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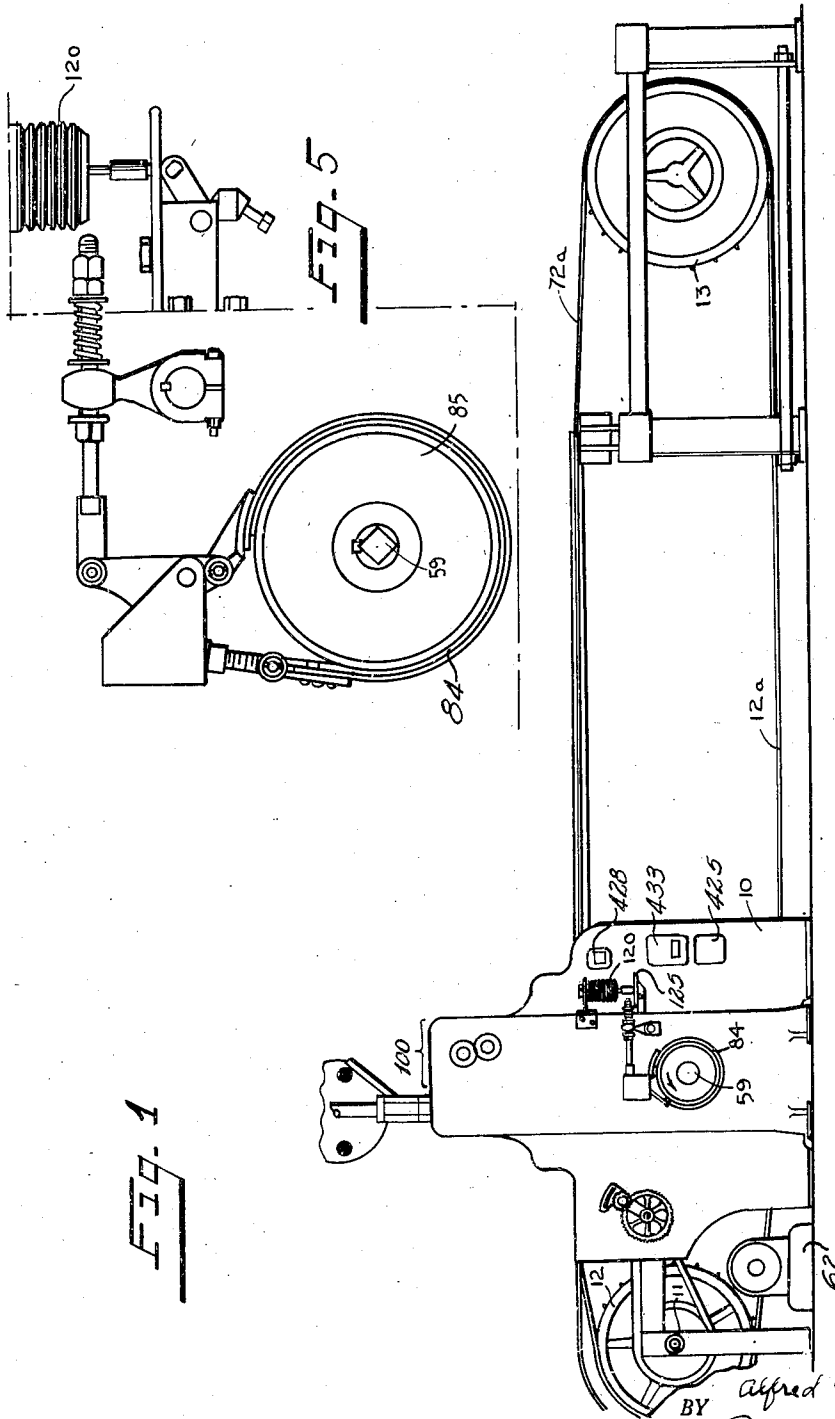
A. L. ROSENMUND

2,482,370

BOX-MAKING MACHINE

Filed May 16, 1945

11 Sheets-Sheet 1



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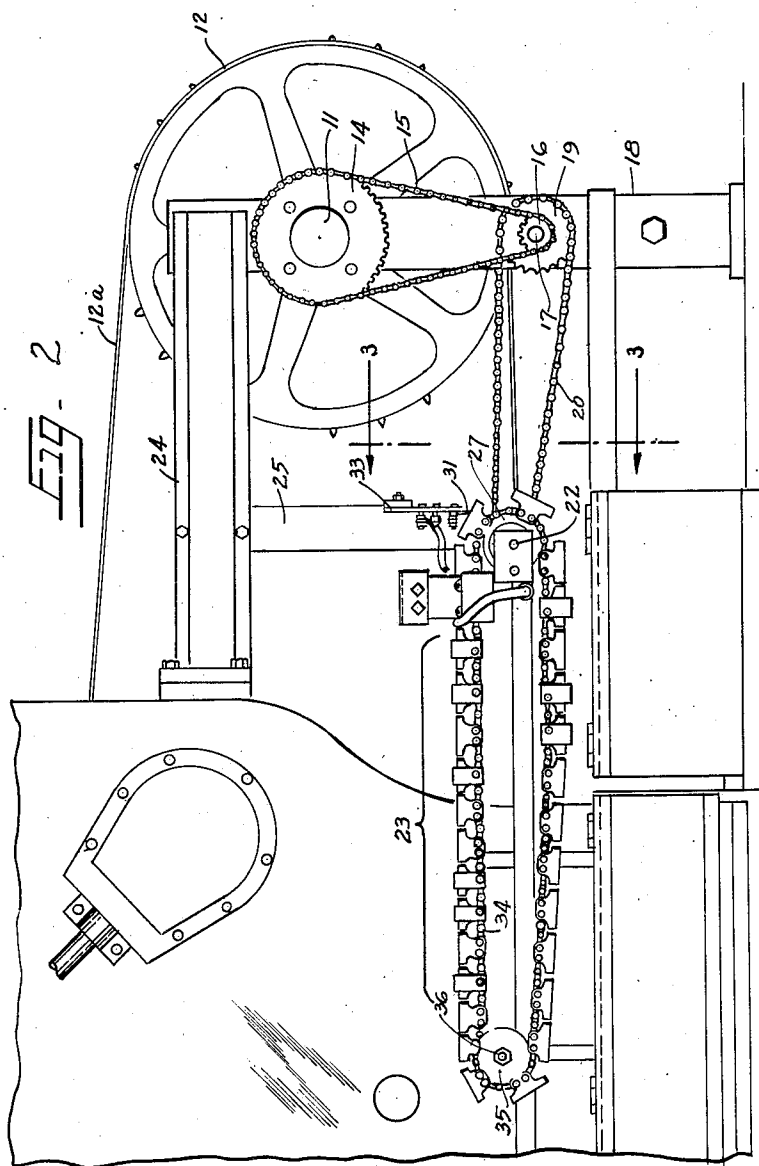
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11 Sheets-Sheet 2



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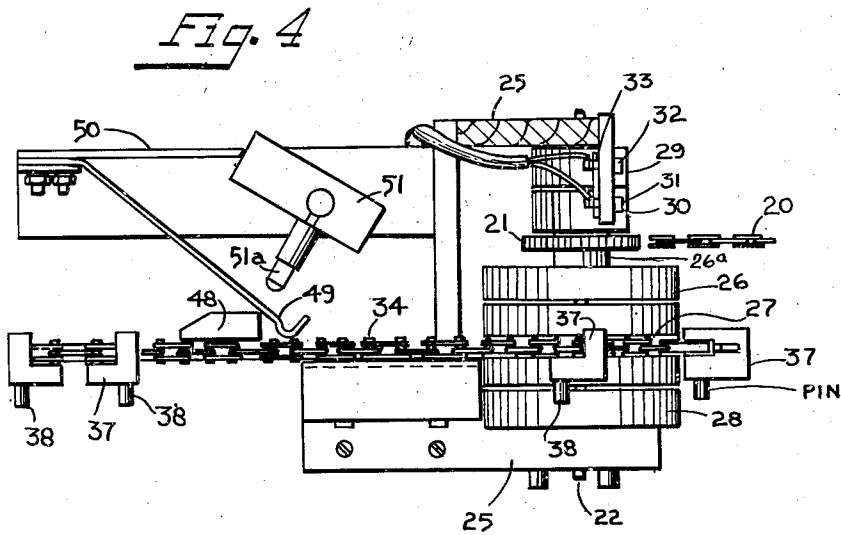
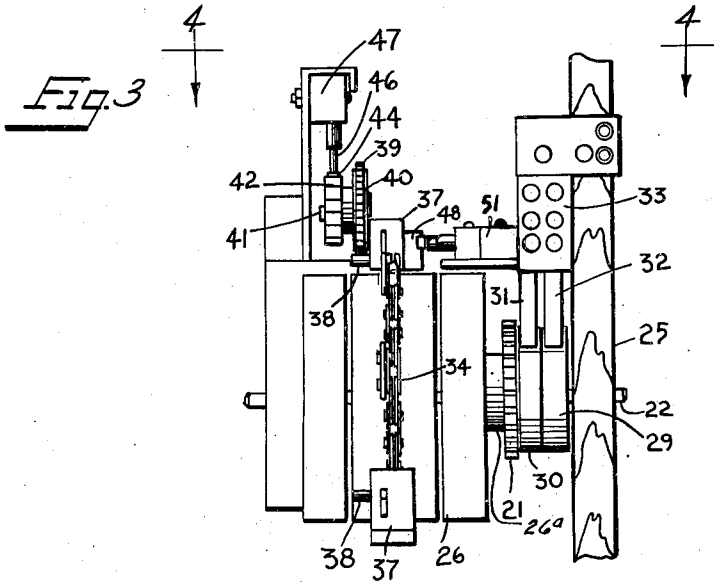
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11 Sheets-Sheet 3



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Fig. 6

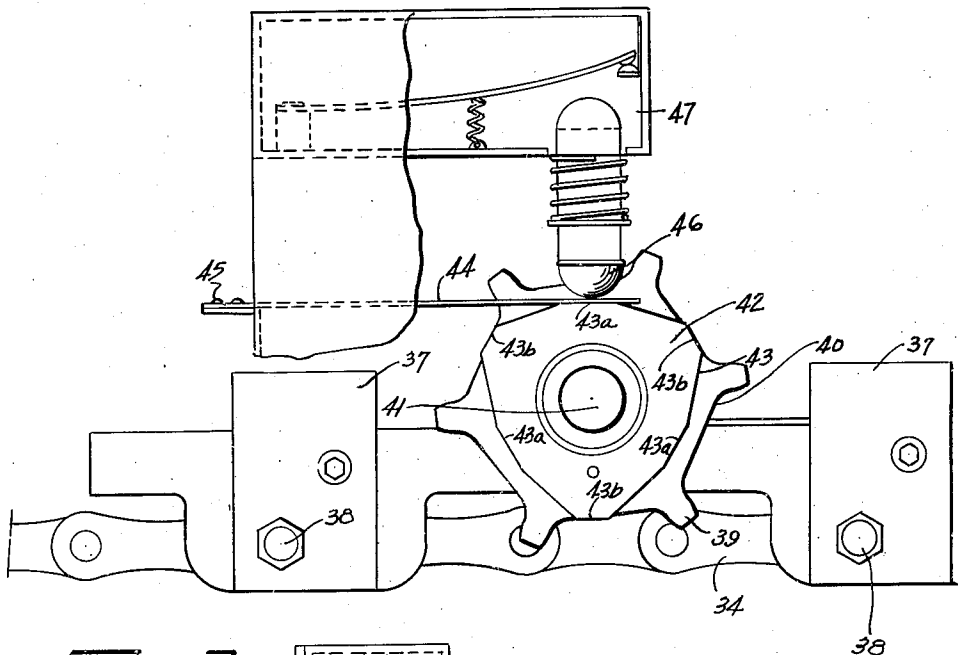
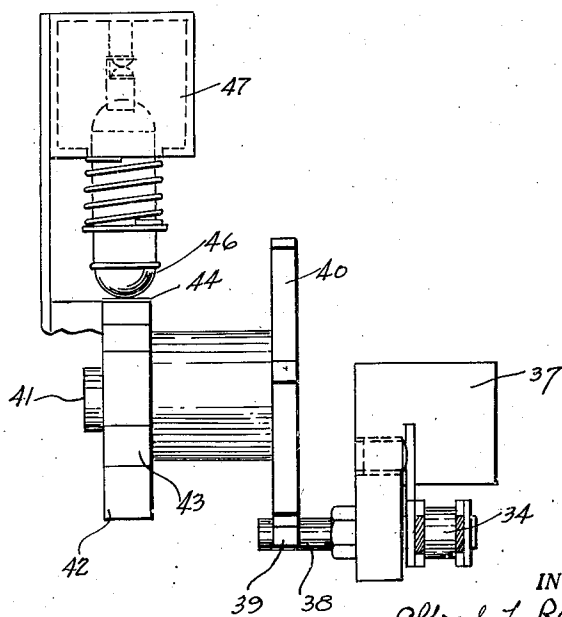


Fig. 7



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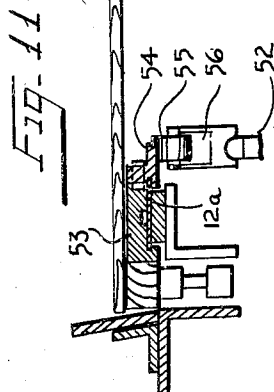
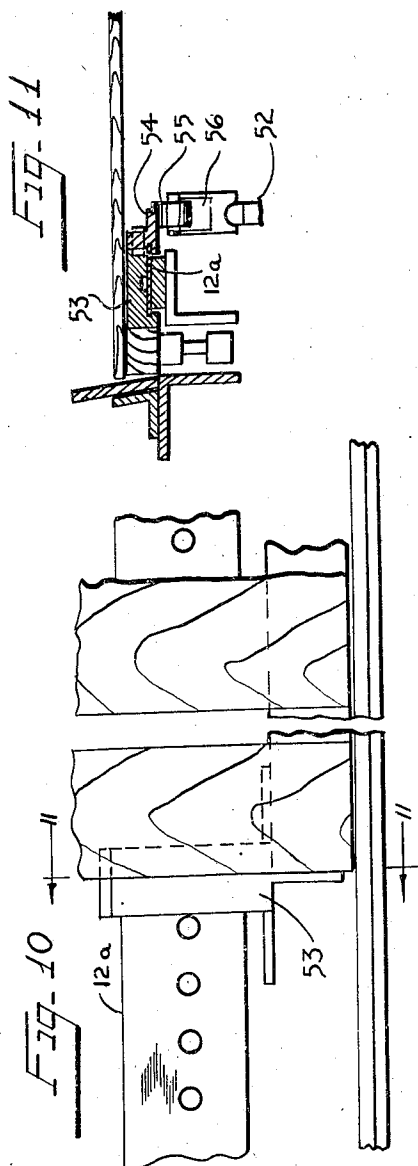
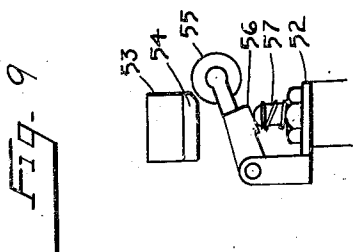
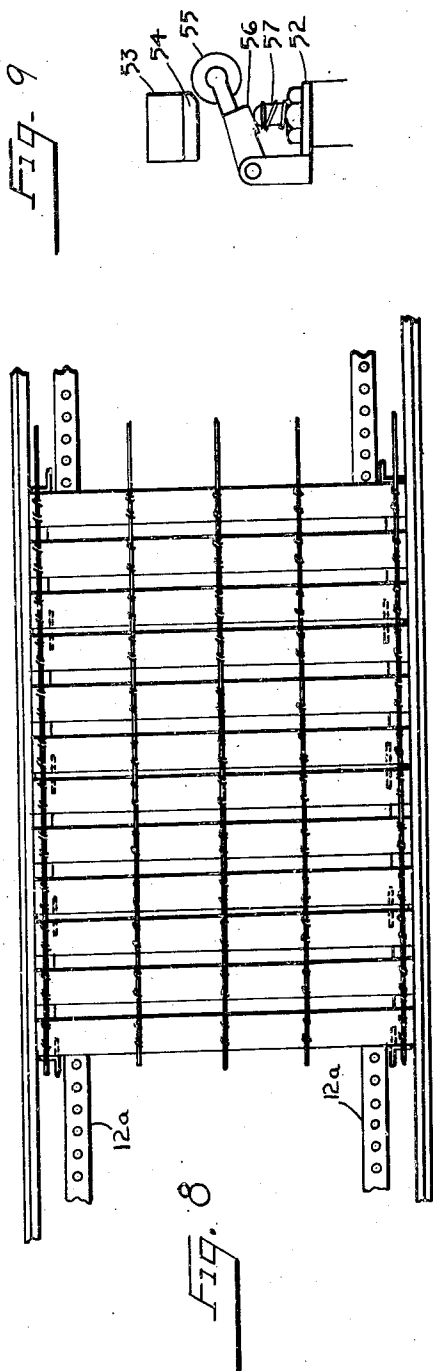
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11 Sheets-Sheet 5



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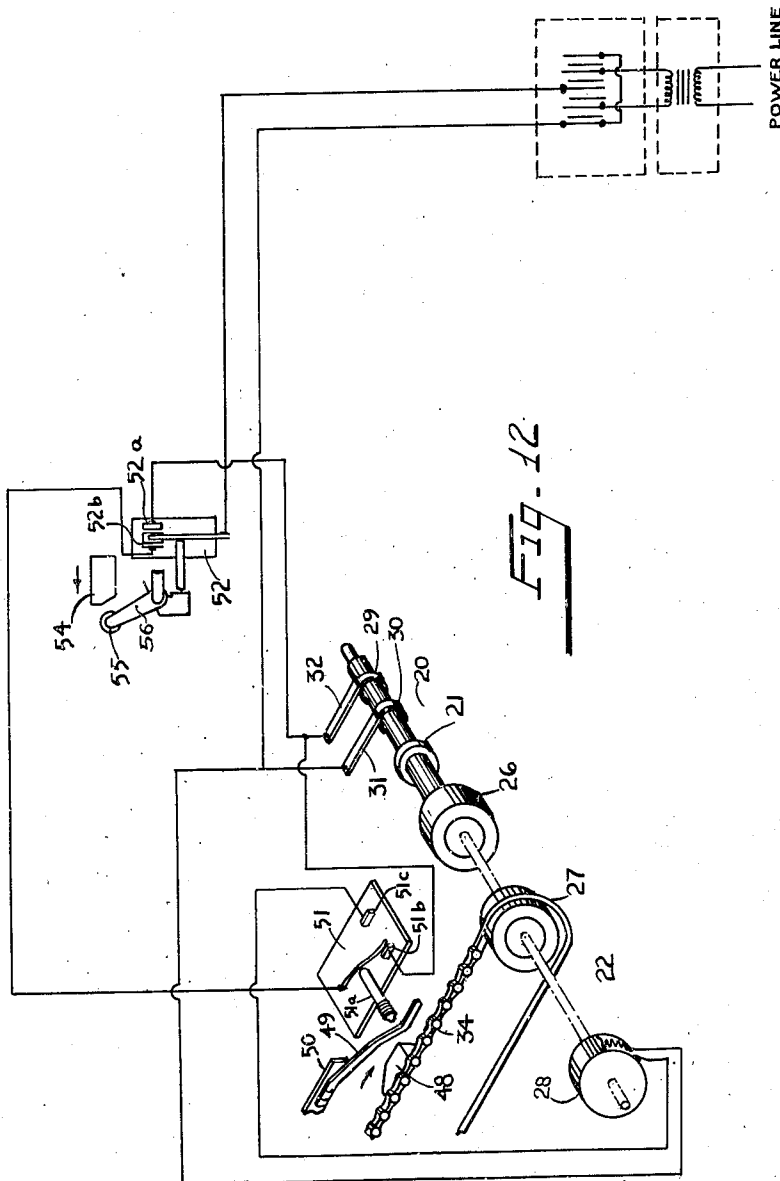
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11 Sheets-Sheet 6



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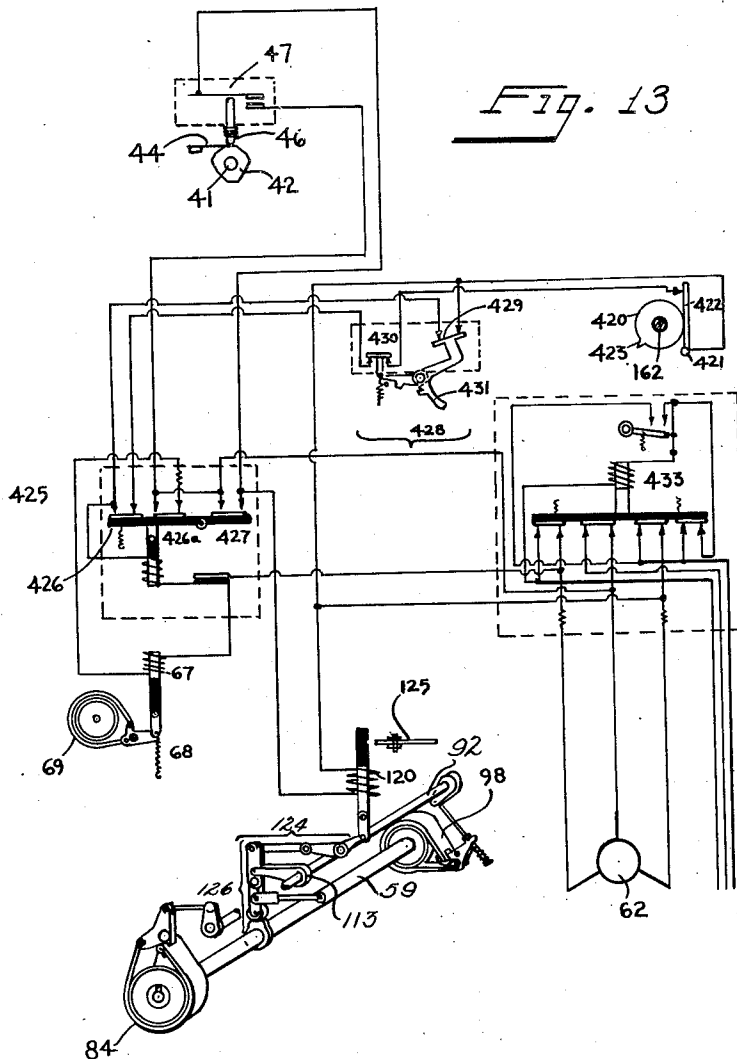
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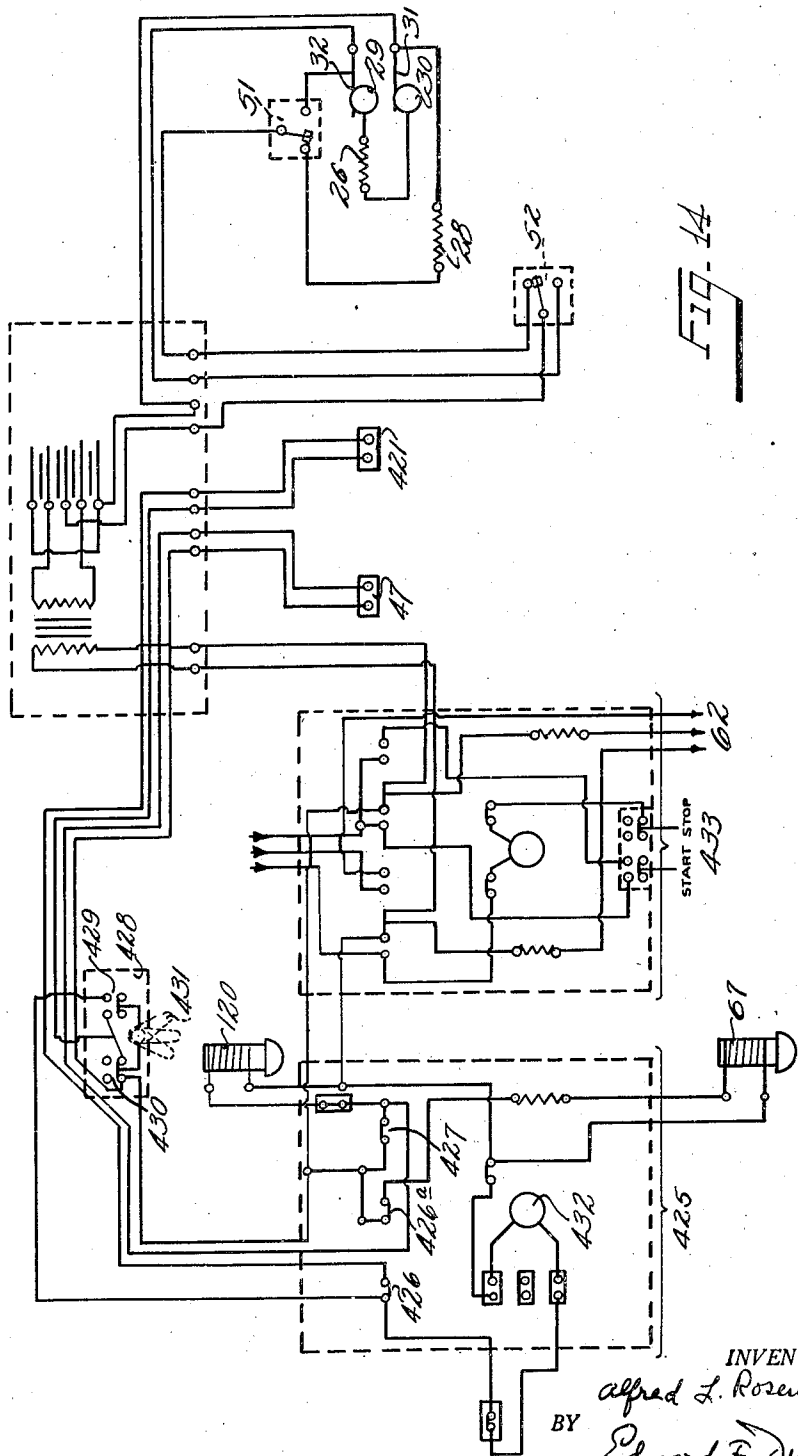


FIG. 14

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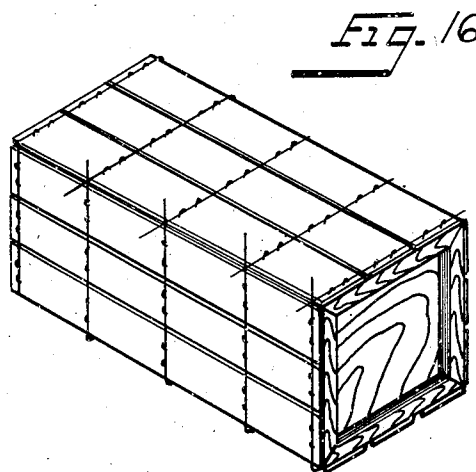
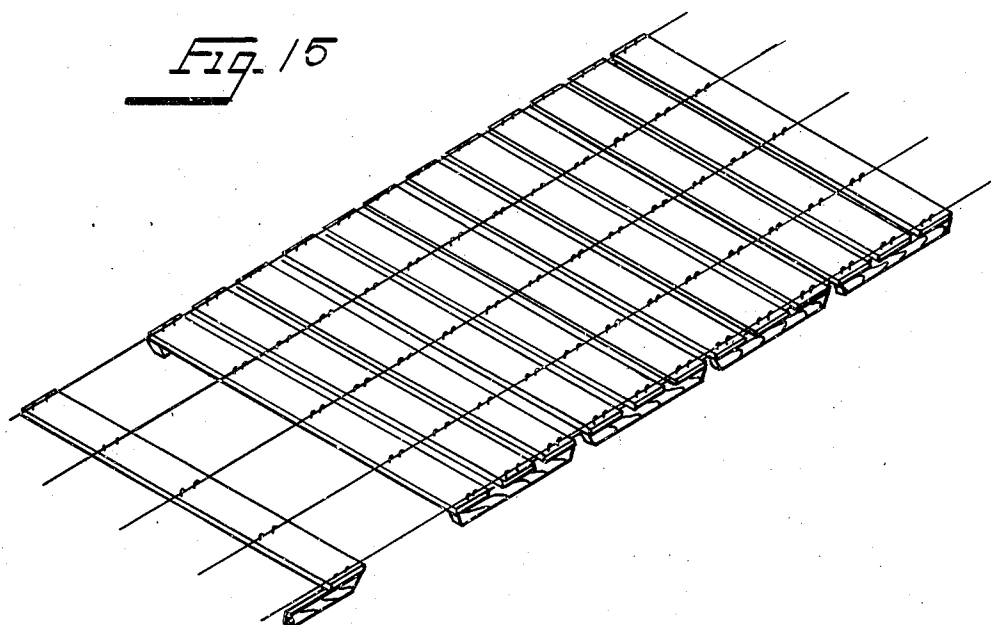
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11 Sheets-Sheet 9



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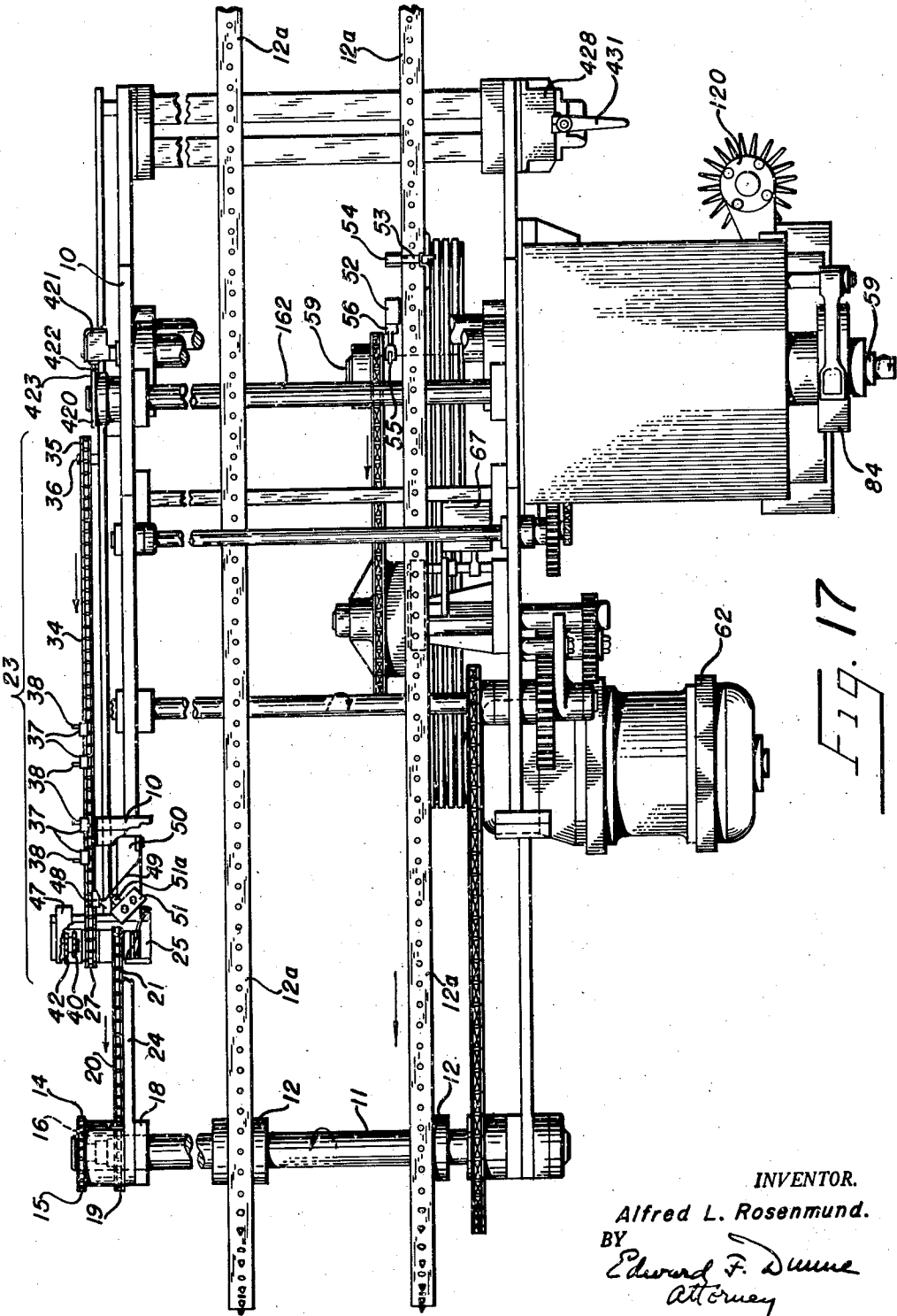
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11 Sheets-Sheet 10



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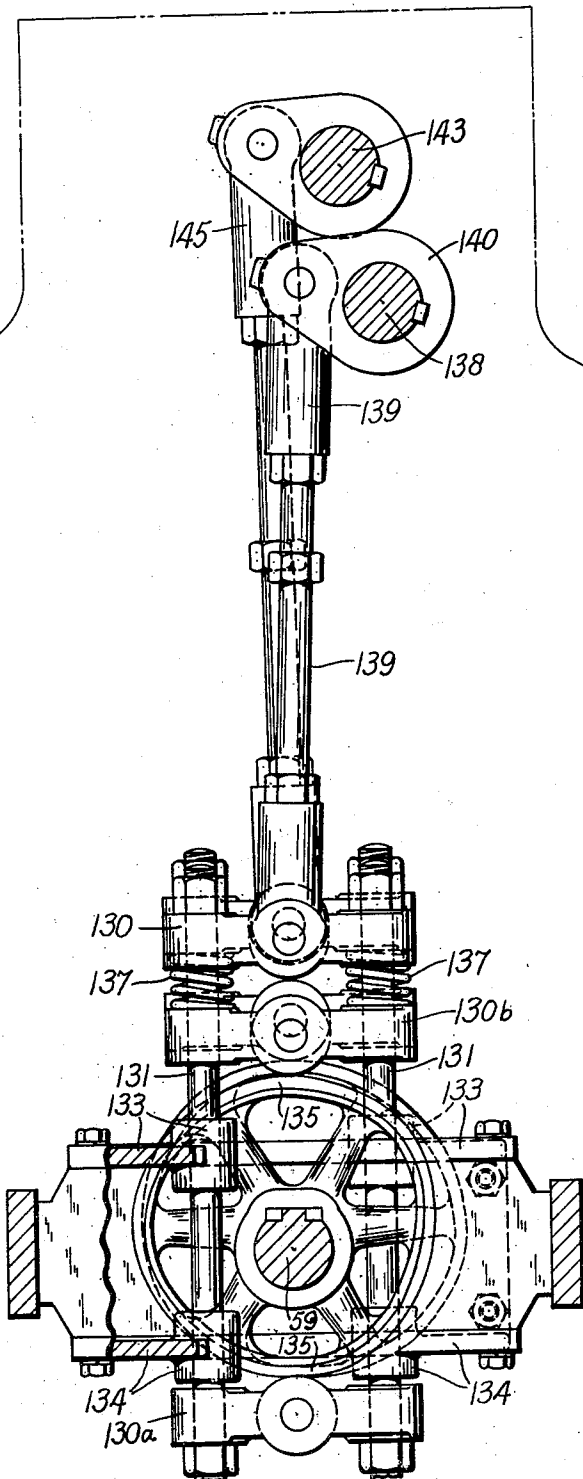
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Fig. 18.



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UNITED STATES PATENT OFFICE

2,482,370

BOXMAKING MACHINE

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Application May 16, 1945, Serial No. 593,994

20 Claims. (Cl. 1—8.2)

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This invention relates to an improvement in the box-making machine disclosed in United States Patent No. 2,304,510, issued December 8, 1942, and one of its objects is to provide an improved automatic control for an operation performing mechanism such as the stapling mechanism shown in said patent.

Another object is to control the operations of the stapling mechanism through a series of switch-operating elements.

Another object is to control the operations of the stapling mechanism by utilizing an endless chain synchronized in movement with the main box blank conveyer bands.

Another object is to control the operations of the stapling mechanism by utilizing an endless chain located and operating in a position remote from that of the conveyer bands.

Another object of the invention is the provision of a pattern control for the stapling mechanism which can be set to control the positions of the staples to be driven into a unit of work and which automatically repeats its operation to control the positions of the staples in a succession of units of work.

Another object of the invention is the provision of a pattern control for the stapling mechanism which can be adjusted for different sizes of units of work and which will function to start and stop the stapling mechanism in predetermined sequence and to automatically repeat its cycle of operation on a succession of units of work.

While the pattern control mechanism in the illustrative embodiment of the invention controls the operation of staplers, it will be understood that such control mechanism may be used to control the operation of other operation performing mechanisms of the machine synchronized with the conveyer movement to effect a like controlled operation of such mechanisms on a succession of spaced units of work without interrupting the operation of the machine.

With the above and other objects in view, the invention relates to certain new and useful constructions, combinations, and arrangements of parts clearly described in the following specification and fully illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation, showing the left side of a box-making machine embodying the invention, with an end portion shown broken away.

Fig. 2 is a side elevation, on a larger scale and broken away, of the right side of the box-making machine, showing the automatic remote control mechanism and the synchronized drive therefor.

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Fig. 3 is a detail end elevation of the remote control mechanism, shown on a larger scale.

Fig. 4 is a fragmentary plan view thereof.

Fig. 5 is a side elevation of a solenoid-operated brake, shown enlarged.

Fig. 6 is an enlarged detail side elevation of the automatic switch of the remote control mechanism which throws the stapling mechanism into and out of operation.

Fig. 7 is an end view thereof.

Fig. 8 is a fragmentary plan view of the box-making machine, showing box parts positioned on the conveyer bands.

Fig. 9 is a side elevation of an automatic start switch for throwing the control mechanism into operation.

Fig. 10 is a fragmentary plan view of one of the endless conveyer bands of the box-making machine and related parts.

Fig. 11 is a transverse sectional view, taken on line H—H of Fig. 10, looking in the direction of the arrows.

Fig. 12 is a diagrammatic view, showing the electrical connections for throwing the remote control mechanism into and out of operation.

Fig. 13 is a diagrammatic view showing the electrical connections for throwing the stapling mechanism into and out of operation.

Fig. 14 is a diagrammatic view of the complete electrical system for the box-making machine.

Fig. 15 is a fragmentary perspective view of one product of the machine, showing a wired box blank which, when folded, constitutes the complete box.

Fig. 16 is a perspective view, showing a complete box before the terminal wires have been joined to close the box.

Fig. 17 is a top plan view of the machine, with certain parts omitted to show more clearly the assembled relationship of the staple control mechanism and the rest of the machine.

Fig. 18 is a vertical section through the machine showing the drive for the stapling mechanism.

In said Patent No. 2,304,510, the stapling mechanism was controlled by means of a bar which was rocked in opposite directions by means of blocks carried by one of the endless conveyer bands, and the rocking of this bar controlled a switch which started and stopped the stapling mechanism, so that a predetermined pattern formation of the driven staples would result. More specifically, in the machine of said Patent No. 2,304,510, the stapling mechanism was thrown into operation by deenergizing a solenoid, and was thrown out of operation by energizing the solenoid. The sole-

noid was deenergized and energized by a switch which, in turn, was operated by a rocking bar through blocks carried by one of the box conveyer bands.

This construction involved a direct operation of the means for controlling the stapling mechanism by the blocks on one of the conveyer bands and necessitated the location of control blocks along the entire length of the conveyer band. Because the conveyer band is long enough to accommodate a plurality of units of work (usually six or seven), any change in the size of a unit of work required a resetting of the control blocks. The labor cost and the loss of machine production for each resetting of the machine for different boxes was a severe disadvantage to box manufacturing. Furthermore, the location of the control blocks on the conveyer band interfered to a certain extent with and so retarded the laying of stock to be fed by the conveyer band.

The present invention separates the control blocks from the box part conveyer system and utilizes a pattern holder which in the present embodiment is an endless chain which is considerably shorter than the box blank conveyers. The chain carries suitable operating parts which in the present embodiment are control blocks arranged in the desired spacing to provide a timing pattern to start and stop the operation of the stapling mechanism so that staples will be automatically applied in the patterned locations on the box blank parts under synchronized driving operation from the shaft of the main box part conveyer bands.

The invention also provides for continual registering of the pattern holder with the box-blank conveyer bands so that each unit of box-blank parts presented to the stapling mechanism is properly related to the pattern holder, and vice versa.

This endless control chain is located at a point on the machine frame remote from the conveyer bands and permits of standardized adjustments of the control blocks for different sizes of boxes.

Referring to Fig. 1, 10 designates the machine frame, and 11 the shaft for driving the large pulley wheels 12, over which the flexible metal conveyer bands 12a travel, as fully described in said Patent No. 2,304,510. The bands 12a also travel over idler pulley wheels 13 at the other end of the machine. The bands are driven at a uniform speed to convey the box parts at a uniform speed under stapling mechanism shown generally at 100 in Fig. 1. The stapling mechanism and its operation and the mechanism for driving the conveyer bands are fully shown and described in said Patent No. 2,304,510 and need not be described in detail herein.

Referring to Figures 1 and 18, the stapling mechanism is driven from shaft 59, and Figure 18 shows details of the mechanism by which the stapling mechanism is driven. The staple formers and drivers (not shown) of the stapling mechanism are operated by rock shafts 138 and 143 respectively.

Rock shaft 138 is rocked by a vertically reciprocating pitman 139 pivotally connected at its upper end to lever 140 keyed to shaft 138, and at its lower end to a vertically movable framework, comprising upper horizontal member 130 and lower horizontal member 130a, and an intermediate horizontal member 130b. Members 130 and 130a are secured together by vertical rods 131 rigidly connecting them. Rods 131 pass through bores provided in intermediate member 130b, and

their vertical reciprocation is guided by brackets 133 and 134 through which rods 131 also pass. The framework as a whole is reciprocated vertically by a cam 135 keyed to shaft 59 and contacting rollers 136 carried by members 130a and 130b. Rollers 136 are held in contact with cam 135 by coil springs 137. Rotation of shaft 59 and cam 135 causes vertical reciprocation of the frame work and thereby produces reciprocation of pitman 139 and oscillation of rock shaft 138.

A similar construction rocks shaft 143.

Rotation of shaft 59 is controlled by alternately deenergizing and energizing a solenoid 120, all as fully described in said Patent No. 2,304,510. In the machine of said patent, the solenoid was deenergized and energized through a switch operated by blocks carried by one of the box conveyer bands. In the present machine, the solenoid 120 is deenergized and energized by a switch 47 (Fig. 3), which is operated, in the manner hereinafter described, by pins 38 (Fig. 4) of control blocks 37 carried by an endless link chain 34 (Fig. 2) located remote from the box conveyer bands, as hereinafter described. Endless chain 34, carrying the stapler control pins 38, is driven synchronously with the box conveyer bands while each unit of box parts is passing beneath the stapling mechanism, and its movement is then automatically stopped until the next unit of box parts reaches the stapling mechanism, all as now described. In this way the timing pattern of the pattern holder is registered with each unit of box parts starting through the stapling mechanism.

Referring to Fig. 2, the conveyor drive shaft 11 is equipped on one end with a sprocket gear 14 which drives an endless chain 15, and this chain has driving engagement with a small sprocket wheel or gear 16 which is fixed to a rotatable shaft 17, suitably supported in bearings, carried by a frame member 18. This shaft 17 also carries and drives a second sprocket gear 19 which is larger than the sprocket gear 16 and which drives an endless chain 20 (Figs. 4 and 17) which has driving engagement with a sprocket gear 21 mounted to turn about a stationary shaft 22 mounted between upright arms of a frame member 25 (Figs. 4 and 12).

The frame member 18 is disposed vertically and is connected to the machine frame 10 by means of a beam 24 which also supports frame member 25 carrying the control mechanism 23.

Referring to the diagrammatic showing in Fig. 12, the shaft 22 carries a magnetic clutch 26 which is free to rotate independently of shaft 22 and which consists of a cylindrical disc and an extended hub member 26a freely mounted on shaft 22. Fixed to the hub 26a are sprocket gear 21 and collector rings 29 and 30. Sprocket gear 21 continuously drives clutch disc 26, and collector rings 29 and 30 serve to conduct electrical current to energize a magnetic coil within the disc of magnetic clutch 26, which coil connected in series with collector rings 29 and 30 by means of wires (not shown) within the clutch hub. Insulating block 33 (Fig. 4), which is secured to the depending frame member 25, carries spring contact fingers 31 and 32 which engage collector rings 30 and 29 respectively.

Attached to frame member 25 is a magnetic brake 28 which consists of a cylindrical disc containing a magnetic coil and which is mounted so as to encircle stationary shaft 22. Between the disc of clutch 26 and brake 28 is mounted drive sprocket 27, which is free to rotate on shaft 22.

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and which serves as an armature plate for clutch 26 and brake 28.

Energizing clutch disc 26 positively connects the disc and sprocket 27 to drive the sprocket from sprocket gear 21. Deenergizing disc 26 releases sprocket 27, and energizing brake 28 abruptly stops the sprocket.

The drive sprocket 27 is engaged by the endless, multiple-link chain 34, and this chain also engages a tension adjusting sprocket 35 (Figs. 2 and 17) which is supported for rotation by a shaft 36 mounted in end bearings which permit of horizontal adjustment of the shaft 36 and its sprocket 35 so that chains of various lengths (i. e., having different numbers of links) may be mounted to operate over the two sprockets 27 and 35.

The drive mechanism connecting drive shaft 11 with drive sprockets 27 through chains 15 and 20 and sprockets 14, 16, 19, and 21, is of proper ratio so that pattern chain 34 moves at a surface speed identical with that of main conveying bands 12a when drive sprocket 27 is engaged by magnetic clutch 26.

As shown in Figs. 4 and 12, the endless pattern-holding chain 34 is equipped with a block 48 which moves against the free yielding outer end of a spring arm 49 which is secured to a stationary support 50. On this support, a stop switch 51 is provided for stopping movement of chain 34 when the block rides under and lifts spring arm 49. Switch 51 is mounted in a diagonal position, and this switch is provided with a spring-pressed plunger rod 51a which projects horizontally in the direction of the spring arm, but is not normally engaged by this arm. The spring arm 49 is forced against the outer end of the spring-pressed plunger rod 51a by the pressure of the block 48, caused by the travel of the chain. In this way the travel of the chain 34 operates the stop switch 51 by forcing the block 48 into engagement with the outer end of the spring arm 49, thereby forcing the spring arm into engagement with the outer end of the plunger rod 51a. Operation of Stop switch 51 by inward motion of plunger rod 51a stops the movement of chain 34, as presently explained.

Switch mechanism for starting chain 34 when a box unit moves to the stapling mechanism is shown in Figs. 9, 11, 12, 14, and 17. A start switch 52, containing a normally closed contact 52b and a normally open contact 52a, is mounted adjacent to the left conveying band 12a, to which are attached the conveying blocks for locating the box parts. The lead block 53 of each box set-up carries a cam lug 54 which engages a roller 55 of a start switch lever 56. The switch lever 56 engages the upper end of a spring-pressed rod 57 of start switch 52 so that the contacts 52a and 52b are reversed when roller 55 is depressed by cam lug 54, and this starts the movement of chain 34, as presently explained.

Electrical power for the remote control mechanism is supplied by a transformer and a rectifier; the electrical connections of the start switch 52, stop switch 51, magnetic clutch 26, and magnetic brake 28 being clearly shown in Fig. 12. At the time lead block 53 approaches roller 55, block 48 of the pattern-holding chain is stationary and is holding switch 51 to close contact 51c, and contact 52b of switch 52 is closed. Thus, magnetic brake 28 is energized, and clutch 26 is opened. When the cam lug 54 of lead block 53 of a box set-up causes reversal of contacts, as previously described, magnetic clutch 26 is mo-

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mentarily energized through contact 52a. At the same time, magnetic brake 28 is released by opening of contact 52b. The cylindrical disc of magnetic clutch 26 engages drive sprocket 27 so that pattern chain 34 is caused to move at uniform speed, being driven from drive shaft 11 through chain 20. Block 48, attached to pattern chain 34, releases spring arm 49 and plunger rod 51a, thereby reversing contacts in stop switch 51 to close contact 51b. Lead block 53 simultaneously passes from roller 55 of start switch 52, permitting plunger rod 57 (Figs. 9, 10 and 11) to return to normal position and again closing contact 52b, and magnetic clutch 26 remains energized through contact 52b of start switch 52 and contact 51b of stop switch 51.

Pattern chain 34 now continues its travel at uniform speed until it has completed one revolution, when block 48 again engages spring arm 49 and plunger rod 51a to reverse contacts of stop switch 51. Magnetic clutch 26 is now released by the opening of contact 51b, and magnetic brake 28 is energized through contact 51c of stop switch 51 and contact 52b of start switch 52. Magnetic brake 28 now engages drive sprocket 27 to stop it and prevent further motion of pattern chain 34. In this manner, pattern chain 34 is caused to make one complete revolution for the passage of each box set-up or unit of work underneath the stitching heads.

In the gap established by the combined lengths of the tie end portions of the wire strands, between the rear end of one group of assembled and stitched box parts and the forward end of the succeeding group of box parts to be stitched or stapled, the pattern chain 34 will be at rest; and in this condition the magnetic brake will remain energized and the magnetic clutch of the pattern chain will be inoperative.

The length of the pattern chain will, of course, be controlled by the number of links which are assembled to compose the complete chain, and this number is determined by the length of the assembly of box parts for a particular box unit which is to be passed through the box-making machine to be stapled by the automatically controlled stapling mechanism.

As shown in Figs. 3, 4, and 17, the endless chain 34 is equipped on one side with a series of adjustable switch operating blocks 37, and each of these blocks is provided with a lateral pin 38, and all of the pins 38 project horizontally and outwardly of the chain 34.

The upper run of the chain 34 travels toward the sprocket 27, so that the lateral pins 38 are successively moved into engagement with teeth 39 of a turnstile wheel 40 (Figs. 6 and 7), which is supported to turn on a shaft 41. The wheel 40 is provided with a cam head 42 which is formed with a series of cam-like surfaces 43 having low points 43a and high points 43b. These surfaces are arranged in multiple groups, and in the showing in Fig. 6, three groups of the cam-like surfaces 43 are shown, each group having a low point 43a and a high point 43b. All the low points are spaced equally from the center of the shaft 41, and all the high points are spaced equally from the center of the shaft, and the three groups divide the surface of the head 42 equally.

A metal spring 44 of flat material projects over the head 42, so as to successively engage the low points 43a and the high points 43b thereof. This spring is supported at 45, and the lower end of a spring-pressed pin or plunger rod 46 engages the upper surface of the free yielding outer end

of the spring 44. The upper end of this plunger rod 46 extends into a switch housing 47. When the turnstile wheel 40 is turned, step by step, by the successively advanced action of the lateral pins 38, the free outer end of the spring 44 will force the plunger pin or rod 46 upwardly; thereby operating the switch in the housing 47. The spacing of teeth 39 of turnstile wheel 40 is arranged to turn the head 42 one-sixth of a revolution by the passage of a single operating block pin 38. In this manner, the passage of a pin 38 moves the head 42 from a low point 43a to a high point 43b, or from a high point 43b to a low point 43a. Through flat spring 44 and plunger rod 46, switch 47 is thus opened by passage of the first pin 38 and remains open until passage of a second pin 38.

The electrical connections for controlling the operation of the machine are best shown in Figs. 13 and 14. A solenoid control contactor 425 interlocks electrically the main clutch solenoid 120 and a conveyor clutch solenoid 67 in the manner described in said Patent No. 2,304,510. This is a magnetic switch which contains two normally open contacts and one normally closed contact. The normally closed contact is connected in parallel with staple control switch 47 which alternately deenergizes and energizes solenoid 120.

There is provided a synchronizing cam 420 keyed on the extreme right end of a clincher shaft 162 (Fig. 17) projecting beyond the outside of the right main frame 10. Fastened to a bracket secured to right main frame 10 is a synchronizing switch 421 which normally is closed and which has fastened thereto, adjacent the synchronizing cam 420, an upwardly-extending member 422 which is contacted by a lobe 423 on the synchronizing cam 420 at the proper time to open the synchronizing switch 421, the function of which will be fully described hereinafter.

An operator's control switch 428 retains therein one normally open contact 429 and one normally closed contact 430. The normally open contact 429 is connected, in series, with a magnetic coil 432 of the solenoid control contactor 425 and the power supply. The normally closed contact 430 is connected, in series, with the synchronizing switch 421 and the normally open contact 426 of the solenoid control contactor 425, which series circuit is connected in parallel with the contact 429.

As heretofore stated, the staple positioning mechanism is electrically controlled and automatically operated by the pattern pins 38 carried by the pattern control chain 34, which pins operate switch 47. As shown diagrammatically in Fig. 13, power is supplied to the staple positioning control circuit and to the drive motor 62 of the machine through a magnetic contactor 433. With the magnetic contactor 433 closed, the main drive motor 62 is energized and power is available at the control circuit.

The sequence of operations which locate staples in the box sections as desired according to a selected pattern are as follows:

With the drive motor 62 rotating and the control circuit energized, current passes through closed contact 427 to energize the main clutch solenoid 120, thus holding the horizontal and vertical toggle linkages 124 and 126 in straight position and maintaining control shaft 92 in rocked position, which holds main clutch control brake 98 engaged, thereby keeping the main clutch released, and also holds the main brake 84 engaged, thus holding main shaft 59 stationary, all

as shown and described in said Patent No. 2,304,510. A safety lever 125 is released manually from engagement with the horizontal toggle 124, which is pivotally connected to the main clutch solenoid plunger to permit such plunger to operate when actuated by pattern control switch 47.

To start operation of the machine, the handle 431 of the operator's control switch 428 is moved to close contact 429. This energizes the solenoid contactor 425 by current passing through the magnetic coil 432 and closes contacts 426 and 426a, while at the same time opening contact 427. Current passes through contact 426a to energize conveyor clutch solenoid 67, which disengages the conveyor clutch brake 69 against the action of brake spring 68, thus engaging the conveyor clutch and causing the conveyor bands 12a to move at a uniform speed. Opening of contact 427 leaves main clutch solenoid 120 free to act in accordance with the action of pattern control switch 47. The plunger of solenoid 120 does not change position by the above-mentioned action, since pattern control switch 47 is normally closed and holds solenoid 120 in the energized position.

With staple control blocks 37 previously located on pattern chain 34 to correctly position the staples as desired, continued movement of conveyor bands 12a will bring cam lug 54 of lead block 53 of the first box set-up into contact with roller 55 of start switch lever 56 (Figs. 9 and 11). Continued movement of cam lug 54 will depress lever 56 into engaging contact with the upper end of the spring-pressed rod 57 of start switch 52 so that the contacts 52a and 52b (Fig. 12) are reversed to start movement of pattern chain 34. Movement of pattern chain 34 causes pin 38 on the first control block 37 of the pattern to open switch 47, as heretofore explained. This will stop the current passing through solenoid 120, and the solenoid plunger will drop by action of a compression spring housed in the solenoid plunger, thereby breaking the horizontal toggle 124 (Fig. 13), which, in turn, breaks the vertical toggle 126 and permits control shaft 92 to rock by means of lever 113 connected thereto. This rocking motion of the control shaft 92 will release the main brake 84 and the control clutch brake 98 to permit the engaging of the main clutch, thereby causing rotation of the main shaft 59 and operation of the stapling mechanism to drive staples at regular intervals into the box parts. Staples will continue to be driven at regular intervals until the pin 38 of the next block 37 on pattern control chain 34 operates switch 47 to close the same. Closing of switch 47 will energize main clutch solenoid 120 and stop the operation of the stapling mechanism. The box parts continue to move, but no staples are driven until the pin 38 of the next block 37 on pattern chain 34 operates switch 47 to open the same and thereby deenergizes the solenoid 120. The arrangement is such that the control blocks on pattern chain 34 alternately throw the stapling mechanism into and out of operation. Thus, it will be seen that the location of the staples in the work may be varied and controlled by the location of the staple control blocks 37 on pattern chain 34.

As heretofore explained, a sufficient number of blocks 37 are set on pattern chain 34 to control the location of the fasteners in one unit of work. After the last staple has been driven in a unit of work, movement of pattern chain 34 is automatically stopped by block 48 on chain 34 which operates stop switch 51 in the manner hereinbefore explained. Chain 34 then remains at rest until

lead block 53 of the next box unit operates start switch 52, whereupon chain 34 is caused to move for another complete cycle and control the positions of the staples in the next box unit.

The operation of the machine of this invention is started by the manual operation of the control switch 428. The motion of the endless pattern chain in synchronism with the motion of the endless conveyer bands of the box-making machine is started by switch 52. The stapling pattern is then automatically controlled by the continuous intermittent operation of the switch 47 by the lateral pins 38 of the endless pattern chain 34.

The lateral pin 38, of the first control block 37 of the pattern, will open the switch 47, thereby starting the operation of the stapling mechanism; and the second control block of the pattern, through its lateral pin 38, will close the switch 47, thereby stopping the operation of the stapling heads of the box-making machine. The number of operations of the stapling heads of the box-making machine will, therefore, be controlled by the spacing of the blocks 37 on the chain 34.

As shown in Figs. 15 and 16, each box slat or longitudinal wood part is engaged by a plurality of wires which are disposed in parallel relation to each other and at right angles to the box slats. Each wire is stapled to each box slat it engages by a group of staples. This grouping of the staples in each box slat, and the necessary spacing of the box members from each other, and the number of box members used in completing a box assembly, necessarily control the number of pattern-determining blocks 37 of the endless pattern chain 34.

It should be noted that the first control block 37 of the pattern starts the operation of the stapling mechanism, and thereafter the control blocks alternately stop and start the stapling mechanism. It should be noted also that it is not necessary to set a control box 37 for each and every stapling operation because when a control block 37 operates to start the operation of the stapling mechanism, such mechanism will continue to operate at regular intervals until the next succeeding control block 37 operates to stop the operation of the stapling mechanism. Thus, after the first control block 37 of the pattern starts the operation of the stapling mechanism, additional stop and start control blocks 37 are needed only when a space between staples greater than a regular space is desired.

When the assembly of box parts for a particular box group has advanced through the cycle of operations, the conveyer bands will, of course, move the next succeeding group of assembled box parts into station position, and the endless pattern chain will be synchronized with the box parts so that the stapling pattern will be automatically repeated.

The remote control mechanism, therefore, provides a pattern chain which may be standardized for each individual box group, and permits of the quick replacement of the required pattern chain for the manufacture of a different box size.

This invention, therefore, provides means for establishing and maintaining accurate standard patterns for all sizes of boxes, which will reduce the time and labor required to adapt the box-making machine for a different box and which will materially reduce errors in adjustment and consequent losses in production.

It should be noted that movement of the pattern chain is automatically stopped after a unit of work has been stapled and remains at rest while

the conveyer bands advance the next unit of work to stapling position, whereupon movement of the pattern chain is automatically started and continues its movement until the second unit of work has been stapled. This automatic starting and stopping of the pattern chain to properly relate the pattern controls to each succeeding unit of work makes it possible to effect a like location of staples in a succession of variably spaced units of work without stopping the machine or interrupting the movement of the work through the machine.

It will be understood that the invention is not to be limited to the particular embodiment shown here for illustration; and that all of the inventive features need not be used conjointly, as such inventive features may be variously embodied and used in various combinations and subcombinations without departing from the invention.

I claim:

1. In a box-making machine having stapling mechanism for driving staples into box parts, an endless constantly moving conveyer adapted to feed continuously to the stapling mechanism a plurality of box parts arranged to form spaced box units, and having apparatus to control the operation of the stapling mechanism and to cause it to drive staples at predetermined points in the box units comprising, an endless chain proportioned to the length of a box unit, a series of selectively spaced control members carried by the chain, and a stationary controller operable by said control members and located beside said chain and connected to the stapling mechanism to start and stop the driving of staples by said stapling mechanism while said conveyer is feeding a box unit through said stapling mechanism, in combination, a driver for driving the chain only at the speed of the conveyer to move the control members past said stationary controller thereby to operate said controller alternately to start and stop the driving of staples in accordance with the selective spacing of said control members, a starter carried by the endless conveyer at a point thereon related to the position of the front end of a box unit for connecting up said driver to move the chain, and a stopper independent of said control members and carried by the chain at a point related to the position of a predetermined staple in a box unit for disconnecting said driver to stop the chain, whereby the position and movement of the chain are correlated with the constantly moving conveyer and so with the position and movement of each box unit through the stapling mechanism and a like location of staples in each of the succession of variably-spaced box units is effected by movements of said chain.

2. In a box-making machine having an endless continuously moving conveyer adapted to feed continuously to the machine a plurality of box parts arranged to form spaced box units and having apparatus to control the operation of the machine in synchronism with the movement of the box units by said endless conveyer to convert the box parts into fabricated box units, in combination, an endless chain proportioned to the length of a box unit, a series of selectively spaced control members carried by the chain, a stationary controller operated by said control members and located beside said chain, and connected to start and stop a part of said machine while said conveyer is feeding a box part to said machine, a driver for driving the chain only at the speed of the conveyer to move the control members past said stationary controller thereby

to operate said controller alternately to start and stop said part in accordance with the selective spacing of said control members; a starter carried by the endless conveyer at a point thereon related to the position of the front end of a box unit for connecting up said driver to move the chain, and a stopper independent of said control members and carried by the chain at a point related to the position of a predetermined point along the length of a box unit for disconnecting said driver to stop the chain whereby the position and movement of the chain are correlated with the continuously moving conveyer and so with the position and movement of each box unit through the machine and like operations are performed by said part in connection with each of the succession of variably-spaced box units by movements of said chain.

3. In a box-making machine having stapling mechanism for driving staples into box parts, a control switch for said stapling mechanism, and a continuously moving endless conveyer adapted to feed a plurality of spaced box units continuously to the stapling mechanism, in combination apparatus to control the operations of the stapling mechanism to drive staples at predetermined points in the box units comprising an endless chain having a length proportioned to the length of a box unit located adjacent said control switch, a series of selectively spaced staple control members carried by the chain and movable by the chain to operate said control switch to cause said stapling mechanism to drive staples while a box unit is passing beneath the stapling mechanism, a drive to move the chain at the speed of the conveyer, a starting switch for conditioning said drive to move the chain, a starting switch-operating part carried by the conveyer for operating said starting switch, a stopping switch independent of said starting switch for conditioning said drive to stop the chain, a stopping switch-operating part independent of said control members and carried by the chain for operating said stopping switch, said starting and stopping switch-operating parts respectively being adjustable along said conveyer and chain to cause said chain to start moving when the front end of each successive box unit reaches the stapling mechanism, and to cause said chain to stop after the last staple has been driven, and after the chain has completed a revolution, whereby the position and movement of each box unit through the stapling mechanism and a like location of staples is effected in a succession of variably spaced box units on said endless conveyer.

4. In a box-making machine having an endless conveyer adapted to feed continuously to the machine a plurality of box parts arranged to form spaced box units and having apparatus to control the operation of a part of the machine in synchronism with the movement of said box units by said endless conveyer to convert the box parts into fabricated box units, in combination, a control switch for controlling the operating of said part, an endless chain adjacent said control switch and having a length proportioned to the length of a box unit, a series of selectively spaced control members carried by the chain and movable by the chain to operate said control switch to cause said part to operate on box parts being conveyed to said machine by said conveyer, a drive to move the chain only at the speed of the conveyer, a starting switch for conditioning said drive to move the chain, a starting switch-operating part carried by the conveyer for operating

said starting switch, a stopping switch adjustably mounted for conditioning said drive to stop the chain, a stopping switch-operating part carried by the chain and independent of said control members for operating said stopping switch, said starting and stopping switch-operating parts respectively being adjustable along said conveyer and chain to cause said chain to start moving when the front end of each successive box unit reaches the machine, and to cause said chain to stop after a predetermined length of the box unit has passed through the machine, and after the chain has completed a revolution, whereby the position and movement of each box unit through the machine and like operations of said part of said machine is effected on a succession of variably-spaced box units on said endless conveyer.

5. In a box-making machine having stapling mechanism for driving staples into box parts, a control switch for starting and stopping the stapling mechanism, a continuously moving conveyer adapted to feed a plurality of spaced box units to the stapling mechanism and having mechanism to control the operations of the stapling mechanism to drive staples at predetermined points in the box units: comprising a pattern holder mounted adjacent said control switch, and selectively spaced staple control members mounted on the pattern holder and movable by the pattern holder to operate said control switch alternately to start and stop the stapling mechanism while a box unit is passing beneath the stapling mechanism, in combination, a drive to move the pattern holder, and apparatus automatically controlling the movement of the pattern holder to start movement of the pattern holder when each box unit reaches the stapling mechanism and to stop the movement of the pattern holder after the last staple has been driven into each box unit, whereby the movement of the pattern holder is correlated with the movement of each box unit beneath the stapling mechanism and a like location of staples may be effected in a succession of variably spaced box units, said apparatus comprising a stationary starting member located beside said continuously moving conveyer for conditioning said drive to move the pattern holder, a plurality of spaced parts carried by said conveyer and located at points thereon related to the positions of the forward ends of the successive box units for operating said starting member, and a stationary stopping member located beside said pattern holder for conditioning said drive to stop the pattern holder, and a part carried by the pattern holder and independent of said plurality of spaced parts for operating said stationary stopping member and so located as to stop said member always in position for said starting movement.

6. In a box-making machine having stapling mechanism for driving staples into box parts, a control switch for starting and stopping the stapling mechanism and a continuously moving conveyer adapted to feed a plurality of spaced box units to the stapling mechanism: apparatus to control the operations of the stapling mechanism to locate staples at predetermined points in the box units, comprising a pattern holder mounted adjacent said control switch, a set of selectively spaced staple control members mounted on the pattern holder, and movable by the pattern holder to operate said control switch alternately to start and stop the stapling mechanism while a box unit is passing beneath the

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stapling mechanism, a drive to move the pattern holder, and an electrical circuit automatically controlling the drive to connect said drive to move the pattern holder when each box unit reaches the stapling mechanism and to disconnect the drive and stop the movement of the pattern holder after the last staple has been driven into each box unit, whereby the movement of the pattern holder is correlated with the movement of each box unit beneath the stapling mechanism and a like location of staples may be effected in a succession of variably spaced box units, said electrical circuit including a starting switch operated by a switch operator carried by the continuously moving conveyor to connect said drive, and a stopping switch operated by a switch operator carried by the pattern holder to disconnect said drive.

7. In a box-making machine having an operation performing mechanism, a control switch, and an endless conveyor adapted successively to feed through the machine box parts arranged to form spaced box units: apparatus automatically to operate the control switch at selected times to cause said operation performing mechanism to operate at selected times in connection with each said box unit comprising, an endless chain, selectively spaced control members carried by said chain and forming a timing pattern for the operation of said operation performing mechanism by successively operating the control switch upon movement of the chain, a drive for moving the chain to bring said control members successively into position to operate the control switch, a circuit for controlling said drive, a switch in said circuit operated by movement of the conveyor to condition said drive to move the chain, and an adjustably mounted switch in said circuit operated by movement of said chain to condition said drive to stop said chain, whereby movement of the chain may be correlated with movement through the machine of each of a succession of variably spaced box units.

8. In a box-making machine having a stapler, a stapler control switch, and an endless conveyor adapted successively to feed spaced box units to the stapler: apparatus automatically to operate the stapler control switch at selected times to locate staples at predetermined points in the box parts comprising, an endless chain, selectively spaced control members carried by said chain and forming a timing pattern for locating staples in a box unit by successively operating the stapler switch upon movement of the chain, a drive for moving the chain to bring said control members successively into position to operate the stapler switch, a circuit for controlling said drive, a switch in said circuit to condition said drive to move said chain, a switch-operator carried by said conveyor to operate said switch, and a second switch in said circuit for conditioning said drive to stop said chain, and a second switch-operator carried by said chain and independent of said control members to operate said switch, whereby movement of the chain may be correlated with the movement through the stapler of each of a succession of variably spaced box units.

9. In a box-making machine having a switch controlled operation performing mechanism, a control switch, and an endless conveyor adapted to feed a plurality of spaced box units to the operation performing mechanism: apparatus to operate the control switch at selected times to cause said operation performing mechanism to operate on each box unit at predetermined points there-

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along, comprising, an endless chain carrying selectively spaced control members forming a timing pattern for a box unit and adapted successively to operate the control switch upon movement of the chain, a drive to move the chain to bring said members successively into position to operate the control switch, a starting switch operable successively by selectively placed members on the conveyor to condition said drive to move the chain when each box unit reaches the operation performing mechanism, and an adjustably mounted stopping switch operable by a selectively placed member on the chain to condition said drive to stop the movement of the chain after the last of a series of operations is performed by said operation performing mechanism on a box unit.

10. In a box-making machine having a switch controlled operation performing mechanism, a control switch therefor, and an endless conveyor adapted to feed a plurality of spaced box units to the operation performing mechanism; apparatus to operate the control switch at selected times to cause said operation performing mechanism to operate on each box unit at predetermined points therealong comprising, a pattern holder carrying selectively spaced control members for a box unit adapted successively to operate the control switch upon movement of the pattern holder, a drive to move the pattern holder to bring said members successively into position to operate the control switch, a starting switch operable successively by selectively placed members on the conveyor to condition said drive to start movement of the pattern holder when each box unit reaches the operation performing mechanism, and an adjustably mounted stopping switch operable by a member associated with the pattern holder to condition said drive to stop the movement of the pattern holder after a complete revolution thereof.

11. In a box-making machine having operation performing mechanism, a control switch and a conveyor movable at a constant speed to feed successively spaced box units to the operation performing mechanism: apparatus to control the operation of the operation performing mechanism comprising a pattern holder and control members thereon selectively spaced to operate the control switch upon movement of the pattern holder through a cycle to cause the operation performing mechanism to operate at predetermined points on each box unit moving through the machine, a drive to move the pattern only at the speed of said conveyor to bring the control members successively into position to operate the control switch, a circuit for controlling the starting and stopping of the pattern holder without interrupting the movement of the conveyor, said circuit being conditioned by movement of said conveyor to connect the drive to move the pattern holder and being subsequently conditioned by movement of said pattern holder to disconnect the drive to stop the pattern holder, whereby the movement of the pattern holder may be correlated with the movement through the machine of each of a succession of variably spaced box units to effect like operations by said operation performing mechanism on each box unit.

12. In a box-making machine having operation-performing mechanism, a control switch, and a conveyor adapted to feed successively spaced box units through the machine; the combination of a pattern holder and control members thereon selectively spaced to operate the control switch upon movement of the pattern holder through a cycle to cause the operation-perform-

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ing mechanism to operate at predetermined points on each box unit moving through the machine, a drive to move the pattern holder to bring the control members successively into position to operate the control switch, a circuit for controlling the starting and stopping of the pattern holder without interrupting the movement of the conveyer, a first switch in said circuit and a switch-operator for said first switch carried by said conveyer to operate said switch to condition said circuit to connect the drive to move the pattern holder, an adjustably mounted switch in said circuit and a switch-operator carried by said pattern holder to operate said second switch to condition the circuit to disconnect the drive to stop movement of said pattern holder, whereby the movement of the pattern holder may be correlated with the movement through the machine of each of a succession of variably spaced box units to effect each box unit.

13. In a box-blank-making machine having stapling mechanism for successively driving staples into box parts, a continuously moving endless conveyer for feeding to the stapling mechanism a plurality of box parts and provided with sets of box-parts-spacing elements arranged around said conveyer, each set being arranged to hold box parts for a box-blank unit, a drive for driving the stapling mechanism at a fixed rate and a clutch for connecting and disconnecting the drive, in combination, apparatus for operating the clutch to control the operation of the stapling mechanism to drive staples at desired points in the box parts as they move past the stapling mechanism, said apparatus comprising a stationary switch for operating the clutch, a pattern holder movable past the switch in successive cycles, a pattern-holder drive to drive the pattern holder at a speed having a fixed ratio with respect to the speed of the conveyer, switch-operating parts located in spaced relation along the pattern holder and forming a timing pattern to control the stapling operations per box-blank unit, said spacing corresponding to the spacing between the points on said box parts at which staple driving is desired to start and at which it is desired to stop, said pattern-holder drive being set to maintain said pattern-holder conveyer speed ratio the same as the ratio of the spacing between said switch-operating parts to the spacing of the points along the box parts where stapling is to start and stop, and members respectively carried by said conveyer and pattern holder for respectively controlling the starting and stopping of said pattern holder to synchronize the movement of said pattern holder with the movement of each successive box-blank unit fed to said stapling mechanism by said continuously moving conveyer.

14. In a box-blank-making machine having stapling mechanism for successively driving staples into box parts, a continuously moving endless conveyer for feeding to the stapling mechanism a plurality of box parts and provided with sets of box-parts-spacing elements arranged around said conveyer, each set being arranged to hold box parts for a box-blank unit, a drive for driving the stapling mechanism at a fixed rate and a clutch for connecting and disconnecting the drive, in combination, apparatus for operating the clutch to control the operation of the stapling mechanism to drive staples at desired points in the box parts as they move past the stapling mechanism said apparatus comprising a stationary switch for operating the clutch, a

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pattern holder movable past the switch in successive cycles, a pattern-holder drive to drive the pattern holder at a speed having a fixed ratio with respect to the speed of the conveyer, switch-operating parts located in spaced relation along the pattern holder and forming a timing pattern to control the stapling operations per box-blank unit, said spacing corresponding to the spacing between the points on said box parts at which staple driving is desired to start and at which it is desired to stop, said pattern-holder drive being set to maintain said pattern-holder conveyer speed ratio the same as the ratio of the spacing between said switch-operating parts to the spacing of the points along the box parts where stapling is to start and stop, and a circuit for controlling said pattern-holder drive to stop and start the pattern holder, said circuit being conditioned by movement of said conveyer to connect the pattern-holder drive to drive the pattern holder and being subsequently conditioned by movement of the pattern holder to cause the pattern-holder drive to stop movement of the pattern holder, thereby to synchronize the movement of said pattern holder with the movement of each successive box-blank unit fed to said stapling mechanism by said continuously moving conveyer.

15. In a box-blank-making machine having an operating performing mechanism for performing an operation on box parts, an endless conveyer for feeding to the machine a plurality of box parts, said conveyer having sets of spacing elements arranged around the conveyer, each set arranged to position box parts for a box unit, in combination, apparatus for controlling the operation of said operation performing mechanism to cause the mechanism to operate on said box parts at desired points on each box unit moving through said machine, said apparatus comprising, a stationary switch for controlling the operation of the operation performing mechanism, a pattern holder independent of said conveyer and movable past said switch in successive cycles, a drive for driving the pattern holder at a speed having a ratio fixed with respect to the speed of the conveyer, switch-operating parts spaced along said pattern holder and forming a timing pattern for the operation performing mechanism per box-blank unit for causing said operation performing mechanism to operate on each box unit at desired spaced points, the spacing of said switch-operating parts around said pattern holder being related to the spacing between points on said box units at which operations are to be performed by said operation performing mechanism, and the fixed ratio of speed of pattern holder to speed of conveyer being equal to the ratio of the distances between the parts on said pattern holder and the distances between said points on said box units.

16. In a box-making machine having an operation performing mechanism, a control switch, an endless conveyer provided with selectively spaced blocks for positioning and feeding a plurality of box parts arranged to form spaced box units, and a power drive for moving the conveyer through the machine at substantially a uniform continuous speed: apparatus to control the operations of the operation performing mechanism to perform operations on said box parts at predetermined selected points along the box units, comprising, an endless chain shorter in length than the endless conveyer, a series of selectively spaced control members for a box unit carried by the chain and upon movement of the chain successively contacting and operating the

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control switch to cause the operation performing mechanism to operate on box parts of a box unit passing through the machine, an electrically controlled driving connection between the power drive and the chain to move the chain with the conveyer at selected times, and operators controlling said driving connection to start a movement of the chain when each box unit reaches a predetermined position in the machine and to stop movement of the chain after each box unit has travelled a predetermined distance past said point, said operators comprising a first switch, and selectively spaced blocks on the conveyer for operating said switch to condition said driving connection to drive the chain, and a second switch, and a block on said chain to operate said second switch to condition said driving connection to stop said chain, whereby the movement of the chain is correlated with the movement through the machine of each of a succession of spaced box units and a like operation of said operation performing mechanism may be effected on a succession of variably spaced box units.

17. In a box-making machine having an operation performing mechanism, a control switch, an endless conveyer provided with selectively spaced blocks for positioning and feeding a plurality of box parts arranged to form spaced box units, and a power drive for moving the conveyer through the machine at substantially a uniform continuous speed: apparatus to control the operations of the operation performing mechanism to perform operations on said box parts at predetermined selected points along the box units, comprising, a pattern holder holding selectively spaced controlling members for a box unit operable upon movement of the pattern holder, successively to contact and operate the control switch whereby the operation performing mechanism is alternately started and stopped while a box unit is passing through the machine, a controllable driving connection between the pattern holder and the power drive to move the pattern with the conveyer at selected times, and operators for controlling said driving connection to start a movement of the pattern holder when each box unit reaches the operation performing mechanism and to stop movement of the pattern holder after a complete revolution thereof, said operators comprising, a starting switch, selectively spaced blocks on the conveyer to operate said starting switch to condition said driving connection to drive the pattern holder, a stopping switch, a block movable by said pattern holder to operate said stopping switch to condition said driving connection to stop the pattern holder, whereby the movement of the pattern holder is correlated with the movement through the machine of each of a succession of spaced box units and like operations of said operation performing mechanism may be effected on a succession of variably spaced box units.

18. In a box-blank-making machine having an operation performing mechanism for successively performing operations on box parts arranged to form a box-blank unit, an endless conveyer for conveying box parts to the operation performing mechanism prearranged to form a box-blank unit, a drive shaft to drive the conveyer, and a circuit to control the operation of said operation performing mechanism, in combination; an endless pattern holder carrying control members which by their movement past a switch condition said circuit either to cause the operation per-

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forming mechanism to operate or not to operate on said box-blank units, mechanism for driving said endless pattern holder, comprising, a rotatable driving member over which said pattern holder passes, a rotatable gear continuously connected to and driven by said drive shaft, a magnetic clutch for engaging said rotatable gear and driving member to drive the pattern holder, a magnetic brake for stopping said rotatable driving member, a starter switch operated by movement of said conveyer simultaneously to energize said magnetic clutch and deenergize said magnetic brake, a stopper switch operated by movement of said endless pattern holder after a complete revolution thereof to deenergize said magnetic clutch and to energize said magnetic brake to stop said pattern holder, whereby said pattern holder is started by movement of said conveyer and is stopped after each complete revolution of the pattern holder.

19. In a box-making machine having as an operation performing mechanism a control switch therefor, a continuously moving conveyer adapted to feed successively spaced box units to the operation performing mechanism, the combination of a pattern holder, and control members thereon selectively spaced to operate the control switch upon movement of the pattern holder through a cycle to cause the operation performing mechanism to operate on each box unit at predetermined points therealong, a drive to move the pattern holder to bring the control members successively into position to operate the control switch, a circuit for controlling the starting and stopping of the pattern holder in coordination with the movement of the conveyer, a first switch in said circuit, and a switch operator for said first switch carried by said conveyer to operate said switch to condition said circuit to connect the drive to move the pattern holder, a second switch in said circuit, and a switch operator carried by said pattern holder to operate said second switch to condition the circuit to disconnect the drive to stop movement of said pattern holder, and a support for said second switch adjustable with respect to the pattern holder whereby the position of said switch may be adjusted to cause said pattern holder to stop at the desired position with respect to said control switch so that the movement of the pattern holder may be correlated with movement of said variably spaced box units by said conveyer.

20. In a box-making machine having an operation performing mechanism, a control switch, and an endless conveyer adapted successively to feed box parts arranged to form spaced box units to the machine: apparatus automatically to operate the control switch at selected times to cause said operation performing mechanism to operate at selected times in connection with each said box unit comprising, a pattern holder, selectively spaced control members carried by said pattern holder and forming a timing pattern for the operation of said operation performing mechanism by successively operating the control switch upon relative movement between said control switch and said pattern holder, a drive for relatively moving said pattern holder and control switch to bring said control members and control switch into successive positions to operate the control switch, a circuit for controlling said drive, a switch in said circuit operated by movement of the conveyer to condition said drive to produce said relative movement

and a second switch in said circuit operated by one of the relatively moved pattern holder and control switch to condition said drive to stop said relative movement, whereby said relative movement may be correlated with movement through the machine of each of a succession of variably spaced box units.

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