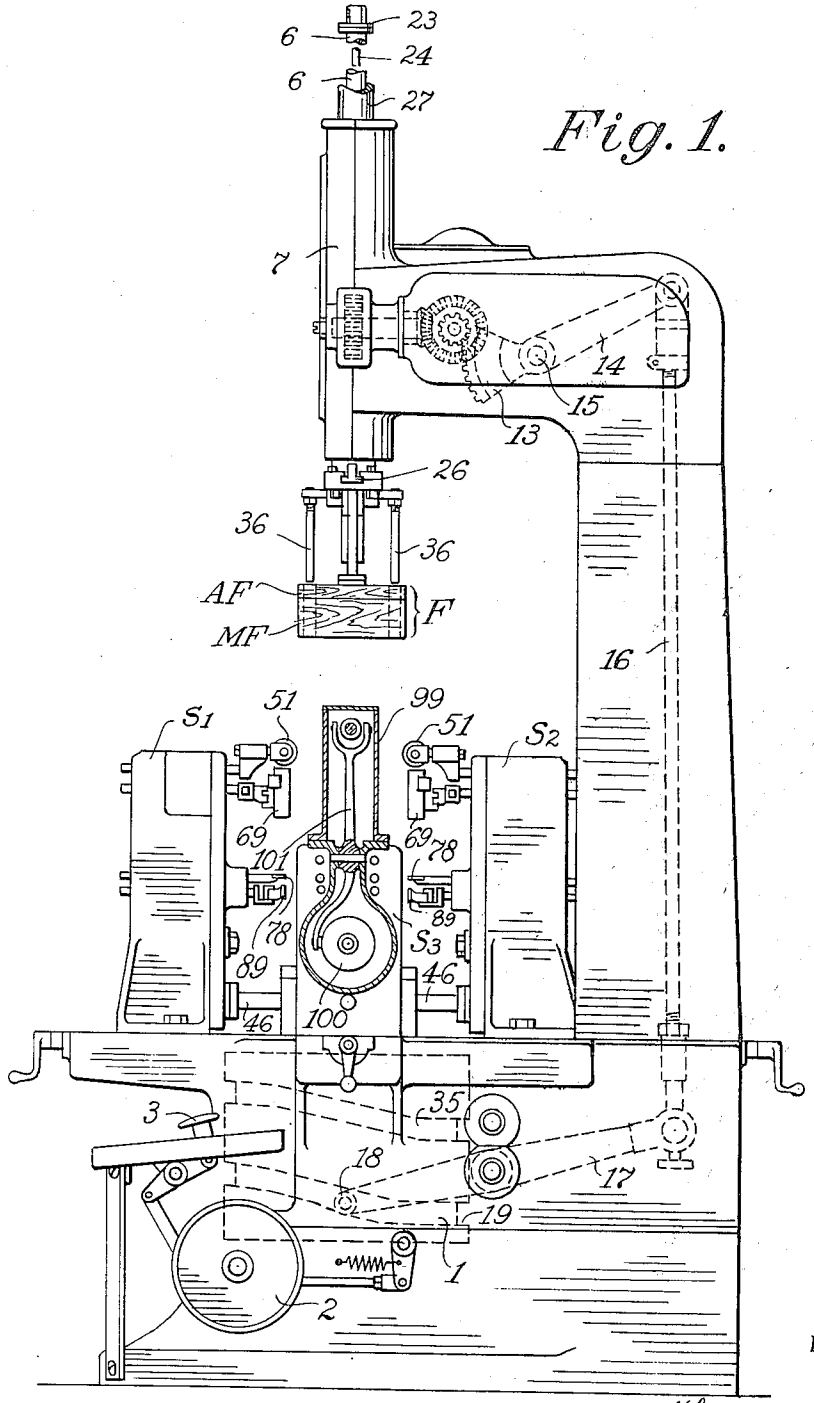
June 16, 1936. T. A. FEDERWITZ 2,044,606

BOX MACHINE

Filed Oct. 10, 1935 7 Sheets-Sheet 1

Fig. 1.



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BOX MACHINE

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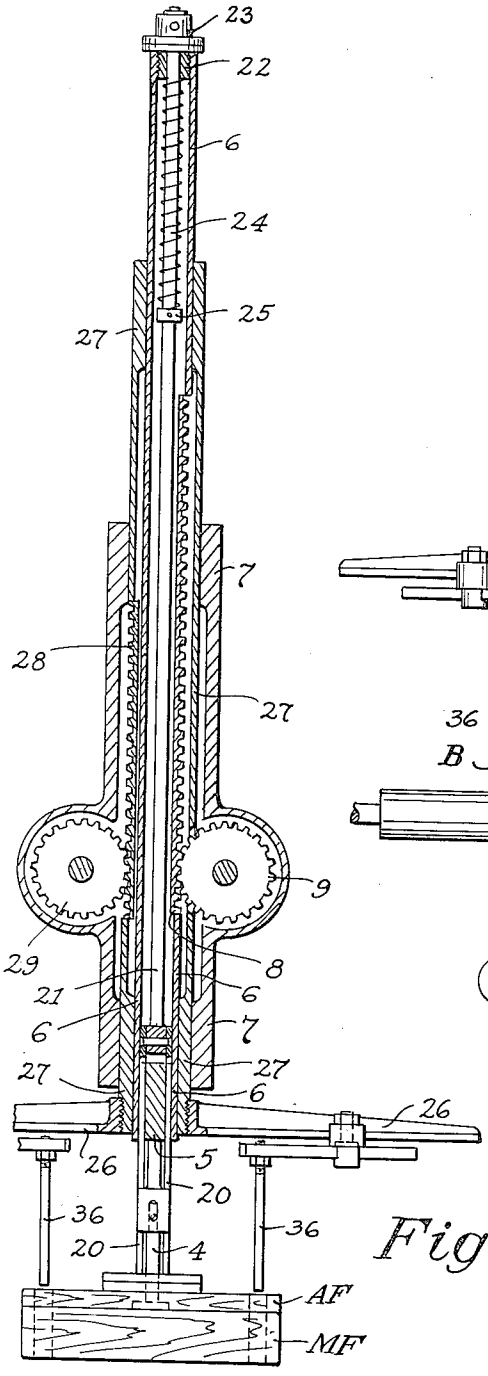


Fig. 2.

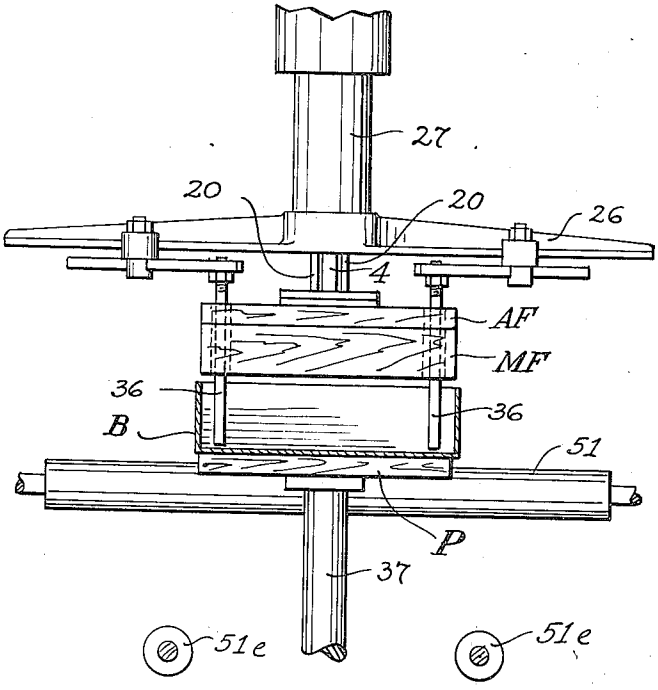


Fig. 8.

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June 16, 1936. T. A. FEDERWITZ 2,044,606

BOX MACHINE

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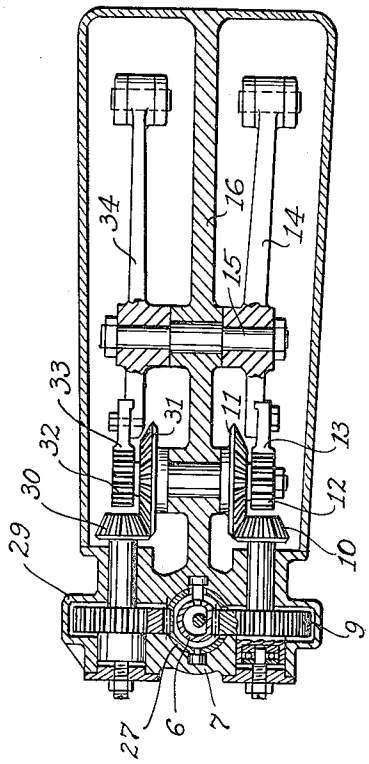


Fig. 3.

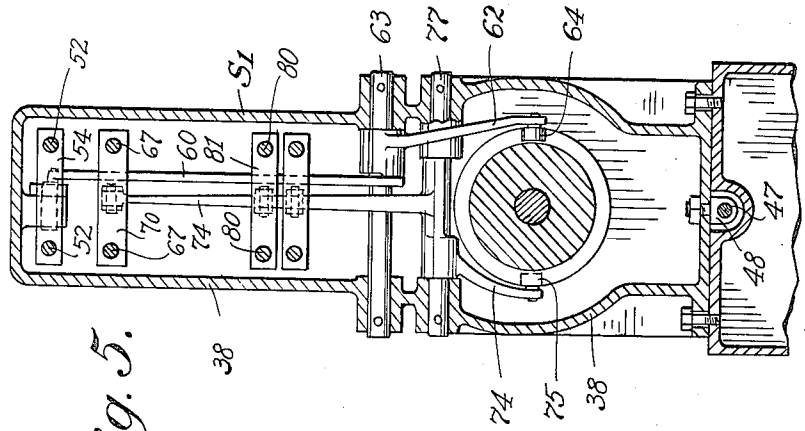


Fig. 5.

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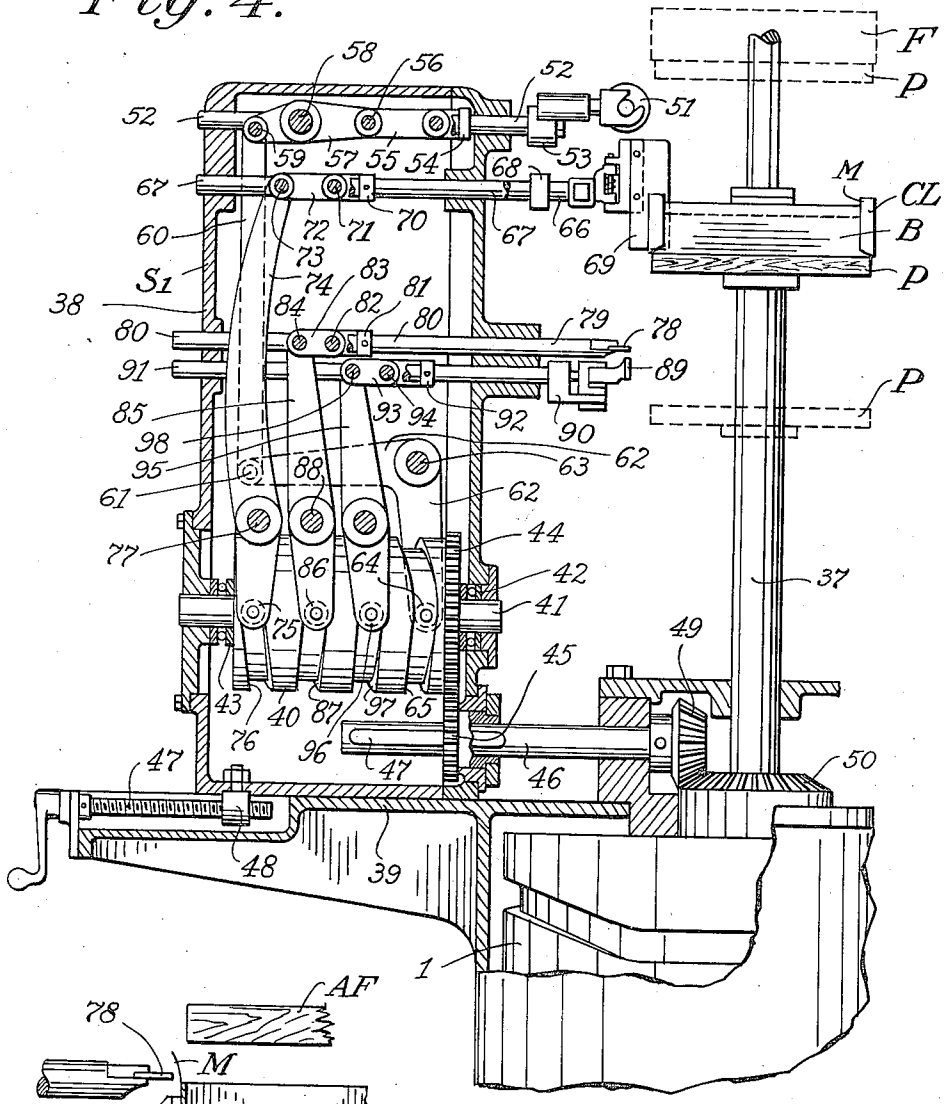
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June 16, 1936. T. A. FEDERWITZ 2,044,606

BOX MACHINE

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Fig. 4.



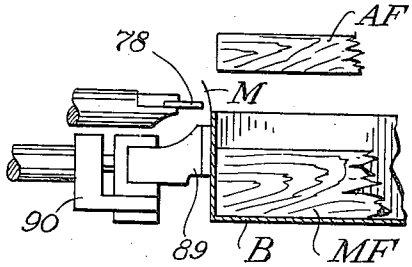


Fig. 7.

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BOX MACHINE

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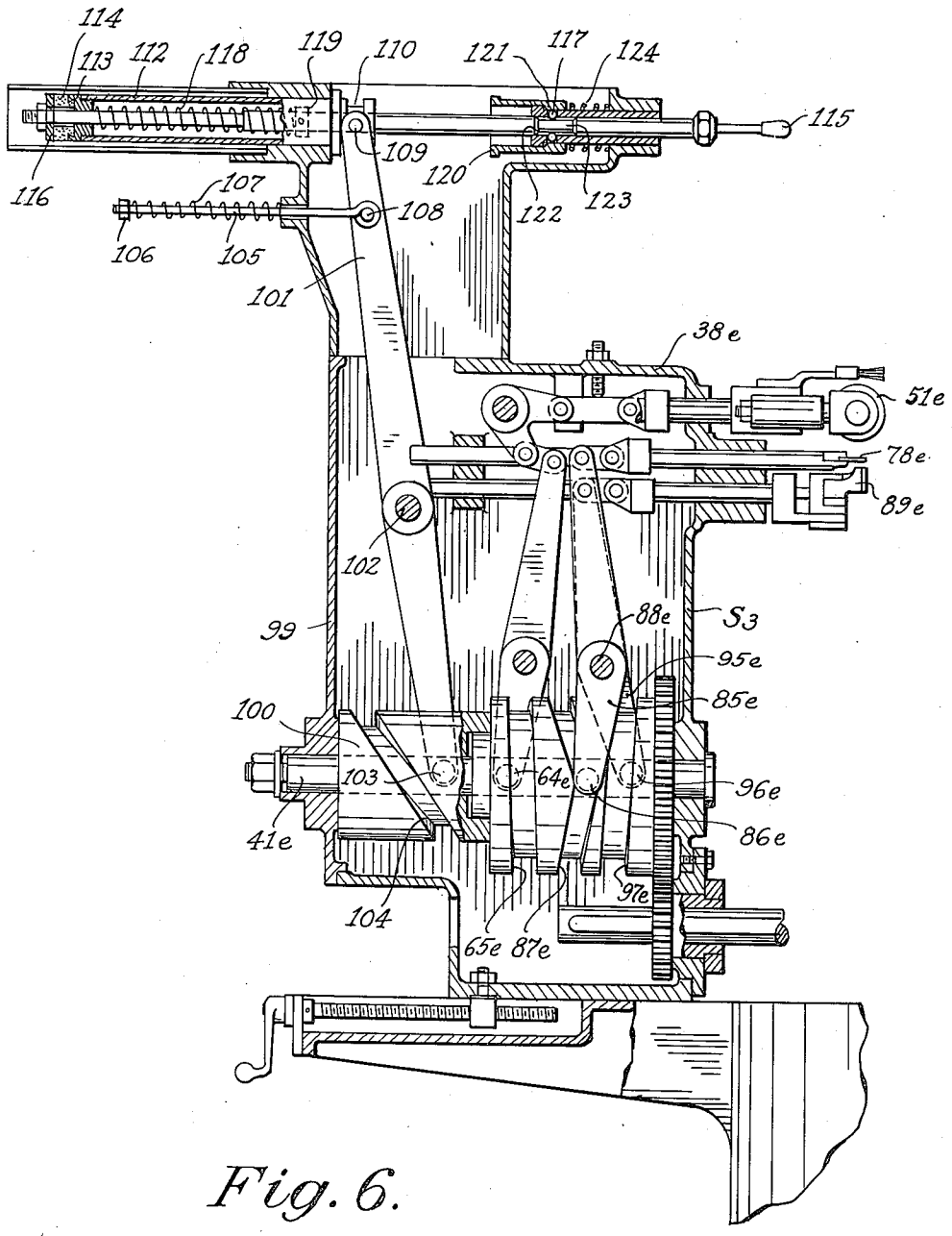


Fig. 6.

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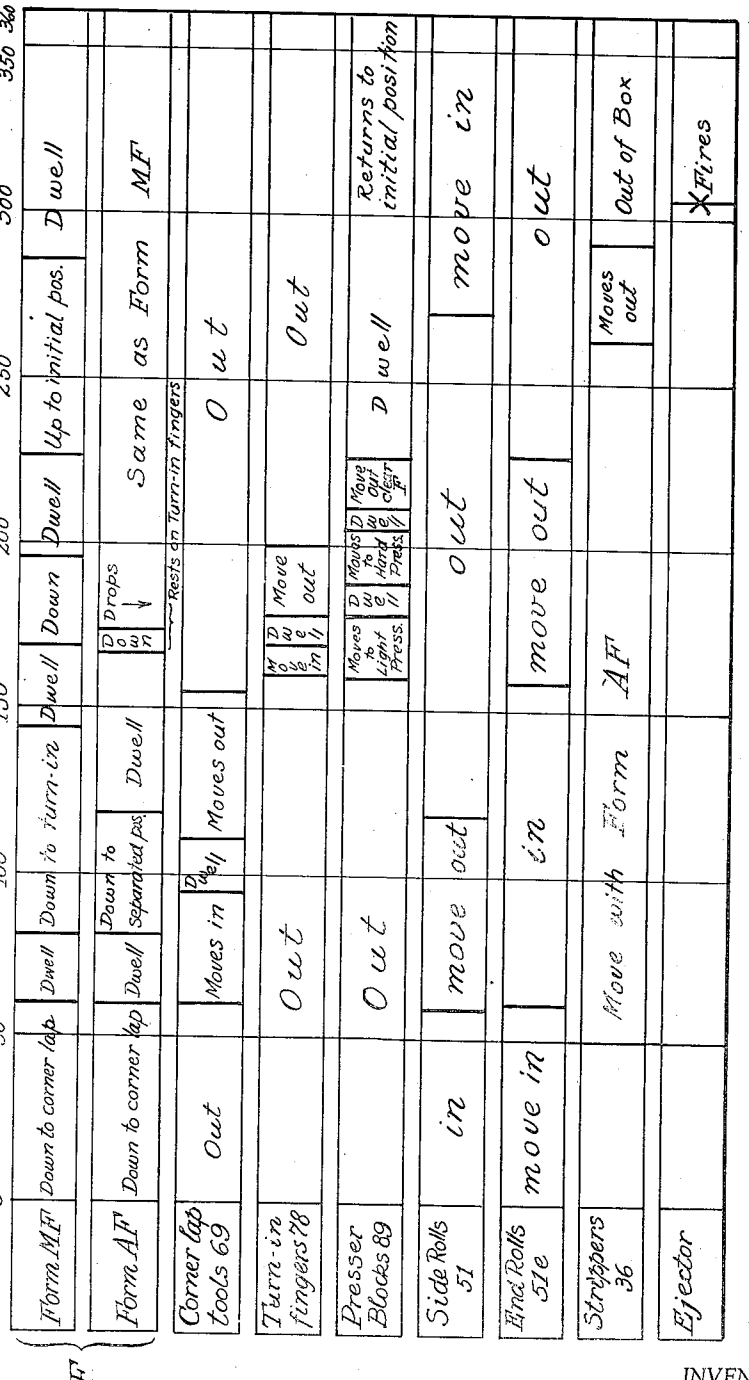
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BOX MACHINE

Filed Oct. 10, 1935 7 Sheets-Sheet 6

Fig. 9.



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BOX MACHINE

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Fig. 10.

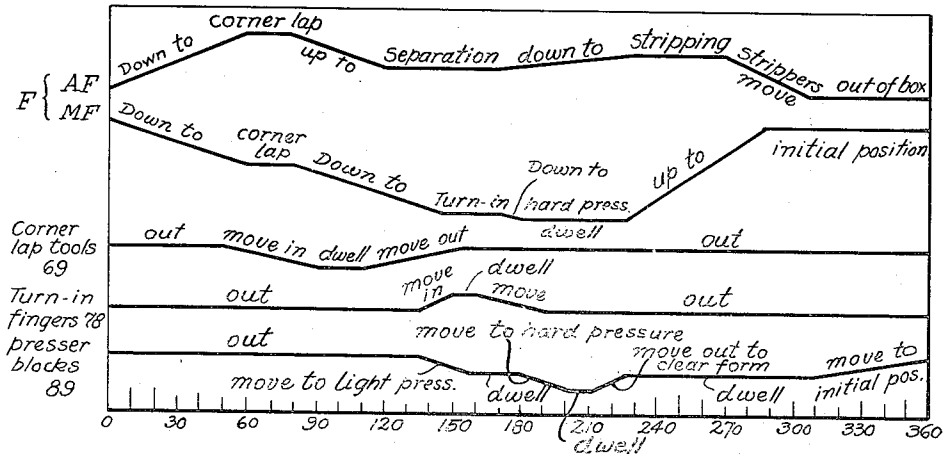
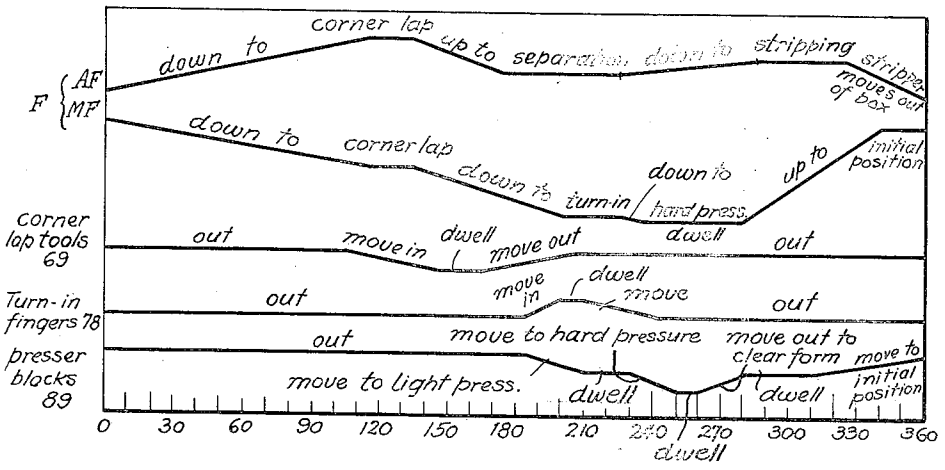


Fig. 11.



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Patented June 16, 1936 2,044,606

UNITED STATES PATENT OFFICE

2,044,606

BOX MACHINE

Theodore A. Federwitz, Philadelphia, Pa., assignor to Stokes and Smith Company, Summerdale, Pa., a corporation of Pennsylvania

Application October 10, 1935, Serial No. 44,315

16 Claims. (Cl. 93—54.2)

My invention relates to apparatus for covering previously formed or stayed boxes for applying thereto a wrapper, label, or equivalent, or for forming a box from a single or multipiece box blank by applying sheet material, as a tabbed or untabbed wrapper, or tabs solely, previously partially applied or adherent to the box blank, to hold the box-blank elements in box-forming position; and relates particularly to box machines of the type having a reciprocating form block which carries the box structure through various sheet-applying and/or staying stages.

In accordance with my invention, to permit highspeed operation of the machine for increased output, there is provided in each cycle of the machine a period, during which a stayed or unstayed box may be placed on the form-block, which is a materially greater proportion of the machine cycle than heretofore, and which is, for manual application of boxes to the form block, of materially greater or several times the duration of the time permitted in prior machines thereby to require less effort on the part of the operator in compensation for the greater labor required in applying a much greater number of boxes to the form block; the prolonged feeding time may be obtained either by causing the form block to remain at rest in a predetermined box-receiving position for a substantial part of the cycle after the previously completed stayed, tabbed, or wrapped box has been stripped from the form block and removed or ejected from the machine, or by causing the form block structure to move slowly toward the first of the sheet-applying tools during a substantial part of the machine cycle.

More particularly, the operating mechanism for the various sheet-applying tools is constructed to effect completion of the wrapping, staying, tabbing or formation of a box within a substantially reduced proportion of the cycle of operation of the machine and to make available, either by dwell or pause or by protracted slow motion of the form block structure, a greater proportion of the cycle for feeding of a box or box blank to the form block structure.

Further and more specifically in accordance with one form of my invention, a completed box is stripped from the form block and removed or ejected from the machine substantially before the beginning of the next cycle of the machine, to allow a substantial period during which another box structure can be placed on the form block.

In accordance with another form of my invention, a prolonged feeding time is obtained by providing for slow motion of the form-block structure during its travel toward the sheet-applying tools.

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

For an understanding of my invention, reference is to be had to the accompanying drawings in which:

Figure 1 is a side elevational view with parts in section of a box machine;

Fig. 2 is a front view in section and on enlarged scale of the operating plungers for the form block shown in Fig. 1;

Fig. 3 is a plan view in section and on enlarged scale of mechanism for operating the plungers of Fig. 2;

Fig. 4 is a side elevational view, in section and on enlarged scale, of one of the tool slides of Fig. 1;

Fig. 5 is an end elevational view in section of the tool slide shown in Fig. 4;

Fig. 6 is a front elevational view, in section and on enlarged scale, of one of another of the tool slides of Fig. 1;

Fig. 7 shows tools of Fig. 4 in a different operating position;

Fig. 8 is a detail view illustrating box-stripping action of mechanism shown in Figs. 1 and 2;

Fig. 9 is a timing diagram of the various components of the box machine of Fig. 1;

Fig. 10 is a development of the cams for operating the form block components and certain of the sheet-applying tools;

Fig. 11 is a modification of Fig. 10.

Referring to Fig. 1, the box machine is generally of the type disclosed in Nitsch et al. Patent No. 1,540,900 and Federwitz Patent No. 1,924,681. The main cam 1 is driven from a suitable source of power, not shown, through the one-time clutch 2 controlled by the foot pedal 3. A suitable clutch construction is more fully shown in Rider et al. Patent No. 1,916,440. If the pedal 3 is held depressed, the cycle of operation of the machine continuously repeats, the form block structure F moving from the box receiving position shown in Fig. 1 downward along a path adjacent the slide units S1—S4 carrying the various wrapping tools, and then returning upwardly to its original position. When the form block F is in the position shown in Fig. 1, an operator places thereon an

assembly comprising a stayed or unstayed box and an adhering wrapper or tabbing. During descent of the form block the wrapper, or other sheet material, is, as hereinafter described, applied by the various wrapping tools. As the form block returns toward its original position, the completed box is stripped from the form block and ejected from the machine. Heretofore the proportion of the cycle in which the form block was accessible and in position to receive the box or box blank to be wrapped and/or stayed was very small, corresponding in time with approximately 15° of a revolution of the main cam 1 which rotates once for each cycle of the machine. Consequently it was previously necessary, in order to provide sufficient time for an operator to place the assembly on the form block, either to run the machine at slow speed, or to allow the one-time clutch 2 to stop the machine at the end of each cycle, the operator tripping the clutch by the pedal 3 to initiate the next cycle after a box had been placed on the form block F both modes connoting low output. The purpose of the changes in construction hereinafter described is substantially to increase the proportion of the cycle in which the form block is in position and accessible to receive a box so that the machine may be operated continuously at higher speed and output and yet provide sufficient at least as much time as in the prior machines in each cycle for an operator to place a box or box blank on the form block. In other words, notwithstanding the time per cycle is decreased, the number of cycles in a given time increased, the operator, for continuous operation of the machine, is afforded in each cycle sufficient time to place a box structure and adhering wrapper and/or tab material on the form bottom block.

The form block structure F comprises, as shown in Figs. 1 and 2, the main form block MF and the auxiliary form block AF. The combined height, width and length of the form block components AF and MF correspond respectively to the inside height, width and length of the boxes to be wrapped or formed. The form block MF is secured to the lower end of the bar 4 connected at its upper end to the block 5, Fig. 2, which is suitably secured in the lower end of the plunger or cylinder 6 slidable within the fixed guide member 7. The rack 8, integral with or attached to the cylinder 6, is adapted to mesh with the gear 9 rotatable with the pinion 10, Figs. 2 and 3. Pinion 11 for driving gear 10 is rotatable with gear 12 which is in mesh with the gear sector 13 secured to arm 14 which is pivotally supported by the shaft 15 extending from the frame member 16. To the other end of arm 14, Figs. 1 and 3, is connected with the link 16 whose lower end is pivotally connected to one end of arm 17 whose other end is provided with a cam follower 18 engaging the cam track 19 of cam 1. Accordingly, as cam 1 rotates, the form block MF is reciprocated to and from the position shown in Fig. 1 in accordance with the timing diagram of Fig. 9.

The form block AF is connected to the lower ends of the rods 20 which pass through the block 5 and are connected to the lower end of the rod 21 which passes through the block 22 in the upper end of cylinder 6. The cap 23, secured to rod 21 exteriorly of plunger 6, extends beyond the periphery of plunger 6 for a purpose hereinafter stated. The spring 24 disposed between the collar 25 secured to rod 21 and the block or plug 22, serves to maintain the form block components AF and MF in engagement, form block AF, except as hereinafter provided, moving with the form block MF in accordance with the cam track 19 of main cam 1.

The bar 26, Figs. 1 and 2, is suitably secured to the hollow plunger 27 also slidable in the guide member 7. The rack 28 secured to or integral with the plunger 27, is in mesh with gear 29 rotatable with bevel gear 30, Fig. 3, which is in mesh with the bevel gear 31. The gear 32, rotatable with gear 31 is in mesh with the gear sector 33. The arm 34 effecting oscillation of gear sector 33 is actuated by cam track 35 of the main cam 1 through a lever and link arrangement similar to that afforded by the arm 17 and link 16. As will hereinafter more clearly appear, the movement of the plunger 27 controls removal of the completed box from the form block by the strippers 36 and also provides for separation of the form block components AF and MF for operation of certain of the wrapping tools.

As the form block structure descends from the position shown in Fig. 1, it meets the platen P carried by the cylinder 37 suitably biased, as by a spring (not shown), to the upper dotted line position, Fig. 4. As the form block structure continues its downward movement it passes between the slide units S1 to S4. The slide units S1 and S2 are disposed adjacent the path of travel of the sides of the box and the slide units S3 and S4 are disposed adjacent the path of travel of the ends of the box. Since the side units S1 and S2 are identical, the construction and operation of only one of them need be described in detail. Referring to Fig. 4, the slide unit S1 comprises a housing 38 resting on the frame plate 39 of the machine. The cam barrel 40 disposed within housing 38 rotates with shaft 41 journaled at its opposite ends in the front and back of the housing. The thrust bearings 42 and 43, at opposite ends of the cam barrel, accurately maintain its position to prevent axial displacement which would affect operation of the tools hereinafter described. The gear 44, secured to and rotatable with the cam barrel, is in continuous engagement with the gear 45 which is slidable with housing 38 relative to shaft 46. The key 47, or equivalent, provides for continuous driving engagement between gear 45 and shaft 46 for all positions of the housing and during its adjustment in setting the slide for different sizes of boxes. This adjustment is effected by rotation of the threaded member 47 which engages the nut 48 secured to the housing 38. To the other end of shaft 46 is secured a beveled gear 49 which meshes with gear 50 rotating in unison with main cam 1.

It is to be understood that each of the slide units includes a cam barrel corresponding to cam 40, which is similarly driven from the main cam 1. The roll 51 is carried by a frame comprising the rods 52 which extend through the front and rear walls of the housing 38 and are joined by the cross-member 53 exteriorly of the housing and cross-member 54 interiorly thereof. To the latter is pivoted the link member 55 connected at its other end by pivot pin 56 to one arm of a lever 57 pivoted at 58 to the housing 38. The other end of lever 57 is connected through pin 59, link member 60, and pin 61 to one arm 62 of a bell-crank lever pivoted at 63 to housing 38, and whose other arm carries a cam follower 64 in engagement with groove 65 of cam barrel 40.

Accordingly, for each rotation of the cam barrel 40, which occurs once for each cycle of the machine, the roll structure 51 is moved toward and away from the path of the form block struc-

ture F. The roll 51 wipes the side panel of the wrapper into engagement with the side panel of the box as the box moves downwardly from the top dotted line position indicated in Fig. 4. When the box is unstayed, the roll 51 has the additional function of erecting the side of the box. The timing of the movement of the roll is hereinafter more fully described.

The frame 66 comprises the rods 67 guided by the front and rear walls of housing 38 and joined exteriorly thereof by the cross-member 68. The frame 66 carries two corner-lap tools 69, one for each end of the box, which fold the corner-lap sections CL of the wrapper side panel into engagement with the ends of the box. The cross-member 70 is pivotally connected by pin 71 to one end of link 72 whose other end is connected by pin 73 to the upper end of the lever 74 whose lower end carries the cam follower 75 in engagement with groove 76 of cam barrel 40. The lever 74 is pivotally mounted on shaft 77 whose opposite ends are received by the opposite sides of housing 38. The timing of the operation of the corner-lap tools is hereinafter more fully described.

The marginal turn-in finger 78 which folds over the portion M of the wrapper extending above the top of the box side is mounted upon a frame 79 comprising the rods 80 which extend through the housing 38 and are supported by the front and rear walls thereof. To the cross-member 81 of the frame is pivotally connected, by pin 82, the link 83 which is connected by pin 84, to the upper end of lever 85 whose lower arm carries the cam follower 86 for engagement with groove 87 of the barrel cam 40. The shaft 88, upon which lever 53 is mounted, extends transversely of the housing, its opposite ends being received by the opposite sides of the housing.

The presser block 89 is carried by the frame 90 which comprises the two slidable bars 91 connected interiorly of the housing by cross-member 92 to which the link 93 is joined by pin 94. Lever 95, whose lower end carries the cam follower 96 for engagement with groove 97 of cam barrel 40, is connected at its upper end to the link 93 by the pin 98.

All of the tools of slide unit S1 for working upon the box blank, or box, and partially applied wrapper or tab structure, are operated from the common barrel cam 40. The mechanism described for operating the tools, as will hereinafter more fully appear, permits the completion of the wrapping or forming of the box in a substantially reduced fraction of the complete cycle of operation of the machine and so makes it possible to provide for a longer period of dwell of the form block in box-receiving position.

The construction of the two end slide units is similar to Fig. 4 except for omission of the corner-lap tools and their operating mechanism. For brevity, therefore, the construction and operation of the side slides, one of which is shown in Fig. 6, is not repeated, corresponding elements being identified by the same reference character with addition of the subscript *e*. The two end slides S3 and S4 are identical except that one of them, S3, Fig. 6, is provided with additional mechanism for ejecting the finished box.

The housing 99 for the ejector is adapted to be suitably secured to the housing 38*e* of the slide S3. The shaft 41*e* is suitably elongated to carry the cam 100, which preferably can be adjustably secured in different angular positions to the shaft 41*e*. The lever 101 pivoted on shaft 102 is provided at one end with a cam follower 103 for engagement with the groove 104 of cam 100. The arm 101 is biased to the position shown in Fig. 6 by the spring 105 disposed between the housing and the collar 106 on rod 107 which is pivotally connected by pin 108 to the lever 101. The upper end of the lever 101 is bifurcated and is provided with inwardly directed pins 109 for engaging the groove 110 of the member 111 secured to the ejector cylinder 112. To the other end of the cylinder is secured the plug 113 having on its outer face a block 114 of suitable shock-absorbing material. The ejector rod 115 passes through cylinder 111 and plug 113 and is provided exteriorly thereof with a stop plate 116. When the parts are in the position shown in Fig. 6, the balls 117 prevent movement of the ejector rod, so that as arm 101 rotates in clockwise direction from the position shown, spring 118 between the plug 113 of cylinder 112 and the collar 119 or rod 115 is compressed. For continued movement of the lever 101, the member 111 pushes the sleeve 120 to the right so that eventually the shoulder 121 passes beyond the balls 117, allowing them to be cammed outwardly by the sloping surface 122 of rod 115. The ejector rod is thus released for rapid, forcible movement by the compressed spring 118 to eject a completed box from the machine.

As lever 101 is moved in counterclockwise direction towards the original position shown in Fig. 6, the rod 115 is moved to the left by the engagement between cylinder 112 and the stop 116. When the section 123 of reduced diameter of the rod comes opposite the balls 117 they are forced inwardly by the sleeve 120 under the influence of spring 124. The elements of the ejector mechanism are thus reset to the position shown in Fig. 6.

In the machine shown and according to the timing diagram of Fig. 9, the machine cycle begins when cam 1 is in such position that the form block will begin its downward movement upon movement of the cam from such position and is completed when the cam 1 makes one revolution and returns to that position. It is to be understood, however, that my invention is not limited to beginning of the cycle at any particular position of the form block.

In describing the operation of the machine, it is assumed that a box and wrapper assembly have been placed upon the form block and that the form block has moved downwardly from the box-receiving position of Fig. 1 to the upper dotted line position shown in Fig. 4. As the form block continues to move beyond this position, the side rolls 51 of units S1, S2 wipe the side panels of the wrapper into engagement with the side walls of the box. When the form block reaches the position shown in full lines in Fig. 4, the form block remains at rest for about 20° of rotation of the cam 1, Figs. 9 and 10. Preferably slightly before the form block reaches this position, the corner-lap tools 69 start to move inwardly to the position shown and complete their inward movement after the form block has resumed its downward travel, the tools remaining in their forward position, Fig. 4, for approximately 25° of rotation of the one-time cam 1, Figs. 9 and 10. The corner-lap tools are then returned to their original position and remain there throughout the remainder of the cycle.

As the form block continues its movement, the end rolls 51*e* wipe the end panels of the wrapper into adhesive engagement with the end walls

of the box and the inturned corner-lap sections CL applied by the corner-lap tools 69.

As the form block F continues to move towards the position shown in Fig. 7, the cap 23, Fig. 2, engages the top of the hollow cylinder 27, Fig. 2, arresting movement of the upper form block component AF. The movement of the form block component MF continues until the top edge of the box is in the plane of the marginal turn-in tools 78, Fig. 7, whereupon the form block componets AF and MF remain stationary for approximately 25° rotation of the cam 1, Figs. 9, 10 and 11. During this time the marginal turn-in fingers 78 are moved inwardly to move the margins M, Fig. 7, of the wrapper projecting beyond the top edges of the box inwardly to an angle of approximately 90°. While the tools 78 remain in, cylinder 27 is lowered under the control of cam groove 35 of the main cam 1 to allow the upper form block components AF to drop on the turn-in fingers, and shortly thereafter the turn-in fingers are withdrawn so that the upper form block by gravity and with the assistance of spring 24 moves downwardly to its original position against the form block component MF and, in doing so, turns the inturned margins of the wrapper another 90° into engagement with the inside of the box.

The significant movements of a turn-in finger 78 are performed, in the examples illustrated by Figs. 10 and 11, in a period corresponding with about 60° of a total cycle of the machine, and more particularly within the period comprising the "turn-in" dwell of the form block component MF corresponding with about 25° of said cycle; both said periods may vary, generally inversely, from their aforesaid exemplary magnitudes in accordance with such variations in the prolonged period of accessibility or dwell of the form block structure, for placing a box and wrapper thereon, as come within the spirit of my invention. The aforesaid significant movements of a turn-in finger may, for brevity, be termed turn-in movements, which include, as indicated in Figs. 10 and 11, a dwell of the finger, the significant or essential portions of the movements toward and away from the dwell, all coming within the "turn-in" dwell of the form block component MF. The period of these significant turn-in movements, in the examples illustrated, falls within the period of the hereinafter described significant movements of the presser block.

Substantially concurrently with the initial inward movement of the turn-in fingers, the presser blocks 89 lightly press the side and end walls of the box against the lower form block MF. After the margin of the wrapper has been turned in against the inside of the box by the descent of the upper form AF, the form block components move as a unit under the control of cam groove 19 of the main cam 1 to a slightly lower position, bringing the upper edge of the box approximately even with or preferably slightly below the upper edge of the presser blocks. The motion of the form block is then again arrested by cam groove 19 and during the dwell, the tools 89 are again operated to exert a heavy pressure which insures intimate adhesive engagement between the turned-in margin of the wrapper and the inside of the box.

The presser blocks are then moved outwardly and the form block structure is moved upwardly to carry the completed box to the discharge position.

The significant movements of a presser block 89 are performed, in the examples illustrated by Figs. 10 and 11, in a period corresponding with about 100° of a total cycle of the machine, and more particularly within the period, comprising the "turn-in" and "hard-press" dwells (and transition from the one to the other) of the form block component MF, corresponding with about 80° of said cycle; both said periods may vary, generally inversely, from their aforesaid exemplary magnitudes in accordance with such variations in the prolonged period of accessibility or dwell of the form block structure, for placing a box and wrapper thereon, as come within the spirit of my invention. The aforesaid significant movements of the presser block are, for brevity, termed pressure movements, which include its movement to and dwell in light pressure position, movement to and dwell in hard pressure position, and release of the hard pressure, which series of pressure movements in Figs. 10 and 11 begins with the movement marked "move to light press" and terminates with a movement marked "move out to clear form"; and the aforesaid form block dwells for "turn-in" and "hard press" are, for brevity, collectively termed "turn-in" dwell.

As the form block and completed box approach the position of Fig. 8, the upward movement of cylinder 27 is arrested to retain the stripping tools 36 in the position of Fig. 8 so that the continued upward movement of the form block to the position of Fig. 8 is accompanied by stripping of the completed box therefrom. When the form has moved sufficiently to clear the box, the movement of cylinder 28 is resumed to lift the strippers 36 out of the box and substantially as soon as the strippers are free of the box, the ejector 115 fires, forcibly to remove the completed box from the machine.

With the improved construction shown and in accordance with Figs. 9 and 10, all of the wrapping operations have been completed in about 165° of a revolution of cam 1, whereas, in prior machines of this type about 220° movement of the main cam was required to effect completion of the wrapping operations. The form block is stationary at its upper or box-receiving position, Fig. 1, for approximately 80° of the revolution of the cam 1, Fig. 9, whereas, in the prior machines the dwell was not greater than about 30°. Furthermore, in the prior machines the dwell did not permit an operator to place another box on the form because the strippers did not clear the box until practically the end of the cycle and the ejector did not fire until substantially the end of the cycle. In the present construction, the strippers are clear of the box and the ejector fires to remove the completed box shortly after the beginning of the long form block dwell, Fig. 9, leaving substantially entirely all of the dwell available to an operator to place another assembly on the form.

The relation between the movements of the form block and the various wrapping tools, the strippers and the ejector can be clearly understood from the timing chart of Fig. 9 and the cam developments of Fig. 10. These figures, however, are understood to be only illustrative, and not restrictive, of my invention. Preferably, increased feeding time is obtained by reducing the time for performing the various wrapping operations rather than by increasing the speed of the form block because it is desired that the form block motion should be harmonic and

should not be at high speed because of the substantial weight and inertia of the mechanism which produces it.

Instead of constructing the main cam to provide a long dwell or pause of the form block at box-receiving position as in Figs. 9 and 10, it may, as will be understood from Fig. 11, be constructed to provide relatively slow downward movement of the form block structure from the top of its stroke toward the sheet-applying tools. For this part of the cycle, the form block is clear of all obstructions and in condition to receive an assembly of sheet material with a stayed or onstayed box. By providing for slow motion of the form block in this part of the cycle, corresponding with the time between points 0° and about 40°, (or higher, depending upon the depth of the box) Fig. 11, there is ample time afforded in each cycle to place an assembly on the form block structure even when the machine is operated at speeds substantially in excess of those corresponding with production of twenty boxes per minute. This prolonged feeding time is contributed to by the above-described improved operating mechanism for the various sheet-applying tools which effects completion of their operations in a substantially smaller fraction of the cycle than heretofore. As apparent from comparison of Figs. 10 and 11, the operation of the sheet-applying tools occurs later in the cycle of Fig. 11 though in both modifications the proportion of the cycle required for the wrapping and/or staying operations, and the proportion of the cycle available for feeding a stayed or unstayed box to the form block structure, are substantially the same.

The longest total period or entire time occupied or consumed, within one cycle of the machine, by and in operation of a wrapping tool, for example the presser block **89**, or the total period or entire time occupied by or consumed in operation of a plurality of wrapper tools, for example presser block **89** and turn-in finger **78**, corresponds with, in the examples illustrated, approximately 90° or one-quarter of a complete cycle of the machine; and the period of accessibility of the form block structure for feeding thereto is, in the examples illustrated, from about 40° to 60° of an entire cycle of the machine. For the purposes of my invention, the ratio of the aforesaid total period for operation of one or more wrapper tools, particularly presser block and/or turn-in finger, to the period of accessibility of the form block structure ranges from about 2 to about 1.5. The period of accessibility to the form block structure, the period of wrapper-tool movement or operation, or the magnitude of their ratio to each other, may vary from that corresponding with the examples illustrated so long as there is procured one or more advantages of my invention. In general, the period of accessibility of the form-block structure for feeding thereto and/or the aforesaid period of operation of aforesaid wrapper-applying tool or tools so substantially differs or differ from prior practice as to procure an output material in excess of twenty wrapped or stayed boxes per minute, without exceeding the skill or endurance of the operator, or as to impose upon the operator less strain and fatigue at any machine speed or output whether it be that of the aforesaid old practice or materially higher as exemplified herein.

The cycle of the machine, in accordance with my invention, is new and different in nature and characteristics from that of the aforesaid old-type machines, so significantly different that a new order of capacity or output is attained, and so significantly different that the movements of the operator as imposed or permitted by the so differing cycle are performed with greater ease, smoothness and efficiency, and, as confirmed in practice, with less strain and with less simply physical fatigue.

With the improved construction shown, the percentage of the cycle in which the operator may place a box on the form block is so substantially increased that the machine may be operated continuously and at higher speed, giving greater output, and yet afford ample time in each cycle for the operator to place a box and wrapper on the form block. With the prior mechanism, assuming an operating speed of about twenty boxes a minute, there was an interval of about only 0.1 second when the form block was stationary and in condition to receive a box, whereas, due to the above described improvements, the present machine, operating at the same speed, provides a period of about .66 second, or about .44 second for a speed of 30 boxes per minute, when the form block is in condition to receive a box.

A skilled operator is able, with the aforesaid old-type machines, to feed to the form-block about twenty boxes per minute, with a box feeding time, as aforesaid, of about .1 second. In accordance with the present invention, however, the time for manually applying a box to the form-block is as long as heretofore, and may be and preferably is several times as great as heretofore, to compensate for the greater labor otherwise imposed upon the operator to feed to the form-block many more, for example thirty, boxes per minute.

It is therefore apparent the speed of the machine in accordance with the present invention corresponds with an output materially greater than twenty boxes per minute, for example, thirty boxes per minute, and there is afforded in each cycle of the form-block a box-feeding period not only as great as the feeding period in the prior slower speed machines, but which may be and preferably is several times as great, in order to ease the operator sufficiently to permit, for example, thirty feeding operations per minute and yet not exceed the average operator's skill or endurance.

The increased length of time in which the form block is in position and in relation to receive a box blank is also of advantage when the boxes and blanks are fed automatically to the form block, since it simplifies the construction and operation of the automatic feeding mechanism.

The period of accessibility of the form block structure, for feed thereto, manually or automatically, of a box and wrapper, includes, in accordance with my invention as embodied in machines of the particular constructions hereinbefore described, the total time, without stopping the machine, elapsing from the time the form block structure is clear of the box-removing means substantially or approximately up to the time when there remains insufficient clearance for admission of the next box to be wrapped.

For brevity in the appended claims, the term "wrapping" is used generically to comprehend the application of wrappers, tabbed or untabbed, or of staying or tabbing material; and the term "box" is used generically to comprehend a stayed, an unstayed box, a box blank, or one or more components of a multipiece box blank.

What I claim is:

1. A box wrapping machine having an output materially in excess of twenty boxes per minute comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, of not less than about 40° of a total cycle of the machine, a plurality of wrapper-applying tools, and mechanism including cam structure constructed to complete the movements of said tools during a total period dissimultaneous with respect to the aforesaid period of accessibility of the form-block structure.

2. A box wrapping machine having an output materially in excess of about twenty boxes per minute comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of dwell or slow movement of said form-block structure, which includes a period during which box structure may be applied, materially in excess of 30° of a total cycle of the machine, a plurality of wrapper-applying tools, and cam structure constructed to complete the movements of said tools during a total period dissimultaneous with respect to the aforesaid dwell or slow movement of said form-block structure.

3. A box wrapping machine having an output materially in excess of twenty boxes per minute comprising form-block structure, wrapper turn-in and presser tools, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, not less than about 40° of a total cycle of the machine, and to provide a turn-in dwell of said form-block structure distinct from said period of accessibility, and mechanism including cam structure to effect completion of the turn-in and pressure movements of said tools in a period within the range from about 100° to 120° of a total cycle of the machine.

4. A box wrapping machine having an output materially in excess of twenty boxes per minute comprising form-block structure, wrapper turn-in and presser tools, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, not less than about 40° of a total cycle of the machine, and to provide a turn-in dwell of said form-block structure of materially less than 140° of a total cycle of the machine, and mechanism including cam structure to effect completion of the turn-in and pressure movements of said tools during said dwell.

5. A box wrapping machine having an output materially in excess of twenty boxes per minute comprising form-block structure, wrapper turn-in and presser tools, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, not less than about 40° of a total cycle of the machine, and to provide a turn-in dwell of said form-block structure, distinct from said period of accessibility, the ratio of whose period to said period of accessibility ranges from about 1.6 to materially less than 7, and mechanism including cam structure to effect completion of the turn-in and pressure movements of said tools within said dwell.

6. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide access to said form-block structure, for applying box structure thereto, for not less than about 40° of a total cycle of the machine, wrapper turn-in and presser tools, and mechanism including cam structure constructed to effect completion of the turn-in and pressure movements of said tools in materially less than 140° of a total cycle of the machine.

7. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a dwell or slow movement of said form-block structure, which includes a period during which box structure may be applied, materially in excess of 30° of a total cycle of the machine, wrapper turn-in and presser tools, and mechanism including cam structure constructed to effect completion of the turn-in and pressure movements of said tools in materially less than 140° of a total cycle of the machine.

8. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide accessibility of said form-block structure, for applying box structure thereto, for a period not less than about 40° of a total cycle of the machine, presser tools, and mechanism including cam structure constructed to effect completion of the pressure movements of said tools in materially less than 140° of a total cycle of the machine.

9. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide for accessibility of said form-block structure, for applying box structure thereto, for a period not less than about 40° of a total cycle of the machine, presser tools, and mechanism including cam structure constructed to effect completion of the pressure movements of said presser tools in about 100° of a total cycle of the machine.

10. A box wrapping machine comprising form-block structure, mechanism including cam structure for reciprocating said form-block structure and constructed to provide a substantial dwell or prolonged slow movement of the form-block structure, which includes a period during which box structure may be applied, not less than about 40° of a total cycle of the machine, presser tools, and mechanism including cam structure constructed to effect completion of the pressure movements of said tools, while said form-block structure is at rest, in materially less than about 140° of said cycle.

11. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a dwell or slow movement of said form-block materially in excess of 30° of a total cycle of the machine, tools for applying a wrapper to box structure on said form-block structure, stripping means for removing a completed box from said form-block structure, means for ejecting a stripped box from said machine, and mechanism including cam structure for completing the operation of said tools, said stripping means and said ejecting means within a total period such that thereafter there remains of said dwell or slow movement a period not less than about 30° of said machine cycle for accessibility

of said form-block structure for applying box structure thereto.

12. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, of not less than 50° of a total cycle of the machine, and to provide a turn-in dwell of said form-block structure distinct from said period of accessibility, turn-in and presser tools, and mechanism including cam structure to effect completion of the turn-in and pressure movements of said tools during said dwell.

13. A box wrapping machine comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, of not less than 50° of a total cycle of the machine, wrapper turn-in and presser tools, and mechanism including cam structure constructed to effect completion of the turn-in and pressure movements of said tools in a period within the range from about 100° to 120° of a total cycle of the machine.

14. A box wrapping machine comprising form-block structure, presser tools, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a prolonged dwell or slow movement, within which the form-block structure is accessible to receive box structure, not less than about 40° of a total cycle of the machine, and mechanism including cam structure for operating said tools and constructed to complete their pressure movements in materially less than about 140° of said cycle and within a period from about two to not more than seven times as great as the period during which said form-block is accessible.

15. A high output box wrapping machine comprising form-block structure, mechanism including cam structure, for operating said form-block structure substantially in excess of twenty machine cycles per minute, constructed to provide in each cycle a period of accessibility not less than 0.2 second, for manual application of a box to said form-block structure, wrapper turn-in and presser tools, and mechanism including cam structure for completing the turn-in and pressure movements of said tools in about 100° of a total cycle of the machine.

16. A box wrapping machine having an output materially in excess of twenty boxes per minute comprising form-block structure, mechanism including cam structure, for reciprocating said form-block structure, constructed to provide a period of accessibility of said form-block structure, for applying box structure thereto, of not less than about 40° of a total cycle of the machine, and a plurality of slide units adjustable toward and from the path of said form-block structure, each of said units comprising a turn-in tool and a presser tool, a system of levers carried by the slide unit and operatively connected to said tools, and mechanism including cam structure for actuating said lever system to complete the movements of said tools during a period within the range of from about 100° to 120° of a total cycle of the machine.

THEODORE A. FEDERWITZ.

CERTIFICATE OF CORRECTION.

June 16, 1936.

Patent No. 2,044,606.

THEODORE A. FEDERWITZ.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 22, after "F" insert a semicolon; line 29, strike out the word "sufficient"; page 5, first column, line 14, for "onstayed" read unstayed; line 67, for "material" read materially; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of December, A. D. 1936.

Henry Van Arsdale

Acting Commissioner of Patents.

(Seal)