed blank to erect the end walls of the blank, there is provided an aligning or registering mechanism R comprising the arm **32**, Fig. 2, attached to shaft **33** and having at its free end a box-engaging member **33***a* which, when the arm **32** is in its lower position, Fig. 8, preferably just clears the top of the conveyor belt C and which, when in its upper position, Figs. 2 and 7, is out of the path of box structures on the conveyor to avoid obstruction to their movement toward the stop **29**. When the member **33***a* is in its down position, Fig. 8, it is in alignment with one end of the form block F, and the stop **29**, as previously stated, is in alignment with the opposite end of the form block. Preferably for unstayed blanks, there should be provided the stop **33***b*, or equivalent, adjustably attached to the arm **32**, Fig. 16, to limit the bending movement of the rear side panel of the blank when engaged or struck by the registering member **33***a*. The swinging movement of the arm **32** is, therefore, effective, in the case of stayed boxes, to align them with the form block, and in case of unstayed boxes, performs the additional function of erecting the box ends so that they are in alignment with the ends of the form block structure F.

Preferably, the shape and angular position of cam **158**, Fig. 15, is such that the suction in housing **150** is suitably reduced or cut off during registration of an assembly by mechanism R and remains off during transfer of the registered assembly by mechanisms hereinafter described.

The aligned or registered box structure is moved from the position shown in Fig. 8 toward the path of the form block F by transfer mechanism P including the arm **35** pivotally mounted at one end to the reciprocable carriage **36** and at its other end having a suction plate **37** for engagement with a box structure on the conveyor C. During movement of the conveyor C the arm **35** is in its upper position, Figs. 2 and 7, permitting the box structures to move with the conveyor without obstruction by arm **35** or the suction plate **37**.

After the box structure has been aligned by the registering mechanism R, as above described, the arm **35** is rocked in clockwise direction to effect engagement of the suction plate **37** with the box blank, Fig. 8. This movement of the arm **35** is effected by the mechanism now described. Arm **35** is attached to shaft **38**, Fig. 7, supported by the brackets **39** of carriage **36** and to shaft **38** is also attached the arm **40** upon

the end of which is mounted a roller 41 received by a groove or slot 42 in the member 43, Fig. 2, from which depend the supporting members 44, 45 pivotally mounted to the arms 46, 47 of bell-crank levers 48, 49 supported from the bracket 50 attached to the main frame of the machine. The arms 51, 52 of the bell-crank levers 48, 49 are pivotally connected to the bar 53 which extends toward the rear of the machine and is there pivotally connected to the lower end of a lever 54, Fig. 10, supported by, and free to rotate with respect to, the shaft 55. From lever 54 extends the arm 56 having thereon a cam follower 57 for engaging the cam 58 formed on the under side of the cam member 59, Fig. 2, which rotates with shaft 2. Lever 54 is biased, as by a spring not shown, to maintain engagement of follower 57 with cam 58.

When the cam follower 57 moves upwardly under the control of cam 58, the lever 54 swings in clockwise direction to effect movement in the same direction of bell-crank levers 48, 49, thus lifting the grooved member 43 to swing the arm 35 in clockwise direction to effect engagement of the suction plate 37 with a registered box structure, Fig. 8. While the arm 35 remains in this angular position with respect to its shaft 38, the carriage 36 is moved toward the path of the form block to move the box structure to the position shown in Fig. 9. The mechanism for effecting this movement of the carriage is now described.

As shown in Figs. 2 and 7, the carriage 36 is supported by the two guide rods 60 whose ends are supported by the bracket 50. One end of the link 61 is connected at 62 to the carriage 36 and the other end of the link is connected, at the rear of the machine, to the lower end of a lever 63 attached to the shaft 55. The arm 64 of lever 63, Fig. 2, carries the cam follower 65 received by the groove 66 in the cam member 59 on shaft 2.

When, during the cycle of the machine, the lever 63 is swung in counterclockwise direction, the bar 61 is moved to the right, Fig. 2, to move the carriage 36 and the arm 35 thereon toward the path of the form block thus moving the box structure or assembly to the position shown in Fig. 9. After a predetermined dwell, the rise of cam 58 engages the cam follower 57 on lever 54 to move the link or bar 53 to the right, Fig. 2, to lower the member 43 and so cause the pusher-arm 35 to swing in counterclockwise direction to its upper position, shown in Fig. 2; concurrently, the cam track 66 causes the arm 63 to swing in clockwise direction, moving the bar 61 to the left, and so returns the carriage 36 and arm 35 to its original position, shown in Fig. 7. The arm 35 remains in its upper position until after the conveyor has moved a box blank into engagement with the stop 29, and the registering mechanism R has aligned the next box structure to be transferred.

The movement of the arm 32 and box-engaging member 33*a* of the aligning mechanism R is derived from the member 43 whose reciprocation controls the movement of the pusher member 35. As shown in Figs. 2 and 8, to the front end of the shaft 33 which supports the arm 32 of the aligning member is attached the arm 68 connected by link 69 to a lever 70 pivoted on bracket 71 adjustably secured to bar 71*a*. The roller 72 on arm 70 is received by a slot 73 in the extension 74, Fig. 2, of the vertically reciprocating member 43.

When member 43 is lifted under the control of cam 58 to swing the arm 35 from the position shown in Fig. 7 to the box-engaging position shown in Fig. 8, aligning arm 32 is therefore concurrently swung from the position shown in Fig. 7 to the position shown in Fig. 8 to register the stayed or unstayed box in anticipation of its movement towards the form block by the pusher-arm 35. During the forward movement of the pusher-arm, the aligning member 33*a* remains in its down position and serves as a guide for the box structure during its movement toward the position shown in Fig. 9.

When the member 43 is moved downwardly under the control of cam 58 to swing the arm 35 upwardly away from the conveyor, the operating arm 70 for the aligning member 33*a* is concurrently operated to swing the arm 32 from the position shown in Fig. 9 to the position shown in Fig. 10, the arms 35 and 32 remaining in their upper positions until the member 43 is raised in the next cycle of the machine, thus to avoid obstruction to movement of the box structures toward stop 29.

To transfer the assembly A from the position shown in Fig. 10, into the path of the form block, Fig. 7, there are provided the members 74, 74 adjustably secured to the bars 75, 75 which, in turn, are adjustably secured to the movable supporting member 76 at the rear of the machine. The members 74, 74 of the second transfer device T extend from the rear of the machine, straddle the form block, and upon reciprocation of the supporting member 76 move from the box-receiving position of Fig. 9 above the conveyor and displaced from the center thereof toward the form block to the box-discharging position of Fig. 7. At their forward ends the members 74, 74 are provided with box-engaging or holding members 77, 77. The distance between members 77, 77 is adjustable to correspond to the length of the box structure to be transferred, the extreme outer ends of members 77 preferably being slightly flared to facilitate entry of a box between the members. The inner faces of members 77, 77 are provided with ports 78 through which suction may be applied to hold the box against these members which serve as suction-type grippers. For application of suction to the ports 78, the members 74, 74 are hollow and connect at their rear ends with the suction hose 79. Each of the members 77, 77 is provided with a stop 80 defining the limit of movement of the box structure by the pusher arm 35. From each of the members 74, 74 depends a supporting member 81 adapted, as most clearly shown in Fig. 2, to pass beneath and support the leading panel of a wrapper attached to the box structure to be transferred into the path of the form block; members 81 may be provided, as shown in Fig. 8, with suction ports 81*a*. The member 81 keeps the leading panel of the wrapper out of contact with parts of the mechanism, for example, the platen 82 (Figs. 9, 10, 11), during the transfer of the assembly to the position shown in Fig. 7 above the platen which is biased to the position shown in Figs. 2 and 7, as by a spring, not shown.

The carriage comprising the members 74, 74 is reciprocated between its box-receiving position above the conveyor belt and its box-discharging position in the path of the form block F by the mechanism now described. The supporting structure 76 for members 74, 74 is connected by link 83 to the lower end of arm 84 pivoted at its upper end to the bracket member 85 and connected by link 86 to arm 87 attached to the oper-

ating shaft 55 for the carriage 36 of the other transfer device 35.

Concurrently with movement of carriage 36 towards the path of the form block of the wrapping machine to effect transfer of a box structure by arm 35 from the aligning station, the members 74, 74 are therefore moved from the position shown in Fig. 7 toward the box-receiving position shown in Fig. 9, the relative movement of the two transfer devices causing the box structure to be transported from the position shown in Fig. 8 transversely of the conveyor to the position shown in Fig. 9 at which it is received by the box-holding members 77, 77. The distance between the center lines of the conveyor and of the form block is fixed for all sizes of boxes within the range of the machine; the strokes of the two transfer devices are therefore fixed and each follows the law of harmonic motion insuring smooth operating action.

Preferably before the box structure is moved from the position shown in Fig. 9 to the position shown in Fig. 10, the suction applied through the suction plate 37 to the box structure is cut off and substantially concurrently the suction is applied or increased through the ports 78 of the box-engaging members 77, 77. The valve mechanism for shifting the application of suction from one of the transfer devices to the other is shown in Figs. 5 and 6.

The piston 88 of the suction valve V is connected by link 89 to the arm 90 rockable by the cam 91 on shaft 2 of the box machine. As the pusher-arm 35 and the carriage members 74, 74, are moving toward each other, the valve piston 88 is in the position shown in Fig. 6, providing a path for suction through the plate 37, flexible hose 92, pipe 93, port 94 of valve V, about the piston 88, and thence through port 95 and pipe 96 to the intake of a suction pump not shown. The port 97 of the valve is blocked by the piston 88, preventing application of suction through the ports 78 and 81*a* of the box-engaging member 77, 77 and 81, 81 respectively, of the transfer carriage.

Substantially concurrently with the raising of arm 35 to the position shown in Fig. 2, the piston valve is moved from the position shown in Fig. 6 to the position shown in Fig. 5 to close the port 94 and so discontinue application of suction through the plate 37 and substantially concurrently to permit application of suction through the port 97 which is in communication with the suction ports 78 and 81*a* of the carriage members 74, 74. Suction may be continuously exerted through the ports 78 until the arm 25 moves from the position shown in Fig. 7 to the position shown in Fig. 8, at which time suction is transferred to the suction plate 37 to hold the box blank to the member 35 for its movement toward the form block or, more specifically, to the box-receiving position of the carriage members 74, 74.

Preferably, the transfer devices, the conveyor C, and the form block of the wrapping machine are so timed that the parts are in the position shown in Fig. 10 at or just before the end of the cycle of the machine. As there indicated, the finished box has been, or is being ejected by the ejector 98, the conveyor C is stationary, the carriage members 74, 74 are in their box-receiving position, the pusher member 35 has completed its transfer movement of a box structure, and members 35 and the aligning member 33*a* are in their raised positions.

When the operator presses the pedal 5, the two transfer devices move away from one another, the carriage members 74, 74 moving assembly A to the position shown in Fig. 7, in the path of the descending form block F, and the other transfer device comprising arm 35 returning to its position above the aligning station, Fig. 7. While the two transfer devices remain stationary at these positions, the form block in its descent carries the assembly from the position shown in Fig. 7 downwardly adjacent the various sheet-applying tools, and during this dwell of the transfer device the conveyor C operates to bring another box structure or assembly against the stop 29. The carriage is free to move its box-receiving position as soon as the descending form block has removed the assembly therefrom. For holding the box end against the form block until operation of the corner-lap tools, which apply the flaps *f* of the wrapper to the box ends, there may be utilized the holders 100 of the type described in Lange application Serial #86,591, filed June 22, 1936, or in lieu thereof, the form block F may be of the suction type disclosed in Rider application Serial #86,221, filed June 20, 1936.

While the conveyor C is stationary, the member 33*a* of mechanism R swings from the position shown in Fig. 7 to the position shown in Fig. 8 to align a box structure or assembly with the form block, and the member 35 swings downwardly into engagement with the registered box structure, the valve V causing suction to be applied to the box structure through the plate 37 on arm 35. Substantially concurrently with interruption of movement of the conveyor, the two transfer devices move toward each other, the arm 35 moving the box assembly to the position shown in Fig. 9, and the carriage members 74 concurrently moving to the position shown in Fig. 9 to receive the box. During this movement of the transfer devices, and while they are still in the position shown in Fig. 9, the form block F may substantially complete its upward movement, the completed box having been removed therefrom by the stripper rods 99. Before the end of the cycle of the machine, the pusher-arm 35 and the aligning arm 32 may be swung upwardly to the position shown in Fig. 10 to avoid obstruction to the next assembly to be or being transported to the registering station.

The aligning mechanism R, and the transfer mechanisms P and 74 are specifically claimed in copending Lange application Serial No. 152,354, filed July 7, 1937.

The conveyor C is driven, Fig. 11, from shaft 2 in timed relation to the movement of the form block F by mechanism including the train of gears 102—105, mutilated bevel-gear 106, bevel gear 107, a selective gear transmission 108, whose use is optional, and driving roll 109. During each cycle of the machine M, the gear 106 drives the conveyor belt C for a definite fraction of the cycle to move the wrappers or assemblies through a predetermined distance. Preferably, the timing relation of gear 106 to shaft 2 is such that movement of conveyor C begins substantially concurrently with tripping of the gluing machine G by cable 110, for example, at about 60° of the cycle of machine M, and ends at about the time the transfer devices P and R begin to move toward each other, for example, at about 220° of the cycle of machine M.

At one end, the cable 110 is connected to the pivoted arm 111 biased toward the cam 112 on

the main shaft 2 and at its other end is connected to lever 113 of the gluing machine G, Fig. 12. When arm 111 is momentarily rocked by cam 112 during the cycle of the box machine M, it initiates the cycle of the gluing machine G by causing cable 110 to rock lever 113 to withdraw the latch member 114 from engagement with the driven clutch member or dog 115 pivotally mounted on member 116 attached to shaft 117. Release of the driven clutch member 115 permits spring 118 to move it into engagement with the driving clutch member 119 rotatably mounted on shaft 117 and continuously driven by motor 120 through a suitable drive, such as belt 121, shaft 122 and worm 123. At the end of one revolution of shaft 117, the dog 115 strikes the latch 114, which, in the meantime, has been returned to the position shown in Fig. 12 by biasing spring 124, and is thereby disengaged from the driving clutch member 119 to end the cycle of the gluing machine.

When the clutch of machine G is tripped, the carriage 124*b* and suction roll 124*a*, by mechanism such as shown in the aforesaid Federwitz Patent #1,772,344, are reciprocated to remove a wrapper from the top of the stack S and to feed it toward the adhesive-applying roll 125, from which it is deflected onto the conveyor GC, preferably of the suction type described in the aforesaid Davis Patent #1,818,198, which transports it toward the box-machine conveyor C.

The drive for conveyor GC comprises the continuously rotating gear 126, driven by motor 120, which meshes with gear 127 freely to rotate on shaft 128 to which is attached one of the conveyor driving rolls 129, 130. The driving clutch member 131 attached to or integral with gear 127 is adapted to engage the driven clutch member 132 slidably keyed to shaft 128.

The cam 133 on plate 142, whose angular position with respect to shaft 117 may be adjusted, engages arm 134 at suitable time in the cycle of the gluing machine G to slide the driven member 132 of the conveyor clutch from engagement with the driving member 131 to terminate the movement of conveyor GC which began when cam 135 on shaft 2 of the box machine M (Fig. 11) rocked lever 136 during the cycle of machine M.

Rod 137 is at one end connected to lever 136 of the box machine M, Fig. 11, and at its other end is connected at the gluing machine G, Fig. 12, to bell-crank lever 138 connected through link 139, lever 140 and shaft 141 to the operating arm 134 of the conveyor clutch member 132. Preferably the two conveyors G and GC begin their movement at or about the same time.

For all sizes of wrappers within the range of the box machine, the box-machine conveyor C is at rest for a large part of the cycle, specifically from about the 220° point of one cycle to the 60° point of the next cycle so that even when the box machine is in continuous operation at high speed, for example, in excess of thirty-five cycles or boxes per minute without interruption between cycles, the operator is afforded ample time to perform the simple acts of picking up a stayed or unstayed box and registering it on one of the wrappers on conveyor C.

The conveyor C is in motion when engaged by a wrapper being delivered thereto by conveyor GC and is operating at the same, or possibly a slightly higher speed.

Since, regardless of the size of the wrapper, its leading edge reaches the conveyor GC at the same point in the cycle of the gluing machine, it is apparent that for different lengths of wrappers and the same length of travel of conveyor GC, the distance from the center line of the wrapper at the end of the conveyor step to the center line L of the registering station at the box machine would depend upon the length of the wrapper. Therefore, this distance would not be equal to an integral number of steps of conveyor C and the center lines of the wrappers would not coincide with line L after an integral number of steps of conveyor C. To avoid this difficulty, and accommodate the system for wrappers of different lengths, provision for adjustment of the step of conveyor GC is made.

Specifically, for different sizes of wrappers, the cam 133 is adjusted, as provided by a slot in its supporting disk 142 through which bolt 143 extends releasably to clamp disk 142 to the fixed member 144 attached to shaft 117, so that when conveyor GC comes to rest the wrapper to be delivered to conveyor C in the next cycle is in such position that it will, after delivery to and movement by conveyor C in the next cycle, be in such position that an integral number of steps of conveyor C will result in delivery of the wrapper in approximate registry at the transfer station adjacent the path of the form block.

For large wrappers, the step of conveyor GC is large, for example, the conveyor may start at about 60° of the box machine cycle and continue until about 340° of that cycle, whereas, for much smaller wrappers the step ends at about 280° of the wrapping-machine cycle.

During the first part of its movement in a cycle, the conveyor GC delivers a wrapper from the position of Fig. 12 to conveyor C which is at that time in motion and during a later part of its cycle conveyor GC receives a wrapper removed from the stack and delivers it to the position of Fig. 12. It is not, of course, necessary that conveyor GC be so short that it can accommodate only one wrapper at a time, but to make it longer requires more floor space unless conveyor C is correspondingly reduced in length.

The bridging members 145 between the delivery end of conveyor GC and the receiving end of conveyor C prevent the wrappers from following the conveyor belt GC as it curves over roll 146. Preferably, the conveyor belt GC is split lengthwise into two or more sections, Fig. 11, and one or more of the bridging members 145 is provided with an extension extending into the slot or space between adjacent conveyor sections with its upper edge substantially flush with the face of the conveyor belt. If desirable, a light air-blast may be directed upwardly between the rolls 146, 147 to assist in preventing the leading edges of the wrapper panels from curling under as they pass over the gap between the rolls. Since, during the transfer, the wrapper is held by suction exerted through one, or both, of the conveyors, depending upon its position at a particular instant, there is no opportunity for it to lose its proper spacing with respect to the wrappers previously delivered to conveyor C.

Briefly, to review the operation of the entire system, once for each cycle of the box machine M, a wrapper is removed from stack S, coated with adhesive, and delivered to conveyor GC, a wrapper is delivered by conveyor GC to conveyor C, an operator registers a stayed or unstayed box on a wrapper or conveyor C to form an assembly, conveyor C delivers an assembly to the transfer station adjacent the path of form block,

mechanism R aligns the assembly at the transfer station, transfer mechanism P moves the assembly to the receiving position of carriage 14 for transport into the path of the form block during the next cycle, carriage 14 at the beginning of the cycle moves the assembly received by it in the previous cycle into the path of the form block, and the form block moves downwardly to pass the assembly adjacent the sheet-applying tools and thence upwardly for removal of the completed box. The only manual operation necessary is that of registering a box or an unstayed box blank upon the wrapper or tabs on conveyor C; this operation, if desired, may be performed automatically by mechanism of the type disclosed and claimed in Stokes Patent #2,018,237.

Our invention is not restricted to the preferred arrangement specifically illustrated and described, but is coextensive in scope with the appended claims.

What we claim is:

1. A system comprising a machine for applying sheets to box structures, conveyor means for transporting adhesive-coated sheets toward said machine, mechanism for applying adhesive to said sheets, and means controlled by said machine to initiate movement of said conveyor means and controlled by said adhesive-applying mechanism to terminate movement of said conveyor means.

2. A system comprising a machine for applying sheets to box structures, mechanism for applying adhesive to the sheets, a conveyor for transporting sheets away from said adhesive-applying mechanism and toward said machine, and clutch means for controlling said conveyor actuated by said machine to initiate movement of said conveyor and actuated by said adhesive-applying mechanism to terminate movement of said conveyor.

3. A system comprising two mechanisms for operating in succession upon sheets, conveyor means for transporting sheets away from one mechanism and toward the other, and means for controlling said conveyor means actuated by one of said mechanisms to initiate operation of said conveyor means and actuated by the other of said mechanisms to terminate operation of said conveyor means.

4. A system comprising a machine for applying sheets to box structures, mechanism for applying adhesive to sheets, and intermittently-operating conveyor means for transporting sheets step-by-step away from said adhesive-applying mechanism toward said machine, said machine initiating and said adhesive-applying mechanism terminating each step.

5. A system comprising a machine for applying sheets to box structures, mechanism for applying adhesive to sheets, conveyors in tandem between said machine and said adhesive-applying mechanism, means for substantially concurrently initiating operation of said conveyors to effect delivery of a sheet to said machine and transfer of a sheet from one conveyor to another, and means for interrupting movement of said conveyors dissimultaneously to provide for transport of a sheet by one of said conveyors from said adhesive-applying mechanism while the other conveyor is at rest.

6. A system comprising a machine for applying sheets to box structures, mechanism for applying adhesive to sheets, a conveyor extending from said adhesive-applying mechanism, a second conveyor extending away from said first conveyor to said box machine, means controlled by said box machine for initiating operation of both conveyors and for terminating operation of said second conveyor, and means controlled by said adhesive-applying mechanism for terminating operation of said first conveyor.

7. A system comprising two mechanisms for operating in succession upon sheets, a conveyor extending from one of said mechanisms, a second conveyor extending away from said first conveyor to the other of said mechanisms, means controlled by one of said mechanisms to initiate operation of both of said conveyors and to terminate operation of one of them, and means controlled by the other of said mechanisms to terminate the operation of the other of said conveyors.

8. A system comprising a machine for applying sheets to box structures, mechanism for removing sheets in succession from a stack, conveyor means for transporting sheets away from said mechanism toward said machine, and means for controlling operation of said conveyor means actuated by said machine to initiate movement of said conveyor means and actuated by said sheet-removing mechanism to terminate movement of said conveyor means.

9. A system comprising mechanism for removing sheets in succession from a stack, mechanism for operating upon the removed sheets, conveyor means for transporting sheets away from said first mechanism and toward said second mechanism, and means for controlling said conveyor means actuated by one of said mechanisms to initiate operation of said conveyor means and actuated by the other of said mechanisms to terminate the operation of said conveyor means.

10. A system comprising mechanism for removing sheets in succession from a stack, mechanism for operating upon the removed sheets, conveyor means for transporting sheets away from said first mechanism and toward said second mechanism, and means for controlling said conveyor means actuated by said second mechanism to initiate operation of said conveyor means and actuated by said first mechanism to terminate the operation of said conveyor means.

11. A system comprising a machine for applying sheets to box structures, mechanism for removing sheets from a stack, a conveyor extending from said sheet-removing mechanism, a second conveyor extending away from said first conveyor to said machine, means controlled by said machine for initiating operation of said conveyors and for terminating operation of said second conveyor, and means controlled by said mechanism for terminating operation of said first conveyor.

12. A system comprising a cyclically-operating machine for applying sheets to box structures, cyclically-operating mechanism for removing sheets from a stack, a conveyor extending from said sheet-removing mechanism, a second conveyor extending away from said first conveyor to said machine, means controlled by said machine simultaneously to initiate operation of said conveyors and to terminate operation of said second conveyor at a predetermined time in the cycle of said machine, and means controlled by said sheet-removing mechanism for terminating operation of said first conveyor at a predetermined time in the cycle of said mechanism.

13. A system comprising a cyclically-operating machine for applying sheets to box structures, cyclically operating mechanism for applying adhesive to sheets, and conveyor means for transporting sheets step-by-step away from said ad-

hesive-applying mechanism and toward said machine, said machine initiating each step of said conveyor at a predetermined time in its cycle and said adhesive-applying mechanism terminating each step at a predetermined time in its cycle.

14. A system comprising a cyclically-operating machine for applying sheets to box structures, cyclically operating mechanism for removing sheets from a stack, and conveyor means intermittently operated to transport sheets from said mechanism toward said machine, said machine initiating each operation of said conveyor means at a predetermined time in the cycle of said machine and said sheet-removing mechanism terminating each operation of the conveyor at a predetermined time in the cycle of said mechanism.

15. A system comprising cyclically-operating mechanisms for operating in succession upon sheets, conveyor means for transporting sheets away from one mechanism and toward the other, and means for controlling said conveyor means actuated by one of said mechanisms at a predetermined time in its cycle to initiate operation of said conveyor means and actuated by the other of said mechanisms at a predetermined point in its cycle to terminate operation of said conveyor means.

16. A system comprising cyclically-operating mechanisms for operating in succession upon sheets, one of said mechanisms initiating the cycle of the other, conveyor means for transporting sheets away from one mechanism and toward the other, and means for controlling said conveyor means actuated by one of said mechanisms at a predetermined time in its cycle to initiate operation of said conveyor means and actuated by the other of said mechanisms at a predetermined point in its cycle to terminate operation of said conveyor means.

17. A system comprising a cyclically-operating machine for applying sheets to box structures, cyclically-operating mechanism for applying adhesive to sheets, means controlled by said machine to initiate the cycle of said mechanism, and conveyor means for transporting sheets step-by-step away from said adhesive-applying mechanism and toward said machine, said machine initiating each step at a predetermined time in its cycle and said adhesive-applying mechanism terminating each step at a predetermined time in its cycle.

18. A system comprising a cyclically-operating machine for applying sheets to box structures, cyclically-operating mechanism for removing sheets in succession from a stack, means controlled by said machine to initiate the cycle of said sheet-removing mechanism, and conveyor means intermittently operated to transport sheets from said mechanism toward said machine, said machine initiating each operation of said conveyor means at a predetermined time in the cycle of said machine and said sheet-removing mechanism terminating each operation of the conveyor at a predetermined time in the cycle of said mechanism.

19. A system for delivering sheets with their center lines in register with a desired line at a delivery station comprising a conveyor extending to said station, cyclically-operating means for moving said conveyor step-by-step, a second conveyor discharging sheets in succession onto said first conveyor, means effecting engagement of sheets in succession with said second conveyor at corresponding points in successive cycles of said operating means of said first conveyor, and operating means for said second conveyor timed to begin its movement substantially concurrently with each initiation of movement of said first conveyor and to discontinue its movement when the distance from the center line of the sheet to be discharged therefrom to said desired line at said delivery station is equal to an integral number of steps of said first conveyor.

20. A system comprising a box machine having reciprocating form-block structure and sheet-applying tools, an intermittently operated conveyor extending adjacent the path of said form-block structure, means for transferring an assembly comprising box structure and a partially-applied wrapper or tabs from said conveyor into the path of said form block, mechanism for applying adhesive to wrappers or tabs, a conveyor for transporting wrappers or tabs from said mechanism to said first conveyor, and means for controlling operation of said second conveyor actuated by said box machine to initiate movement of said second conveyor and actuated by said adhesive-applying mechanism to terminate operation of said second conveyor.

21. A system comprising a box machine having reciprocating form-block structure and sheet-applying tools, an intermittently operated conveyor extending adjacent the path of said form-block structure, means for transferring an assembly comprising box structure and a partially-applied wrapper from said conveyor into the path of said form block, mechanism for feeding wrappers from a stack, a conveyor for transporting wrappers from said mechanism to said first conveyor, and means for controlling operation of said second conveyor actuated by said box machine to initiate movement of said second conveyor and actuated by said wrapper-feeding mechanism to terminate operation of said second conveyor.

22. A system comprising a conveyor for transporting a box structure, stop structure for engaging a box structure during transport by said conveyor, and means for preventing rebound of the box structure from said stop structure comprising means for applying air pressure to said box structure in the region adjacent said stop structure.

23. A system comprising a conveyor belt for transporting a box structure, stop structure for engaging a box structure during transport by said conveyor, and means for preventing rebound of the box structure from said stop structure comprising means for applying suction through said conveyor belt to said box structure when adjacent said stop structure.

24. A system comprising a conveyor for transporting a box structure, stop structure for engaging a box structure during transport by said conveyor, means for applying suction to said box structure as it approaches and engages said stop structure, mechanism for moving the box structure with respect to said conveyor after its engagement by said stop structure, and means for discontinuing application of suction to said box structure during its movement by said mechanism.

25. A system comprising an endless conveyor belt for transporting a box structure, and stop structure having a substantially vertical portion extending transversely of said belt to engage the leading panel of said box structure and a substantially horizontal portion for engaging the upper edge of said panel in event of tendency

of the box structure to ride over said substantially vertical portion.

26. A system comprising a conveyor for transporting unstayed boxes, stop structure for engaging the leading panel of an unstayed box on said conveyor, and means for registering the box structure arrested by said stop structure comprising a pair of abutments movable in unison, one of said abutments engaging the rear face of the trailing panel of the arrested box structure and the other of said abutments limiting the bending movement of said trailing panel when struck or engaged by said first abutment.

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