Fig. 2.

Fig. 2A.
MULTIPLE FORM MACHINE AND METHOD FOR MAKING PAPER BOXES

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Application May 1, 1953, Serial No. 355,284

5 Claims. (Cl. 93—44.1)

This invention relates to an improved apparatus and method for making containers from flat sheets of bendable material. The particular type of container intended to be made is a paperboard box formed from a flat blank cut and creased to form a bottom wall, two end walls, two side walls and other desired parts such as a cover, partitions, flaps, tabs or the like.

Generally such apparatus has included a stationary magazine containing a plurality of flat blanks, moving mechanisms to feed one blank at a time from the magazine to a stationary forming channel, a plurality of type boxes each reciprocating in a stationary box forming channel, thereby setting up a box around the form box and mechanism for discharging the set up box from the box form after its withdrawal from the channel. A box so formed thus has a bottom wall with four side walls integrally folded therewith the latter being interengaged in various ways well known in the art, such as by interlocking flaps, adhesive tabs, etc.

In the packaging art, rotatable mandrel heads have been used, which follow a path in a horizontal plane, either picking up a paper tube, or forming a paper tube at a first station, feeding a tube bottom at a second station, gluing and pressing the same at subsequent stations and finally discharging the box so formed at some other station.

An object of this invention is to utilize a plurality of form boxes or mandrel heads, each moving intermittently from one station to the next, without excessive vibration and to form a complete box at a single station on the path of the forms rather than requiring a number of operations at several successive stations to complete a box.

Instead of first creating a tube with four connected side walls and then folding in one tube end to form a bottom, in this invention the bottom panel is already formed and the box is created by unfolding integral walls from the bottom panel. Separate bottom forming stations are thus eliminated and the single box setting up station includes a complete box setting up channel mounted to move upwardly into and downwardly out of the closed path of each successive box form.

A further object of this invention is to improve the paperboard forming mechanism of prior devices and to feed individual blanks to each successive box form by bodily moving the entire magazine and stack into and out of the path of the forms.

If the face of the box forms were always in a horizontal plane as in some prior devices, the use of a bodily movable magazine and stack would involve repeatedly lifting the entire weight of the stack up to the face of the form. In this invention the path of the forms is such that the face of each form is in a slightly tilted but substantially vertical plane at the blank feeding station and the magazine with its stack, reciprocates in a substantially horizontal plane while being also slightly tilted thus minimizing the vertical component in the movement of the stack. The heavy blank magazine thus moves substantially horizontally over to the box form carrier and the entire weight of the box form carrier opposes the impact of the box setting up channel thereby protecting the carrier bearings and reducing the power consumed by the machine.

Still another object of the invention is to provide air conduits terminating on the face of each box form and air controls for said conduits. Air is exhausted therethrough to withdraw the end blank from the magazine, retain it during passage through the box setting up station and to offer resistance to the box discharging arms so that the latter will force the locking flaps into full engagement.

Still another object of the invention is to provide novel discharge arms at the box discharging station to effectively remove each blank from the box forms as well as completely interlocking the locking flaps in cooperation with said pneumatic conduits.

A still further object of the invention is to provide an air valve mechanism and apparatus for forming boxes which is completely automatic, simple in operation, and inexpensive to manufacture.

In the drawings,

Fig. 1 is a side elevation with parts broken away from the left of Fig. 2 of a machine constructed according to the invention.

Fig. 1A is an enlarged exploded perspective view of the air valve mechanism of the invention.

Fig. 2 is a front elevation of the machine from the direction of line 2—2 of Fig. 1 with parts broken away.

Fig. 2A is a plan view of one type of blank, having interengaging notched tabs, foldable on this machine.

Figs. 3, 5, 7 and 9 are fragmentary diagrammatic side elevations showing the cycle of operations taking place at each station while the box forms of the invention are temporarily halted by the Geneva motion.

Figs. 4, 6, 8 and 10 are diagrammatic side elevations showing the cycle of operations of the pneumatic control valve mechanism while the box forms of the invention are so halted.

As shown in Figs. 1 and 2, a frame A is provided having oppositely disposed side frame pieces 100 and 101, each having supporting legs such as 102. A suitable platform 104 for an air compressor 106 and a suitable mounting 105 for a motor 107, are provided within frame A. A power pulley 108 is mounted on motor 107 and connected to a pulley 109 by a belt 110, the pulley 109 being mounted on a transverse shaft 111 extending between side pieces 100 and 101. A sprocket 112 also mounted on shaft 111 is powered by pulley 109 and connected by a chain 113 to a larger sprocket 114, the chain passing over a tension sprocket 115. Sprocket 114 is mounted on a shaft 116 upon which are also mounted a sprocket 116, a sprocket 120, a cam 130, a cam 140 and a crank arm 150.

Sprocket 120 is connected by a chain 121 to a sprocket 122 and sprocket 122 powers the Geneva motion 123, 124 which in turn moves the movable carrier or spider C intermittently.

The cam 130 actuates a cam follower 131 connected by a rod 132 to a bell crank lever 133, the lever 133 being pivoted at 134 in side piece 100 and having a long arm 135 and a shorter arm 136. The shorter arm 136 of lever 133 reciprocates the magazine portion of the blank supply means E of the apparatus.

The cam 140 actuates a cam follower and rod 141 which is pivotally connected to the lower end 142 of a lever 143, the other end of lever 143 being fixed on a shaft 144 journaled in side frame pieces 100 and 101. Shaft 144 carries a pair of upwardly extending levers, such as 145, each pivotedly connected at its upper end to a rod such as 146 slideable in guides such as 147. A cross member 148 is provided between the rods such as
146 and the oppositely disposed discharge arms 705 and 706, of box discharging means G, are each mounted at an end of a rod such as 146.

Crank arm 150 is connected by a connecting rod 151 to a rod 152, slideable in guides 153, 154, upon which the forming channel portion of the box setting up means F of the apparatus is carried.

Sprocket 160 is connected by a chain 161 to a sprocket 162 which powers an endless belt, or apron 164, upon which boxes discharged by the apparatus are received and carried away from the machine.

The compressor 106 is of a well known type including a moveable compression tank, gauge and flexible supply pipe 118.

My apparatus can be used with any type of flat box blank capable of being set up into a box by being drawn or forced through a forming channel by force exerted on the bottom panel thereof. For illustration, a blank of this type is shown at B, in Fig. 2A, the blank having a rectangular bottom panel 200, crease lines 201, 202, 203 and 204 at which four wall panels 205, 206, 207 and 208 are articulated and four locking flaps or tabs 209, 210, 211 and 212 suitably cut and creased to hold the walls in unfolded position when the box is set up.

Carrier and forms

The movable carrier and forms of the apparatus are designated generally by C with the carrier comprising a spider 300 having four radial arms 301, 302, 303 and 304 mounted to revolve on a transverse shaft 305 journaled at 306, 307 in side pieces 108, 109 of frame A. The carrier and shaft are revolved intermittently by means of the slotted member 124 of the Geneva motion mounted on shaft 305 and the pin carrying member of the Geneva motion 123 mounted on a shaft 308 powered by sprocket 122.

A plurality of identical box forms 311, 312, 313 and 314 are each mounted at the end of an arm 301, 302, 303 and 304 and it will be obvious that forms with a different surface area may be used for blanks of different sizes.

The blank-engaging face 316 of each box form such as 311 is of substantially the same surface area as that of the bottom panel 200 of the blank B with which it is to be used. The side surfaces 317, 318, 319 and 320 of each box form such as 311 are arranged to closely fit the forming channel portion of the box setting up means F and to cooperate therewith in setting up a box from each blank B.

The box forms 311, 312, 313 and 314 are caused to travel in a closed path by spider 300 and to halt intermittently at each of three operating stations 500, 600, 700 formed at a fourth non-operating station 800 on the path by the Geneva motion 123, 124. The blank supplying station 500 is at the location of the blank supplying means E, the box setting up station 600 is at the location of the box setting up means F and the box discharging station 700 is at the location of the box discharging means G. The closed path of the box forms is in a vertical plane and preferably the plane of the face of each box form is substantially vertical but slightly tilted at the blank supply station.

A plurality of air conduits 331, 332, 333 and 334 are provided, each leading from an air control valve 350 and each terminating in the face such as 316 of each form such as 311. At least one terminal opening such as 417, 418 is provided in said face connected with the conduit for the purpose of applying suction force centrally of the face thereof. As best shown in Fig. 1A control valve 350 is mounted on the shaft 305 and is in synchronization with the movement of the box forms from one station to the next station. The air supply pipe 118 from compressor 106 leads into the non revolving portion 360 of control valve 350 and is retained from revolving with shaft 305 by a screw 361. The opposite end portion 362 of valve 350 is mounted to revolve with the shaft 305 and is provided with four openings 363, 364, 365 and 366, one in each quadrant, and each leading to its respective conduit 331, 332, 333 or 334. A disc 370 is provided between portions 360 and 362, the disc having an elongated arcuate slot 371 therethrough extending through an arc of about 170° and forming an air passage between conduit 118 and such of the openings 363, 364, 365 and 366 with which it connects when oscillated on shaft 305. An additional passage 368 is provided in disc 370, leading to the atmosphere and arranged to break the suction when oscillated opposite an opening such as 363, 364, 365 or 366. The material and fit of portions 360, 362 and 370 of valve 350 is such that there is no leakage of air in all a well known manner.

An arm 380 is fixed to disc 370 and connected by a rod 381 to a bell crank lever 382, the lever having a cam follower 383 actuated by a revolting cam 384 and a return spring 389. Cam 384 is positively connected to the sprocket 162 which powers the endless apron 164 and is thus synchronized with the other moving parts of the apparatus.

The cam 384 is provided with an unraised surface 386 extending about 270° of the circumference thereof and while the follower 383 is in contact with this unraised surface, through three quadrants, the slot 371 connects conduit 118 through openings 363 and 364 to the conduits then located at the supply station 500 and the box forming station 600, as shown in Figs. 6, 8 and 10. In this position of the slot 371 and disc 370 the opening 365 to the conduit to the box discharge station 700 is connected to the atmosphere since it is opposite passage 368 and the opening 366 to the conduit to the box form at the idle station 800 is opposite an unslotted portion of disc 370.

The remaining quadrant of cam 384 is formed with a gradually rising surface 390 ending in an abrupt drop 391 so that the raised surface gradually oscillates disc 370 to cause the body of the disc to cover the conduit to the supply station 500 and to cause the slot 371 to extend to opening 365 of conduit to the box discharge station 700. Thus it will be seen that in this embodiment there is suction at the face of the box form at the forming channel station 600 at all times and no suction at the idle station 800 at all times. While normally open to the atmosphere, there is a short period of suction on the box form at discharge station 700, as indicated in Fig. 4, until the discharge arms have grasped and slightly moved the box on the form. There is suction at the face of the box form at the blank supply station 500, at all times except during this short period when a box is discharged at the station 700, the temporary lack of suction at station 500 making no difference because it occurs while the blank magazine is at a distance from the box form.

As soon as a box has been removed at station 700 and the blank supply magazine has moved up to the form at station 500 the disc 370 is returned to its normal position by cam 384 releasing the suction at the box form station 700 and rotating the slot 371 back to uncover the conduit to the box form at the blank supply station.

Blank supply means

An horizontal platform 501 is provided between frame side pieces 100 and 101 at station 500 and it should be noted that the face such as 316 of each box form such as 311, temporarily halted at this station, is slightly tilted but in a substantially vertical plane. A movable carriage 502, mounted on rollers such as 504, 505, is arranged to reciprocate toward and away from face 316 by means of a cam 516 and is actuated thereby by the shorter arm 136 of bell crank lever 133.

Parallel inclined tracks such as 507, 508 are provided for rollers such as 504, 505, the angle of inclination being arranged to urge the magazine 550 in a direction normal to the face 316 of each form 311 at station 550.

A stack 536 made up of flat blanks such as B each positioned on end so that the blanks are forwardly tilted
but in a substantially vertical plane parallel to face 316 of form 311, is contained in stack bars such as 509, 510. Stack bars 509, 510 are provided with interlocked ends 511, 512 to retain the endmost blank such as 513 against adjusting rod 514, as specified above, to urge the stack downwardly out of the stack bars of the magazine 550. Magazine 550 is supported by a rod 515, adjustably fixed by means of set screw 516 in a guide 517 mounted on carriage 502.

At the top of frame A, a bracket 520 is provided having a guide 531 for a rod 535 and having set screws 522, 523 for adjusting the rod at various angles and distances. A roller 524 is mounted on one end of rod 525 in position to support an articulated cover 250 of a box blank such as B as indicated in dotted lines.

The reciprocable carriage 502, magazine 550 and stack of blanks 538 form the blank supply means E of this invention. Shortly after the Geneva motion 123, 124 has moved a box form such as 311 to station 500, the carriage 502, which has been withdrawn out of the box form path, is moved forward into the path carrying the entire magazine and stack with it until the endmost blank such as 513 contacts the face 316 of a box form such as 311. The face 316 is of the exact size of the bottom of blank 513 in position and makes flatwise contact therewith. Air is immediately exhausted through the openings 417 and 418 in the face of the box form 311, whereby the bottom panel such as 200 of each blank B adheres to the face 316. The carriage 502 together with the entire magazine 550 and stack 538 is then moved rearwardly out of the path of the box forms leaving the endmost blank such as 513 adhered to the face 316 of the box form then at station 500. However, since the interlocked ends such as 511 and 512 of stack bars such as 509, 510 are at the periphery of the blank, and the sucker openings 417, 418 are proximate to one of the bottom panel 200, a bend in the blank takes place as the carriage moves rearwardly. This permits air to enter between the endmost blank such as 513 and the next blank in the stack thus breaking any adhesive force between the two and assuring that only one blank at a time will be fed to the box form such as 311.

I prefer to also use an elongated member such as a rod 960, curved to conform to the path of the forms such as 311 and fixed in position at station 500 by screws 961 so that its free terminal portion lies along the face 316 between said face and the endmost blank in the stack. Thus, in addition to the bends created in the endmost blank above, the rod 960, located adjacent a single exhaust opening such as 417, or between two such openings 417, 418, causes the blank to bend therearound and positively forms an air space behind each of the multiple bows or bends in the blank. Since the end 962 of rod 960 is free, the form 311 and its adhered blank, similarly oriented as they rotate around to the box forming station 600.

Box setting-up means

During the period that a single blank is being fed to a box form such as 311 at station 500, the blank such as B which was fed to box form 312 at station 500, is formed into a complete box at station 600. A rigid, box-forming, or box-setting-up, channel 313 is hinged to the upper end of rod 152 opposite the box form 312 when at its halted position. Immediately after the box form 312, with the bottom panel 200 of a flat blank B adhered thereon, has stopped at station 600, the forming channel 601 which has been withdrawn out of the box form path, is moved upwardly into the path of the box forms by rod 152.

Forming channel 601 may be of any well known rigid type such as are now used in a stationary position with a movable box form which enters therein and sets up a box therewith. In this invention, however, the box form remains in position and the forming channel moves toward and around the box form thereby setting up the flat blank on the box form with no moving parts on the forming channel itself. A pair of first folding plates 605 and 606 are provided forming two opposite sides of the forming channel and each preferably made up of a pair of adjustable elements 607, 608 and 609, 610. Each element such as 607 is provided with an inner longitudinally extending shoulder 611 and is curved outwardly at 612, the shoulders serving to infold the end flaps 206 and 208 more than the locking flaps 209, 210, 211 and 212.

Located below the plane of the lowest points of the curved portions such as 612 of the plates 605 and 606 is a second pair of oppositely disposed folding plates 620 and 621 which form the other two sides of the rectangular setting up channel 601. Each plate 620 and 621 is preferably made up of two or more adjustable elements 622, 623 and 624, 625 and each element such as 623 has an outwardly curved portion such as 626. Plate 621 is located below the plane of the lowest points of the curved portions such as 626 of the elements 624, 625 of plate 620 in order that plate 620 will unfold one side wall such as 205 of blank B before the opposite side wall 207 is unfolded.

As rod 152 raises forming channel 601 up and around a box form such as 312 at station 600, plates 605 and 606 unfold the end walls and the side wall locking flaps, then plate 620 unfolds side wall 205 while infolding locking flaps 209 and 212, and then plate 621 unfolds side wall 207 while infolding locking flaps 210 and 211 into engagement with flaps 209 and 212. A complete box M is thus set up on box form 312 whereupon rod 152 withdraws the forming channel 601 back to its position out of the path of the box forms. Suction is maintained in the face 316 of each box form during its passage from station 500, through station 600 up to station 700 and is maintained for a short interval after arrival at station 700 thus preventing a flat blank B, or complete box M from detaching from the box form during its travel. Station 600 is below the carrier in order that the entire weight of the carrier opposes the upward movement of the forming channel 601 thus reducing the effect on the carrier mounting of the repeated shocks of the box folding operation.

Box discharge means

While the blank supply means E is feeding a blank to a box form 311 and the box setting up means F is forming a box on form 312, the box discharge means G operates to remove the box then on box form 313. It should be noted at this point that blanks such as B depend on the interengaging of notched flaps such as 209, 210 and 211, 212 to keep the box set up and occasionally a flap such as 209 does not completely engage with a flap such as 210 thereby leaving both flaps at a slightly angular relation rather than in straight line continuation of each other. The discharge means of this invention, therefore, not only removes the box from the box form and drops it on the apron 164 but in doing so, positively engages the locking flaps if they are not already in complete interlocking engagement.

Each blank B is positioned in stack 538 so that the flaps 209, 210 and 211, 212 will engage across the end blanks 306 and 308 at the side 318, 328 of each box form such as 311 rather than to the top 317 and at its halted position. Immediately after the box form 312, with the bottom panel 200 of a flat blank B adhered thereon, has stopped at station 600, the forming channel 601 which has been withdrawn out of the box form path, is moved upwardly into the path of the box forms by rod 152.

Forming channel 601 may be of any well known rigid type such as are now used in a stationary position with a movable box form which enters therein and sets up a box therewith. In this invention, however, the box
charge arm 705 while connecting bar 713 is mounted at the end of a rod 714 and carried at the lower end of a discharge arm 706. Each discharge arm 705 or 706 at its upper end is slidable transversely on a transverse extension 148 fixed at the end of a rod such as 146, the rod 146 being slidable in guides 147 affixed to side frame pieces 100, 101. Suitable set screws, not shown, are provided to permit adjusting the discharge arms 705 and 706 transversely on extensions 148 to accommodate box forms of various sizes. When the rods 146 are slid outwardly in their guides 147, arms 705 and 706 move rods 704, 714, bars 703, 713 and hooks 701, 702 and 711, 712 from a position out of contact with box M to a position where the hooks 701, 702, 711 and 712 engage the free ends of flaps 209, 210 and 211, 212 and thence to a position well outside the circular path of the box forms and above the discharge apron 164.

As explained above, the suction on bottom panel 200 is retained at station 700 until the hooks 701, 702 and 711, 712 have engaged the flaps 209, 210 and 211, 212 and have moved such flaps a short distance while the bottom panel is held to the face of the form by suction. The hooks thereby force the flaps into engagement if not already engaged whereupon the suction on bottom panel 200 is automatically released and the hooks continue their function of removing the box from the form such as 313. A counterclockwise 750. Figs. 1 and 9, may be positioned below station 700, and advantageously mounted on a rod 751 in a guide 752 carried by frame A in order to deflect boxes such as M into the position desired on apron 164. Apron 164 has a power pulley 162 and an idler pulley 166 together with a tension pulley 167 all constructed in a well known manner.

A supporting rod 168, having its lower end 169 mounted on frame A and its upper end 170 mounted on a rigid member 180 is provided for supporting pulleys 162, 166 and 167 of apron 164.

As mentioned above in the embodiment described and illustrated herein the box form 314 at station 300 has no blank or box and therefore this station is idle. However, in making certain boxes, such as those sometimes used for frozen foods, a liner of thin water repellent paper is used inside the box. In such case, station 300 is equipped with blank supply means, similar to means E, mounted to reciprocate in and out of the path of the box forms to present the end liner of a stack of flat liners to the face of the forms at station 300. The valve 350 is correspondingly modified by elongating the slot 371 with a tension slot which by-passes opening 363 and extends through another quadrant to opening 366. Thus suction exists on all box forms at all times except that it ceases momentarily at the two supply stations 300 and 800 while the suction is broken at station 700 to discharge a box.

Operation

In Fig. 3, the box forms of this invention are shown just after the Geneva motion has moved spider 309 through a quadrant to present an empty box form at station 500, a flat blank B at station 600 and a complete box M at station 700. The air valve 350 as shown in Fig. 4, at this time has gradually moved disc 370, so that the body of the disc covers the air conduit opening 363 to station 500 and slot 371 uncovers the air conduit opening 365 to station 700. The opening 368, to the atmosphere, which is formed in disc 370 is moved out of operation by the oscillation of disc 370. The conduit opening 366 to station 800 is covered by the body of disc 370 at all times and the conduit opening 364 to station 600 is uncovered by slot 371 at all times. Thus, as shown in Fig. 3, the blank B on box form 312 is adhered thereon by suction and the box M on box form 313 is also adhered thereon by suction.

In Fig. 5 the element 123 of the Geneva motion is shown continuing to rotate while the spider 300 remains halted in position. Blank supply means E, box setting-up means F and box discharge means G have each entered the path of the box forms to perform their various functions. Hooks 701, 702 and 711, 712 of box discharge means G have engaged and completed interlocking of flaps 209, 210 and 211, 212 of box M, the endmost blank 513 of stack 538 is flatwise against form 311 and plates 600 and 606 of channel 601 are upfolding the walls of the blank adhered to box form 312. At this point, valve 350 as shown in Fig. 6 and by reason of cam 384 abruptly moves disc 370 so that slot 371 uncovers the air conduit to station 500 and again exposes the air conduit to station 700 to the atmosphere through passage 368. The bottom panel 200 of box M is thus released from suction at station 800 while the bottom panel 200 of the endmost blank 513 at station 500 is exposed to suction.

In Fig. 7 the element 123 of the Geneva motion is shown still continuing to rotate while the spider 300 remains halted. The cam 384 for valve 350 as indicated in Fig. 8 is also revolving with its unraised surface 386 retaining the disc 370 in its normal position. The blank supply means E is withdrawing out of the path of the box forms with the stack 538 leaving the endmost blank 513 with the central portion of its bottom panel 200 adhered to form 311 and its periphery bent back to create an air space which breaks the adhesion to the next blank in the stack. Figure 9 shows the completed the setting up of flat blank B into a box in cooperation with box form 312 and is commencing to withdraw out of the path of the box forms. The air conduit to station 700 is still open to the atmosphere thus enabling hooks 701, 702 and 711, 712 to move out of the path of the box forms carrying them with the box M.

As in Fig. 9, the element 123 of the Geneva motion has almost completed its circuit while cam 384 is about to commence moving disc 370 of air valve 350 into the position of Fig. 4. It will be apparent that cam 384 is synchronized and shaped to assure that the conduit to station 500 is not covered until after the box form at that station has moved to the next station. Blank supply means E, box setting-up means F and box discharge means G have all returned to their positions out of the path of the box forms leaving the endmost blank 513 flatwise on box form 311, a completed box N on box form 312 and no box on form 313, the box M having dropped onto apron 164.

I prefer to provide a power transfer control device P for the spider 300 of the invention, the device P being associated with the shaft 305 of the slotted wheel 124 of the Geneva motion. The device P includes a bell crank lever 900, pivoted at 901 to a frame piece 100 and having a roller 902 at the free end of the short leg 903 of the lever. A member 906 having identical conaco-convex surfaces 908, 909, 910, 911 in each of the four quadrants of its circumference is fixed on shaft 305 to rotate with spider 300 and member 124. Each surface such as 908 is located between a pair of slots of member 124 and roller 902 engages the surfaces 908, 909, 910 and 911 as they revolve. The longer leg 915 of lever 900 is connected by a spring 916 to frame piece 100 whereby the roller is constantly forced under great pressure against the surface of member 906. As each curved portion such as 908 of member 906 approaches roller 902 the pressure of the roller tends to resist power transfer and increase the load on the Geneva motion. The movement of the carrier, or spider, is thus increasingly resisted as it approaches and stops at a station. As each curved portion such as 908 retreats from roller 902, the loading effect thereof is released and the roller pressure assists the movement of the carrier. The application of a load to the Geneva motion driving mechanism as each box form approaches a station for a halt tends to eliminate excessive vibration and shock and therefore permit higher speed of operation.
1. Apparatus for setting up boxes from flat box blanks of bendable material and having notched interlocking flaps, said apparatus comprising a carrier rotatable about a horizontal axis and having four box forms spaced therearound each with a suction face having central suction openings therein; Geneva motion driving mechanism for halting each box form successively at four stations spaced around the axis of the carrier; blank supply means including a forwardly tilted magazine reciprocating rectilinearly at a slight angle from the horizontal toward and away from the suction face of a box form halted at a blank supply station, said means feeding the endmost blank in the magazine flatwise and feeding said blank during retraction of the magazine; box folding means including a rigid box forming channel, reciprocating rectilinearly at a slight angle from the vertical upwardly toward and downwardly away from the suction face of a box form halted at a box folding station for folding and locking the flaps of a blank adhered thereon; box discharge means including a pair of oppositely disposed pairs of hooks, reciprocating rectilinearly at a slight angle from the horizontal toward and away from the suction face of a box form halted at a box discharge station and positively locking the locking flaps of a box while extracting the box from said box form in a slightly downward direction and suction control means for releasing the suction on the suction faces of said box forms during extraction of a box therefrom, said suction control means including mechanism for releasing the suction on the face of a box form at the box discharge station only after the hooks of said box discharge means have engaged and slightly moved the locking flaps of a box off the form.

2. Apparatus as specified in claim 1 plus an elongated arcuate member having a free terminal portion shaped to conform to the path of a box form around said carrier axis, said member being fixed at said blank supply station and extending between the face of a box form and the adjacent end of said magazine at said station to cause the centre of an endmost blank to bow therearound when adhered to the suction face of the form.

3. Apparatus as specified in claim 1 plus power transfer control mechanism associated with the Geneva motion driving mechanism of said apparatus, said mechanism including a cam member having four identical concavo convex surfaces rotatable with the Geneva mechanism and a spring urged roller engaging said surfaces, for alternately resisting and assisting the transfer of power through said Geneva motion driving mechanism.

4. Apparatus for setting up boxes from flat box blanks of bendable material and having notched interlocking flaps, said apparatus comprising a carrier rotatable about a horizontal axis and having four box forms spaced therearound each with a suction face; Geneva motion driving mechanism for halting each box form successively at four stations spaced around the axis of the carrier; blank supply means including a forwardly tilted magazine reciprocating rectilinearly at a slight angle from the horizontal toward and away from the suction face of a box form halted at a blank supply station and feeding the endmost blank in the magazine flatwise and slightly downwardly to said box form; box folding means including a rigid box forming channel, reciprocating rectilinearly at a slight angle from the vertical upwardly toward and away from the suction face of a box form halted at a box folding station for folding and locking the flaps of a blank adhered thereon; box discharge means including a pair of oppositely disposed pairs of hooks, reciprocating rectilinearly at a slight angle from the horizontal toward and away from the suction face of a box form halted at a box discharge station and positively locking the locking flaps of a box while extracting the box from said box form in a slightly downward direction and suction control means for releasing the suction on the suction faces of said box forms during extraction of a box therefrom, said suction control means including mechanism for releasing the suction on the face of a box form at the box discharge station only after the hooks of said box discharge means have engaged and slightly moved the locking flaps of a box off the form.

5. Apparatus for setting up boxes from flat, bendable, box blanks said apparatus comprising a carrier rotatable around a horizontal axis and having at least three identical box forms spaced therearound, each with a flat suction face; Geneva motion mechanism driving said carrier and adapted to halt each box form successively at a box folding station under said carrier, a box discharge station and a blank supply station; power transfer control means, operatively connected to said Geneva motion mechanism, and adapted to resist the transfer of power therethrough in advance of each station and to assist the transfer of power therethrough in rear of each station, suction control means, operatively connected to said Geneva mechanism, and adapted to maintain suction on the suction faces of said box forms except for a short period of the halt of a box form at said box discharge station, blank supply means, at said blank supply station, including a magazine reciprocating rectilinearly toward and away from the suction face of a box form at said station and a stationary curved rod, positioned between said magazine and face, for feeding a multi-bowed blank to said face; box folding means at said box folding station, including a rigid box forming channel reciprocating rectilinearly and generally vertically toward and away from the suction face of a box form halted at said station for folding a blank on said face into a completed box; and box discharge means at said box discharge station, including a pair of oppositely disposed hooks reciprocating rectilinearly toward and away from the suction face of a box form halted at said station for extracting and discharging a completed box therefrom.

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