

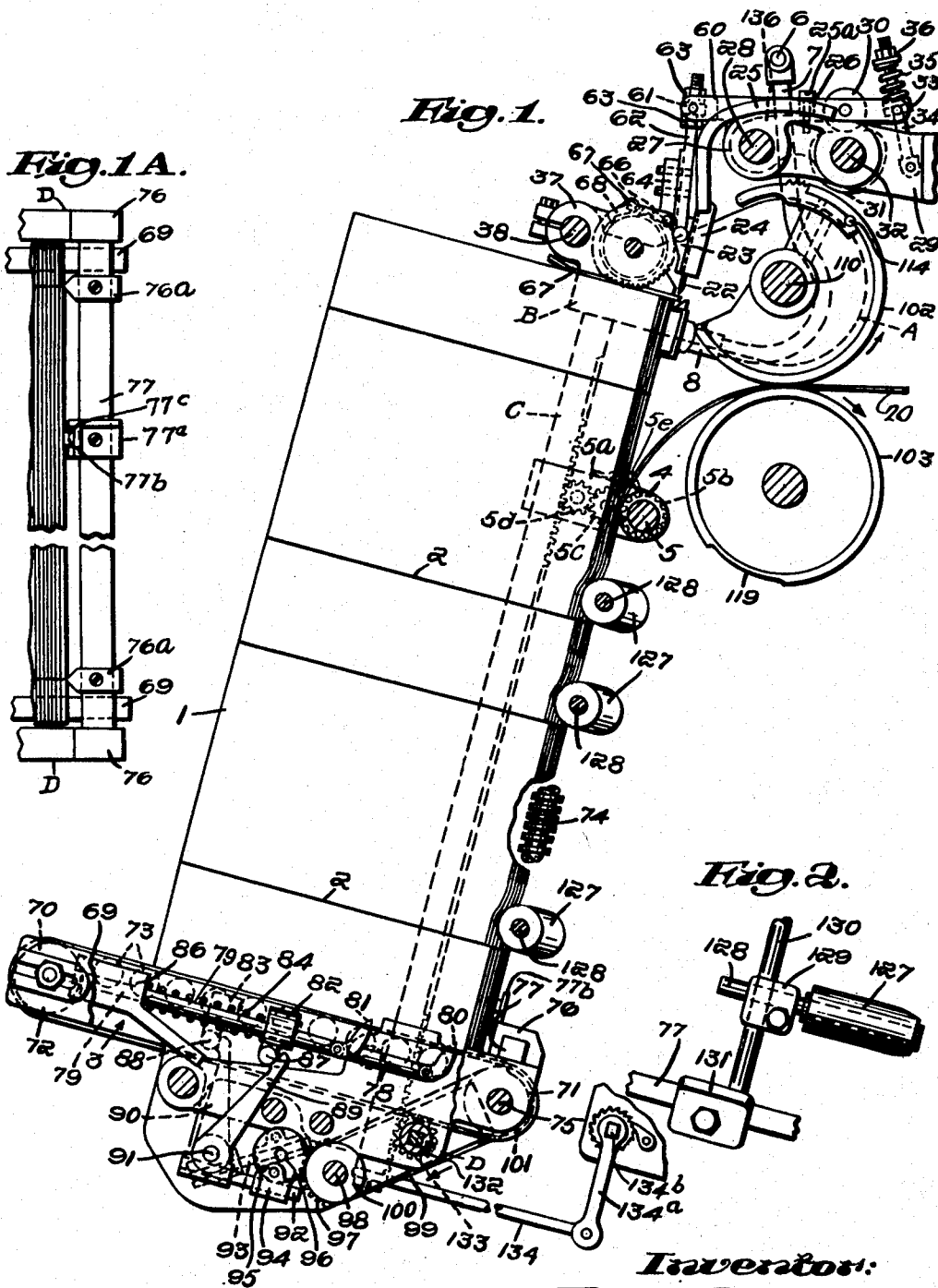
Sept. 21, 1948.

F. H. CHAPMAN
MECHANISM FOR FEEDING SHEETS
OF STIFF FIBROUS MATERIAL

2,449,690

Filed Aug. 21, 1945

4 Sheets-Sheet 1



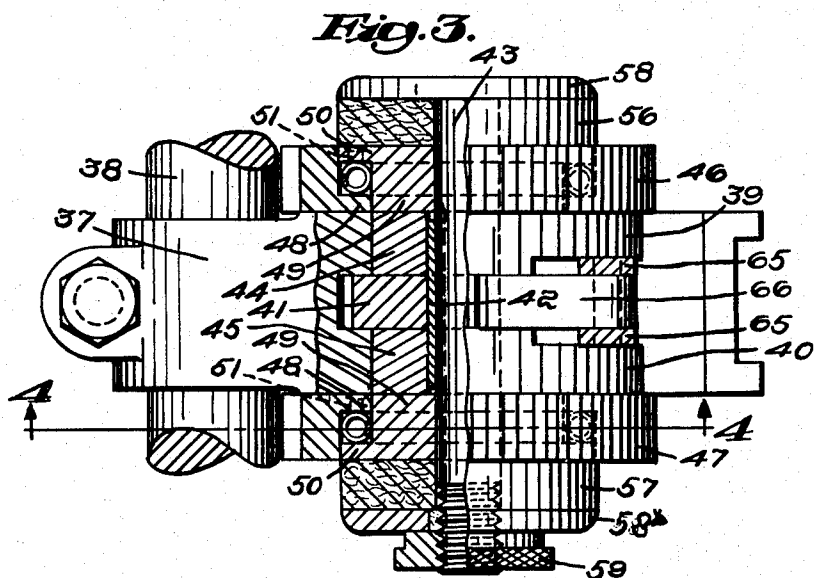
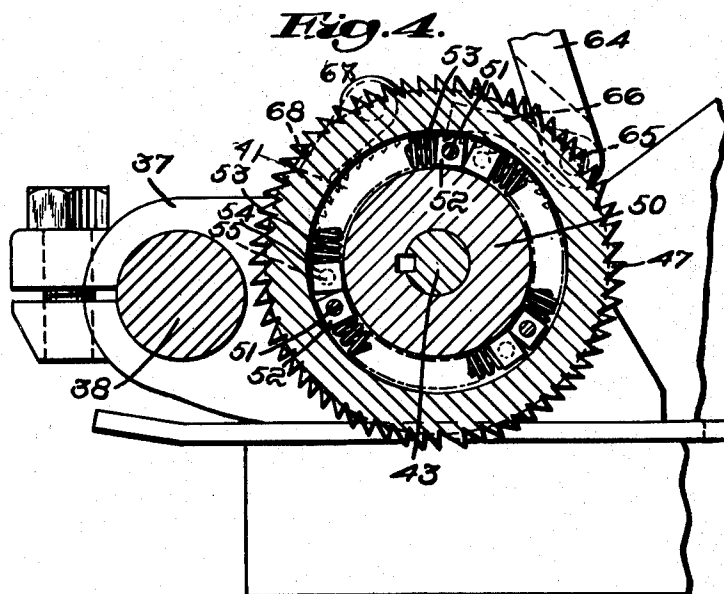
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4 Sheets-Sheet 2



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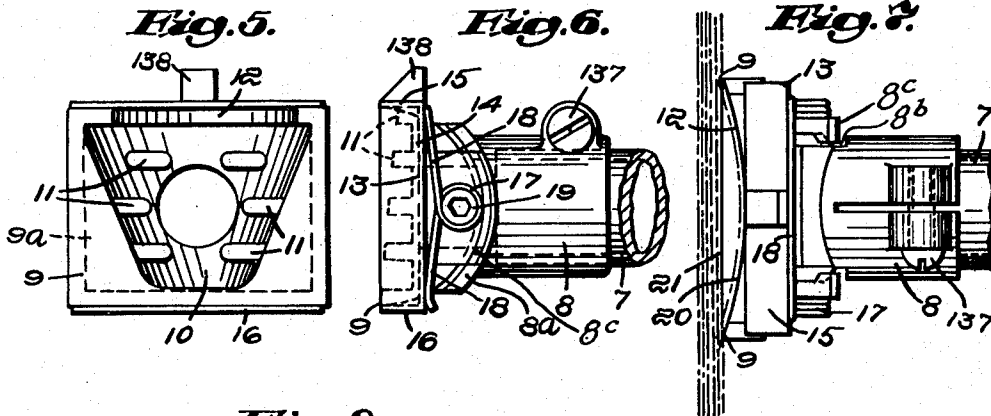
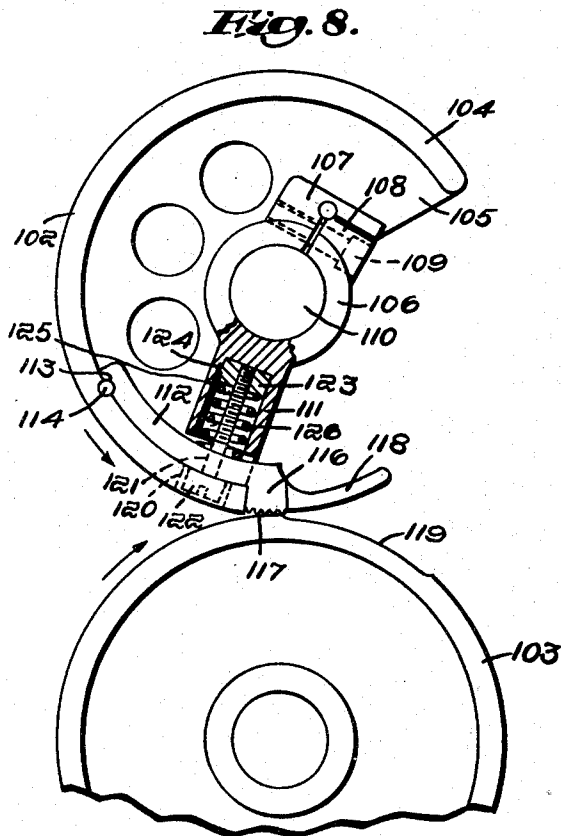
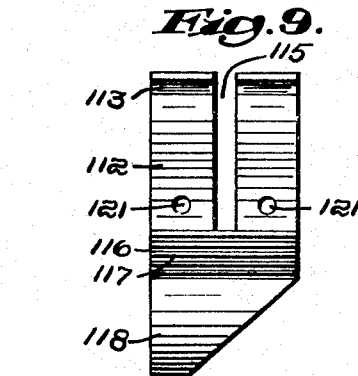
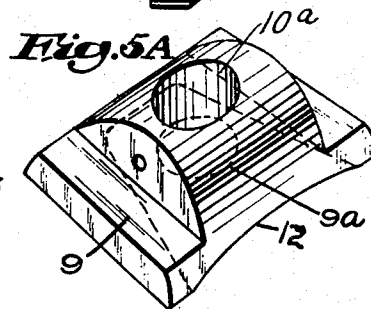
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4 Sheets-Sheet 3



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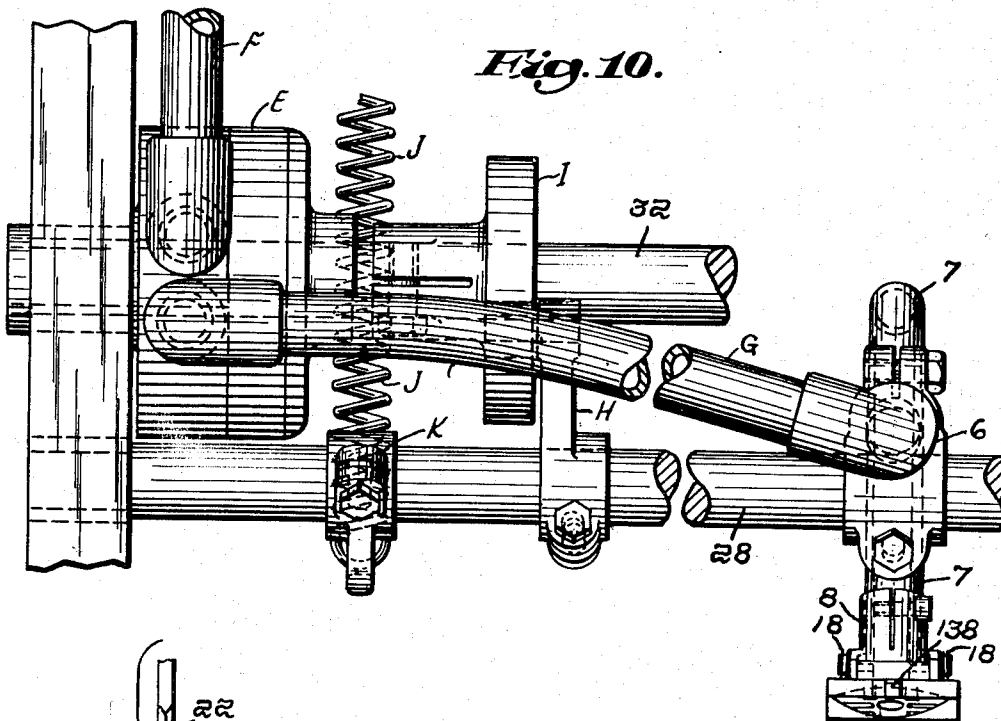
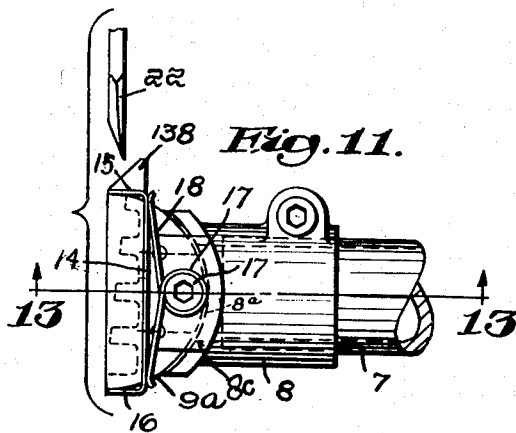
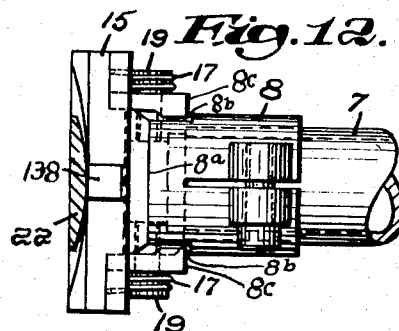
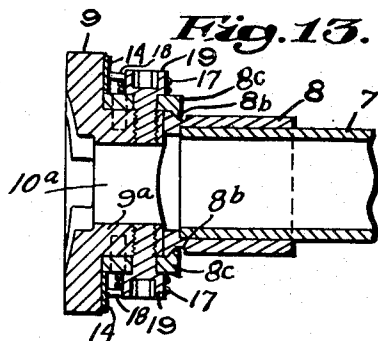
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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MECHANISM FOR FEEDING SHEETS OF
STIFF FIBROUS MATERIAL

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30 Claims. (Cl. 271—26)

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This invention relates to improvements in blank feeding mechanism having means for bending the end portion of the foremost blank of a stack of blanks, such as box blanks, away from the plane of the blank and presenting the same to mechanism for successively forwarding individual blanks.

More specifically the invention relates to blank feeding mechanism of the character described for feeding relatively stiff box blanks of paperboard, or the like, to forwarding mechanism which in turn delivers the blanks successively to box-folding and gluing mechanism. In blank feeding mechanism for forwarding thin blanks, such as those for forming envelopes and the like, suction feeding mechanism has been employed for bending the end of the foremost blank into the path of the forwarding mechanism, but such mechanism is inoperative for the purpose of bending stiff blanks such as box blanks.

If sufficient suction is employed properly to bend stiff blanks, such as box blanks, the degree of suction required has heretofore penetrated through the foremost blank and caused adhesion of the next adjacent blank to it thereby preventing proper deflection of the blank to the forwarding mechanism and is also unsatisfactory for high speed operations of the machine.

One of the objects of the present invention is to provide a suction feed mechanism which will avoid such objection and which will enable more rapid feeding of the blanks than has been heretofore accomplished.

More specifically one of the objects of the invention is to provide movable vacuum mechanism for bending or arching the end portion of the blank away from the next foremost blank before deflection of the end portion toward the blank forwarding mechanism, thus avoiding effective action of the suction mechanism upon the next blank.

Another object of the invention is to provide a construction for supporting a stack slightly inclined to the vertical at a low elevation with respect to the blank forwarding mechanism, thereby enabling the stack to be more readily placed upon its support and providing means for automatically forcing the top and bottom portions of the blank against the mechanism for supporting the stack in such manner as properly to present the upper end of the outermost blank to the movable vacuum mechanism, thereby insuring accurate and uninterrupted forwarding of successive blanks.

Another object of the invention is to provide

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means for preventing deflection of the upper end of the blank next to the foremost blank of the stack during the deflection of the latter and means cooperating therewith to forward the adjacent blanks of the stack into proper position to be engaged by the vacuum mechanism.

Another object of the invention is to provide novel mechanism for advancing the lower ends of the blanks of the stack as successive blanks are withdrawn from the stack operable in conjunction with the mechanism for feeding the top of the blank to maintain the blanks of the stack in proper position for successive removal in the manner above described.

Another object of the invention is to provide means for bending the side flaps of a stack of box blanks in such manner as to prevent interlocking of the same as successive blanks are withdrawn from the stack.

Another object of the invention is to provide novel mechanism for engaging and advancing the upper ends of the blanks of the stack during the depletion thereof.

Another object of the invention is to provide the gripping rolls of the mechanism for forwarding individual blanks with yieldable guiding means for preventing bouncing of the rolls when the end of the deflected blank is gripped thereby to insure accurate forwarding of the blank and to avoid poor registration of the blanks in succeeding operations.

These and other objects and features of the invention will more fully appear from the following description and the accompanying drawings and will be particularly pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which,

Fig. 1 is a view, partially in side elevation and partially in vertical section, of such portions of the stack supporting and feeding mechanism as is necessary to disclose the invention;

Fig. 1—A is a detail plan view showing the abutments for the lower end of the stack of blanks with the foremost blank of the stack engaging said abutments;

Fig. 2 is a detail view of one of the devices for bending the flap portions of the box blanks to prevent interlocking of the flaps thereof during withdrawal of the foremost blank from the stack;

Fig. 3 is an enlarged view, partially in horizontal section, of the mechanism for engaging the top of the blanks of the stack and advancing the same;

Fig. 4 is a view, partially in vertical section and partially in side elevation, of the mechanism shown in Fig. 3;

Fig. 5 is an enlarged view of the face of the suction head for engaging the end portion of the foremost blank of the stack;

Fig. 5—A is a perspective view of the suction plate in reverse position to illustrate the arched portion of the face leading to the suction chamber;

Fig. 6 is an enlarged side elevation of the suction head shown in Fig. 5;

Fig. 7 is an enlarged plan view of the suction head illustrating a portion of the foremost blank arched or spaced away from the next succeeding blank after suction has been applied to the suction head;

Fig. 8 is an enlarged view of the cooperating rolls of the blank forwarding mechanism showing a yieldable segment for guiding the end of the deflected blank into the bite of the cooperating rolls;

Fig. 9 is an enlarged view of the yieldable segment of the forwarding rolls.

Fig. 10 is a detail plan view of a portion of the machine illustrating usual mechanism for applying suction to the suction head;

Fig. 11 is a side elevation of the suction head and the raised position of the stop blade for preventing deflection of the blank next adjacent to the foremost blank at the time the suction head engages the foremost blank, but before deflection thereof;

Fig. 12 is a plan view of the same illustrating the position of the stop blade relatively to the suction head when the blade is in depressed position;

Fig. 13 is a horizontal sectional view on line 13—13 Fig. 11.

Inasmuch as the present invention relates to special mechanism for supporting a stack of blanks, preferably box blanks, deflecting the end portions of the foremost blank and presenting it to mechanism for successively feeding the individual blanks of a well known type of mechanism, in which the frame mechanism and driving mechanism may be of a usual character, only such parts are shown as concern the present invention.

The feeding mechanism embodying the present invention is illustrated herein as applied to a folding machine having complementary gripping members for engaging the deflected end of the foremost blank of the stack thereof and forwarding it to folding mechanism, or other mechanisms for performing subsequent operations upon the machine.

The holder or magazine for supporting a stack of blanks comprises a rigid frame having like end brackets A, preferably of partially cylindrical form, located adjacent the respective side frames of the folding machine and pivotally mounted upon the shaft of the upper gripping roll. Each of the brackets is provided with a flat extension B in which straight bars C are fixedly mounted. The bars C, which are straight and are provided on one side with rack teeth, extend through vertically movable brackets D upon which are mounted a frame extending at right angles thereto upon which means are provided for supporting the lower end of a stack of blanks and progressively advancing the same to position the lower end of the foremost blank properly for withdrawal from the stack.

Means hereinafter described are provided for

adjusting the brackets D upon the bars C to support blank stacks of different lengths, with the upper end thereof in proper position to enable the upper end of the foremost blank to be deflected into the bite of the gripping rolls. Means also hereinafter described are provided for positioning the magazine at such desired angle to the vertical as may be required most effectively to enable the upper end of the foremost sheet to be deflected into the bite of the gripping rolls.

As illustrated in the drawings a stack 1 of box blanks, which blank is provided with suitably spaced slits 2 extending inwardly from opposite edges thereof and defining the side walls and end tabs of a box. The stack is suitably mounted at its lower end upon relatively adjustable spaced frame bars 3 carried by the adjustable bracket D which is suitably adjusted to height and inclination to enable the upper end of the foremost blank properly to be deflected into the bite of the gripping rolls. A cylindrical sleeve 4 is rotatably mounted upon a shaft 5 carried by brackets 5a which are adjustably mounted upon the parallel bars C in order that the rotatable sleeve 4 may be located in a proper position to provide an anti-friction guide so located as to insure proper deflection of the upper end portion of the foremost blank into the bite of the gripping rolls.

Any suitable means may be provided for adjusting the brackets 5a. As illustrated herein the shaft 5 has fixedly secured to it gears 5b which mesh with intermediate gears 5c which mesh with gears 5d which engage the racks upon the bar C, the shafts of the gears 5c and 5d being journaled in the bracket 5a. Suitable means (not shown) are provided for rotating the shaft 5 to cause the brackets 5a to travel along the bars C with suitable means, such as a pawl 5e adapted to engage the teeth of the gear 5b provide means for locking the gears against rotation when the brackets 5a are properly adjusted.

Oscillating vacuum mechanism is provided for engaging successively the upper end portion of the foremost blank of the stack and deflecting it into the bite of the gripping rolls which thereupon draw the foremost blank of the stack over the sleeve 4 and draw it from the stack.

The vacuum mechanism comprises a flexible, preferably rubber, tube leading from a suction pump and connected to a metal union 6 which in turn is fixedly connected to a steel tube 7 having a curved portion extending around and avoiding the shaft of the upper gripper roll and terminating in a straight portion which is substantially perpendicular to the plane of the foremost blank of the stack. The suction head is so secured to the end of the pipe 7 as to permit the flat face thereof to be adjusted in parallelism to the face of the outermost blank of the stack when brought into contact therewith.

The face of the suction head is deformable in such manner as to longitudinally arch the end portion of the foremost blank engaged by the suction head away from the next adjacent blank when suction is progressively applied without permitting the suction to displace the next adjacent blank. The suction head as illustrated in the drawings comprises a split cylindrical sleeve 8 which embraces the end of the steel pipe 7 and is adapted to be clamped thereon in rotatably adjusted positions by a suitable screw, as shown in Figs. 6 and 10 to 13 inclusive.

The sleeve 8 is provided with an adjustable suction plate 9 which can be positioned effectively to engage the face of the foremost blank of an

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inclined stack of blanks the inclination of which to the vertical is adjustable.

In the construction shown in the drawings the sleeve 8 has a generally rectangular arcuate end portion 8a having a cylindrically concave face with parallel flat walls at the ends of the concave face and inwardly extending arcuate grooves 8b adjacent to and concentric with the curvature of said face. The suction plate 9 is of rectangular form having a generally flat surface to engage the foremost sheet of the stack of blanks and is provided with a cylindrically curved central boss complementary to and adapted hermetically to fit the concave surface of the rectangular end portion of the sleeve 8. The rectangular suction plate extends beyond the ends of the cylindrically curved boss and is provided with flat upper surfaces parallel to the portions of the surface which engage the blank. The suction plate 9 is secured to the suction head by parallel clamping plates 9c having inwardly extending wedge-shaped flanges adapted to engage the grooves 8b in the suction head and are clamped upon the suction head by diametrically opposite screws passing through the clamping plates 9c and anchored in the ends of the cylindrically curved boss 9a. By reason of this construction the angular position of the flat face of the suction plate 9 can be adjusted about its horizontal axis to conform accurately to the plane of the foremost blank of the stack.

The suction plate 9 is provided with a preferably conoidal suction chamber 10 progressively increasing in width toward the upper end of the suction plate and a central aperture in the boss 9a communicates with the suction head. A plurality of projections 11 extend from the wall of the chamber 10 in progressively decreasing distances toward the wider end of the suction chamber to engage the arched end portion of the foremost blank as it is deflected by the suction applied thereto. The upper wall of the suction plate 9 is provided with an inwardly arched portion 12 and a suitable yieldable valve is provided for excluding air from entering the suction chamber 10 when suction is initially applied to the foremost blank of the stack, but which will gradually yield to permit admission of air to the suction chamber as suction is increased.

The preferred form of valve which is illustrated herein comprises a sheet metal member 13 having parallel plates 14 which normally engage the flat surfaces of the extensions of the suction plate 9 and are integrally connected to parallel walls 15 and 16 which are at right angles to the plates 14 and slidably fit respectively the upper and lower ends of the suction plate 9. The plates 14 are normally held in engagement with the rear surface of the valve plate by springs having central coils 17 and oppositely extending arms 18 which engage the respective plates 14. The coils 17 encircle the clamping screws 19 which clamp the boss 9a of the suction plate to the end portion of the sleeve 8 as above described. The screws 19 serve the double purpose of forming a pivot for the coil 17 of the spring and also for clamping the boss 9a of the suction plate in such adjusted position that the flat face of the suction plate will tightly engage the foremost blank of the stack when in contact therewith.

When the suction pipe 7 is moved forwardly so that the flat face of the suction plate 9 engages the face of the foremost blank of the stack the spring members 18 will cause the wall 15 of the valve to close the arched recesses 12 in the suc-

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tion plate. When suction is applied the engaged portion 20 of the foremost blank will be bent or arched away from the next adjacent blank 21 into arched form, as shown in Fig. 7, the valve 13 thereby yielding against the pressure of the spring arms 18 as illustrated in Fig. 7 so that the arched portion of the foremost blank will be separated from the next adjacent blank and arched outwardly to the top end of the blank, thereby making a space for the entrance of a stop blade or finger which will prevent possible deflection of the next adjacent blank 21 of the stack. When the valve member 15 engages the face of the foremost blank the arch-shaped aperture to the suction chamber is closely sealed but as the foremost blank is arched by the suction a small amount of air will enter the suction chamber as the suction increases so that no sufficient suction will pass through the foremost blank to cause adhesion of the next adjacent blank to it. When however the engaged portion of the foremost blank is sufficiently bent to engage the curved wall of the arch of the suction plate further entrance of air to the suction chamber will be prevented and the full effect of suction upon the outermost blank obtained.

The subsequent movement of the suction pipe 7 away from the stack will then deflect the upper end portion of the foremost blank into the path of the gripping rolls of the individual blank forwarding mechanism. By reason of this construction the feeding mechanism will operate with such accuracy as to permit the forwarding of individual blanks at high speed.

Desirably means are provided for positively restraining the upper end of the next foremost blank of the stack from displacement as the upper end of the foremost blank is deflected and to insure that the next adjacent blank will be held in proper position for the subsequent operation of the suction feeding mechanism. In the construction shown in Fig. 1 this is accomplished by the insertion of a stop finger or blade into the bent or arched face between the foremost blank and the next adjacent blank produced by the action of the suction head. As illustrated a blade 22 is fixedly secured to a slide 23 which is mounted in a guideway in a rectangular block 24 which is integrally secured to a plate having bifurcated arms 25 which are curved concentrically with the axis of the upper gripping roll and which are adjustably secured by bolts 25a to a similarly curved upper edge of yokes having downwardly extending bosses and which are fixedly secured to opposite sides of the bracket 29 extending from the frame of the individual blank forwarding machine. The finger or blade 22 is actuated by a lever 26 which is connected at one end by a link 27 to the slide 23 and is fulcrumed upon a rock shaft 28 which extends through the bracket 29 and one of the pairs of bosses of the yoke. The opposite arm of the lever 26 is provided with a roller 30 which engages a cam 31 upon the continuously rotating shaft 32. The end of the lever 26 beyond the roller 30 is pivotally connected to a cross head 33 which is slidably mounted upon a rod 34 and a spring 35 which is interposed between the cross head 33 and a nut and washer 36 upon the rod holds the roller 30 in engagement with the cam 31. The cam is provided with a flat face which normally permits the spring to hold the blade 22 above the upper end of the stack. The cam however is provided with a circular face which upon rotation of the cam forces the cam roller upwardly, thereby depressing the blade 22

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into the recess between the outermost blank and the next adjacent blank and in contact with the latter, thereby preventing the possibility of deflection of the upper end of the next adjacent blank. The rock shaft 28 has fixedly secured to it a rearwardly extending arm 136 in which the steel suction tube 7 is mounted, and the rock shaft is oscillated from a suitable cam upon the continuously rotating shaft 32 in synchronism with the reciprocating movement of the finger or stop 22.

In order to prevent the possibility of injury to the blade or suction head in the event of proper relative movements as above described the upper wall 15 of the valve has secured to it a deflector 133 positioned centrally of the length of the member 15 and sloping downwardly and forwardly to the front edge thereof adapted to be engaged by the stop blade 22 in the event of improper operation and as the blade is inserted into the recess 12 in the valve plate to force the valve rearwardly against the pressure of the spring 18 thereby avoiding injury to the parts which might otherwise occur.

Any suitable mechanism may be provided for oscillating the suction head and suitably applying suction therethrough to deflect the upper portion of the foremost blank of the stack and present its end to gripping rolls for drawing it from the stack and no claim is made herein to mechanism for oscillating the suction head. A usual form of mechanism which is employed in the present construction is illustrated in Fig. 10 and comprises a suitable rotary valve mechanism E which is mounted upon the continuously rotating shaft 32, the valve having an inlet pipe F communicating with the suction pump (not shown) and a flexible pipe G leading from the valve E to the union 6 which as illustrated in Fig. 10 is fixedly secured to the rock shaft 28. The union 6 supports and communicates with the upper end of the curved pipe 7 upon the lower end of which the suction head (embodying certain of the novel features of the present invention above described) is mounted.

The means for actuating the rock shaft 28 comprises a rearwardly extending arm H having a follower roll which engages a cam I which is adjustably clamped upon the continuously rotating shaft 32 and desirably is held accurately in contact with the cam I by a spring J connected at one end to an arm K on the shaft 28 and at its other end to a stationary member of the machine (not shown) as in usual constructions. The relative timing of the cam I and the cam 31 is such that immediately after the suction head is applied to the foremost sheet and moved rearwardly to deflect the upper end thereof the stop 22 will be thrust downwardly into engagement with the outer face of the next foremost sheet thereby preventing deflection thereof.

In the present invention means are provided for advancing the blanks of the stack in such manner as accurately to present the foremost blank of the stack properly to the suction operated mechanism for deflecting the upper ends of the foremost blank. Such mechanism includes means for advancing the upper end of several of the foremost blanks of the stack and also means for advancing the lower ends of the stack with means for insuring proper positioning of the foremost blanks of the stack.

The mechanism for advancing the upper end of the foremost blanks of the stack is shown in Fig. 1 and in detail in Figs. 3 and 4. This mechanism

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comprises a bracket 37 which is clamped upon a cylindrical bar 38 which is fixedly mounted at its ends in the side frame of the machine (not shown), the bracket 37 being adjustable longitudinally of the bar 38 and also rotatable thereon.

The bracket 37 has integral spaced cylindrical arms 39 and 40 which form bearings for an intermittently rotatable shaft and means actuated thereby for frictionally rotating the feed wheels. As illustrated a ratchet 41 is secured by a key 42 to a shaft 43 to which is also keyed cylindrical journal disks 44 and 45 which are journaled in the cylindrical bearings of the arms 39 and 40 of the bracket 37. The toothed feed wheels 46 and 47 are of annular form and engage the outer faces of the cylindrical bracket arms 39 and 40. Each of the annular toothed wheels is provided with an inwardly extending flange 48 within which is a hub 49 having an outwardly extending flange 50 which fits within the inner periphery of the feed wheel. The flanges 48 and 50 are so spaced from each other and the hubs from the inner periphery of the feed wheel as to provide an annular channel of rectangular cross section as shown in Fig. 3. The flanges 50 of the respective hubs 49 are provided with three equally spaced studs 51 upon each of which is secured a rectangular block 52. Coiled springs 53, which are enclosed in the channel in the spaces between the blocks 52, abut at one end against the blocks 52 and at their opposite ends against similar blocks 54 which are secured by studs 55 to the respective flanges 48 of the toothed annular feed wheels 46 and 47 respectively. Washers 56 and 57 of frictional material, such as leather, engage the outer faces of the hubs 49.

As illustrated in Fig. 3 the frictional member 56 is interposed between a flat head 58 integral with the shaft 43 and the outer end of the adjacent hub 49 on the shaft 43. The other frictional member 57 is interposed between a flat plate 58x which is keyed to the shaft 43 and the outer face of the adjacent hub 49 upon which the other toothed member 47 is rotatably mounted. The end of the shaft 43 is screw threaded and extends through the washer 57 and plate 58x and a milled nut 59 which is mounted on the screw threaded end of the shaft 43 is provided with a hub which engages the outer face of the plate 58x. By suitably rotating the nut 59 the frictional members 56 and 57 may be adjustably forced against the respective hubs 49 to produce a frictional thrust against the disks 44 and 45 respectively to produce the desirable frictional resistance.

By reason of such adjustment the frictional transmission from the driven shaft 43 and the feed wheels may be so regulated that the feed wheels will exert such normal pressure upon the upper ends of the foremost blanks of the stack as properly to position the foremost blank in engagement with the suction head of the blank deflecting mechanism.

The springs which are interposed between the hubs 49 and the annular feed wheels 46 and 47 will permit such further rotary yielding movement of the feed wheels as may be required when the foremost blank is engaged by the suction head as will insure hermetic sealing of the suction head upon the foremost blank.

Any suitable mechanism may be provided for rotating the feed wheels 46 and 47 in correlation to the movement of the stop member 22 which engages the face of the blank next to the foremost blank which has been bent away from it

by the initial action of the suction mechanism. In the construction illustrated herein the lever 26 is provided with a bifurcated end 60 in which a block 61 is pivotally mounted and has a vertical aperture through which a rod 62 extends and is longitudinally adjustable therein by nuts 63 and 63x, upon the screw threaded upper end of the rod and which engage the upper and lower surfaces of the block 61. The lower end of the rod 62 is pivotally connected to the slide 23 in which the stop blade or finger 22 is mounted.

The rod 62 has a flat face to which is adjustably secured a block 64 having at its end a pin 65 (Fig. 4) upon which is pivoted a spring actuated pawl 66 which engages the teeth of the ratchet disk 41. A spring actuated dog 68, which is pivotally mounted upon a boss 67 on one of the bracket arms, engages the teeth of the ratchet 41 to prevent reverse rotation of the ratchet 41. The rotation of the cam shaft 32 is so timed with the operation of the vacuum mechanism that when the suction head has engaged the upper end portion of the foremost blank and vacuum applied to bend or arch the engaged portion away from the normal plane of the blank the lobe of the cam 31 will raise the cam roller 30 and the end of the lever 26 against the action of the spring 35 and depresses the other end of the lever so that the rod 62 which is pivotally attached thereto will force the slide 23 downwardly and cause the finger or blade 22 to enter the arched space of the foremost blank and engage the face of the next adjacent blank and will remain in such position during the deflection of the foremost blank and until the suction head again engages the then foremost blank. The cam follower 30 will then ride upon the flat face of the cam and the spring 35 press the adjacent end of the lever downwardly thereby causing the end 60 of the lever 26 to raise the rod 60 to remove the finger 22 from engagement with the then foremost blank. As the slide 23 is thus raised the pawl 66, which is pivoted to it, rotates the ratchet in a direction to cause the feed wheels 46 to advance the foremost blanks of the stack against the suction head. By reason of the action of the springs 53 intermediate of the hubs 44 and the annular feed wheels 46 and 47 respectively the foremost blanks of the stack will be permitted to yield in response to the pressure of the suction head upon the foremost blank in such manner as to insure a substantially hermetically sealed engagement between the suction head and the foremost blank.

Means are provided for forwarding the stack and the foremost blanks thereof in coordination with the top feed mechanism to position the stack properly for successive withdrawals of the foremost blank of the stack.

In the construction illustrated the lower ends of the flaps of the blanks of the stack rest upon parallel spaced endless conveyors 69 which are mounted upon pulleys or sprockets 70 and 71 carried by the frame 3. The shaft 72 of the pulley 70 is adjustably secured in slotted ends of the frame members 3. A series of closely associated rollers 73, which are journaled in the frame members 3, underlie and support the conveyors 69 and the lower ends of the blanks. The pulleys or sprockets 71 are fixedly secured to a shaft 75 which is continuously driven by suitable gearing including the worm shaft 74 extending in parallelism with the blanks of the stack and is movable with the stack about the axis of the upper gripping roll.

The lower frame members 3 are provided at their rear ends with bosses 76. A rectangular bar 77, which is mounted in the bosses 76, has adjustably mounted upon it abutment members 78a which engage the foremost blank at the longitudinal score line which define the folds for the respective flaps and around which the flaps of the foremost blank are bent by the conveyor 69 to avoid interlocking with the flaps of the next adjacent blank as the foremost blank is withdrawn from the stack. The bar 74 has also mounted upon its central portion an adjustable bracket 77a provided with an upward extension 77b in which a preferably adjustable friction member, such as a rubber plug 77c, is mounted. This plug is adapted to engage the lower central portion of the foremost blank and when the foremost blank is being withdrawn from the stack frictionally to engage the next adjacent blank and prevent it from being also drawn upwardly with the foremost blank.

In order to insure that the outermost blank of the stack is properly held in contact with the central frictional abutment 77c, supplemental feeding mechanism is provided for engaging and advancing the central portions of several of the foremost blanks of the stack. This is accomplished in the construction illustrated by two parallel, alternately movable, preferably tubular, rods 78 and 79 which are suitably mounted in the frame 3 and are respectively provided at their forward ends with pivotally mounted sharp edge spring actuated fingers 80 and 81 adapted to be inserted between the lower ends of adjacent sheets when the fingers are moved toward the abutment and to be withdrawn from such engagement when the rods are respectively moved in the opposite direction. Brackets 82 and 83 are respectively secured to the rods 78 and 79 and spiral springs 84, which surround the respective rods, abut at one end against the respective brackets, and at their opposite end against a suitable abutment 86 extending transversely of the frame 3. The brackets 82 and 83 are respectively provided with downward extensions having laterally extending cylindrical bosses 87 and 88 which are engaged respectively by the upper ends of bell crank arms 89 and 90 the hubs of which are mounted upon a shaft 91 extending transversely of the frame 3. The other arms of the bell crank levers are in the form of cylindrical rods 92 and 93 upon each of which is a cross head 94 provided with an upwardly extending boss which is pivotally connected to a pin extending outwardly from a disk 95 which is fixedly secured to a shaft 96 mounted in suitable bearings (not shown) in the frame. The bell crank levers are positioned in angular relation to each other and the pins upon the respective disks are in substantial diametrically opposite relation to the axis thereof. The shaft 96 is provided intermediate of the discs 95 with a gear which is driven by a gear 97 fixedly secured upon the shaft 98 which is driven by a belt or chain 99 embracing a pulley or sprocket 100 fixedly secured to the shaft 98 and a complementary pulley or sprocket 101 which is fixedly secured to the driven shaft 75 heretofore described.

By reason of the construction above described the conveyors which support the lower end of the stack are driven at a speed which will advance the lower end of the stack at approximately a rate which will press the flaps of successive foremost blanks against the abutment 76a. In the meantime the gear 97 will rotate the respec-

tive gears 96 and thereby oscillate the arms 89 and 90 of the bell crank levers alternately to force the cross heads 82 and 83 outwardly thereby withdrawing the fingers 80 and 81 alternately outwardly at which time they will by the yielding movement of the respective springs ride along the lower edges of the blanks of the stack. When the respective arms 89 and 90 are moved in the opposite direction by continued rotation of the gears 96 the springs 84 and 85 will force the cross heads 82 and 83 respectively forward, thereby causing the fingers 80 and 81 alternatively to penetrate between the lower edges of the foremost blanks of the stack and yieldingly press them forwardly into proper engagement with the central abutment member 77c.

By reason of the coordination of the movements of the feeding mechanism with the lower end of the stack and the feeding mechanism which engages the upper end of the blanks of the stack, the foremost blanks of the stack are always held in proper position to enable the upper portion of the foremost blank to be engaged by the oscillating suction mechanism and to be deflected thereby into the bite of the gripping rolls of the individual blank forwarding mechanism which will then withdraw the foremost blank from the stack.

Another object of the invention is to provide mechanism for forwarding individual blanks with means which will effectively engage the end of the blank presented to it and insure proper forwarding and registration of the blanks by avoiding the jumping action which is likely to occur when the end of a deflected blank is engaged by the gripping rolls.

A preferred construction for accomplishing this purpose is illustrated in Figs. 1, 8 and 9. The gripping mechanism of the individual blank forwarding means heretofore mentioned comprises a pair of upper rolls 102 narrowly spaced apart to permit the oscillation of the suction pipe 7 and its suction head 8 therebetween and a complementary pair of lower rolls 103 the shafts of the rolls 102 being mounted in yieldable bearings. Each of the upper rolls 102 has a wide cylindrical periphery 104 having centrally of its width a web 105 provided with a split hub 106 having radially extending bosses 107 and 108 which are clamped together by a set screw 109 upon the shaft 110 as shown in Fig. 8. The web is also provided upon opposite sides with radial cylindrical hollow bosses 111 which extend toward but terminate short of the cylindrical periphery 104. A gripping segment 112, which conforms to the inner circumference of the cylindrical periphery 104, is provided adjacent one end with a transverse semi-cylindrical recess 113 (Fig. 9) adapted to engage a pin 114 which is seated in a complementary recess in the inner circumference of the cylindrical periphery 104 (Fig. 8), the segment being provided with a longitudinal slot 115 which slidably fits the web 105.

The segment 112 is provided at the end of the slot 115 with an integral section 116 having a serrated face 117 which is substantially continuous with the outer cylindrical surface of the periphery of the roll 102 and has an integral substantially triangular finger 118 which extends beyond the serrated surface in an arc which is concentric with and of slightly shorter radius than that of the cylindrical periphery of the roll. The inner edge of each of the triangular extensions lies closely adjacent to the path of the suction head so that the narrow ends of the exten-

sions will properly engage the end of the foremost blank as it is presented to the gripping rolls in such manner as not to interfere with the accurate and speedy operation of the machine.

The segment 112 is provided with bores 121 of smaller diameter than the bores 120 and screws 122 having heads which substantially fit within the bore 120 have shanks which extend through the bore 121 in the segment and at their ends engage the bases of the bores in the respective bosses. Suitable nuts 123, which engage the threads of the screws, are provided with one or more lateral projections 124, which engage suitable longitudinal grooves 125 in the walls of the bosses prevent rotation of the nuts when the screws are rotated. Springs 126 are interposed between the cross head 123 and the inner periphery of the segment 112. By rotating the screws 122 the nuts 123 may be moved radially so that the force of the respective springs pressing upon the segment can be accurately adjusted to provide the proper yield of the segments to grip the end of the blank and bring said end of the blank into proper engagement by the cylindrical peripheries of the cooperating feeding members without producing any bounce which might otherwise occur in the absence of the yielding segment.

Inasmuch as the edges of box blanks are provided with inwardly extending slits 2 of proper depth to enable the sides of the boxes to be folded by subsequent machines, as heretofore described, means are provided in the present invention for preventing interlocking of such flaps of the foremost blank with those of other blanks as it is being withdrawn from the stack. The mechanism for accomplishing this purpose illustrated in Figs. 1 and 2 comprises a plurality of rollers 127 which are rotatably mounted on shafts 128 mounted in split bearing blocks 129 which are adjustably clamped upon rods 130 which extend in parallelism with and rearwardly of the foremost sheet of the stack. The respective rollers desirably are positioned slightly above the slits 2 in the edges of the blanks and at such inclination to the plane of the face of the outermost sheet as to bend the edge portions of the foremost blanks of the stack forwardly just above the respective slits sufficiently to prevent the interlocking of the upper edge of one or more of the sections of said foremost blank, defined by the slits thereof with the lower end of the corresponding section of the next adjacent blank defined by the slit thereof as the foremost blank is drawn from the stack by the gripping rollers 102 and 103.

The lower ends of the shafts 130 are respectively mounted in and rigid with blocks 131 which are adjustably clamped upon the rectangular bar 77 so that the rods 130 may be adjusted for different widths of blanks. By then adjusting the bearing blocks 128 upon the rods 130 the rollers 127 may be properly positioned to bend the flaps of the blanks as much as may be necessary to avoid interlocking of the flaps of the foremost blank with those of other blanks of the stack when the foremost blank is being withdrawn from the stack.

As heretofore stated means are provided for raising and lowering the stack supporting brackets D of the stack supporting frame 3 to present the upper end of blanks of different lengths properly to the suction mechanism, the top feeding mechanism, and the mechanisms associated therewith.

In the construction illustrated a shaft 132 is

rotatably journaled in the bracket D and has fixedly secured to it gears 133 which respectively mesh with the rack teeth of the straight bars C. The shaft 132 has square or other angular rectangular ends adapted to be detachably engaged by a crank by means of which the shaft may be rotated to raise or lower the brackets D. Usual locking mechanism is provided, such as a pawl and ratchet mechanism, for locking the shaft when the bracket D is in properly adjusted position.

Mechanism is also provided for adjusting the inclination of the stack support about the axis 110 of the upper gripping roll. As illustrated herein links 134 are connected at one end to the lower end portions of the rack bars C and are pivotally connected at their other ends to the ends of arms 134a which are fixedly secured to a shaft 135 which is journaled in brackets (not shown) extending from the side frames of the individual blank forwarding mechanism. The shaft 135 is provided with angular or square end portions adapted to be engaged by the detachable crank and suitable pawl and ratchet or other locking means provided for retaining the arm 134a in adjusted position. By rotating the shaft 135 in a proper direction the stack supporting unit may be swung about the axis of the upper gripping rolls to any angular position relatively to the vertical which may be required to insure most efficient operation of the feeding mechanism.

By reason of the construction above described successive separation of the foremost blanks from a stack of blanks without adhesion of an adjacent blank thereto is insured so that the machine can be operated at a high speed and by reason of the gripping roll construction jumping of the gripping rolls and consequent defective registration of the blanks upon subsequent forwarding mechanism is avoided.

It will be understood that the particular mechanisms which are shown and described herein are of an illustrative character and not restrictive of the meaning and scope of the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. Movable vacuum mechanism for individualizing the outside blank from a stack of blanks having a chambered suction head comprising a fixed member having a flat face to contact with the face of the blank and a complementary movable member having a flat face to contact with the face of the blank cooperating with said fixed member to exclude outside air from entering the suction chamber operable upon initial application of suction to bend a portion of the blank together with said movable member out of the normal plane of the blank and temporarily to admit such limited amount of air into said suction chamber as to prevent the action of suction upon the next adjacent blank, and means on said suction head for limiting the movement of said movable member to cause the bent portion of the blank to seal the suction head against further admission of air to the chamber thereof.

2. Movable vacuum mechanism for individualizing the outside blank from a stack of blanks having a rigid suction tube, a fitting mounted thereon having a horizontal cylindrical socket, a chambered suction head having a cylindrical boss fitting said socket and a flat face to engage said blank provided with a straight recessed upper wall, and a yieldable valve normally closing said

recess thereby enabling the suction head to be positioned in contact with said blank irrespective of the inclination thereof.

3. Blank-feeding mechanism having movable vacuum means, for deflecting and presenting the end portion of the foremost blank of a stack of flat blanks of stiff material to individual blank-forwarding mechanism, comprising a chambered suction head having a wall provided with a flat surface to engage the face of the end portion of the foremost blank in proximity to its edge with an arcuate recess in the portion of the wall nearest the end of said blank, and a yieldable valve member normally closing said recess against the entrance of air to said chamber yieldable upon application of suction to bend the engaged portion of the blank out of the plane thereof in advance of the blank-deflecting movement of the vacuum means.

4. Blank-feeding mechanism having movable vacuum means, for deflecting and presenting the end portion of the foremost blank of a stack of flat blanks of stiff material to individual blank-forwarding mechanism, comprising a chambered head having a wall provided with a flat surface to engage the face of the end portion of the foremost blank in proximity to its edge with a straight section parallel to the edge of the blank provided with an arcuate recess, a valve plate yieldably mounted on said head having a flange normally closing said recess against the entrance of air to said chamber operable upon application of suction to arch the engaged portion of the blank out of the plane of the blank in advance of the blank-deflecting movement of the vacuum means, and means for limiting the arching of the blank to cause it tightly to fit upon the arcuate wall of said recess to insure maintenance of maximum suction on said blank during the movement of the vacuum means.

5. Blank-feeding mechanism having means for supporting a stack of blanks in suitably inclined relation to the vertical with its upper end in proximity to individual blank-forwarding mechanism, movable vacuum mechanism for deflecting and presenting the upper end of the foremost blank to said forwarding mechanism, a movable stop member for preventing displacement of the upper end of the blank next adjacent the foremost blank upon the deflection of the latter, and rotatable circumferentially yieldable feeding means engaging the upper end of foremost blanks, means operable to rotate said feeding means and thereby position the upper portion of said next adjacent blank for engagement by said vacuum mechanism.

6. Blank-feeding mechanism having means for supporting a stack of flat blanks of stiff material inclined to the vertical in proximity to mechanism for forwarding individual blanks, movable vacuum mechanism comprising a suction head having means operable upon application of suction to engage the face of the end portion of the foremost blank and operable upon application of suction to arch the same away from the next adjacent blank, means for actuating said vacuum mechanism to deflect and present the end of said foremost blank to said forwarding mechanism, a reciprocating stop member, and means for actuating the same to insert it in the arch of the foremost blank into engagement with the face of the next adjacent blank and prevent deflection of the next adjacent blank from the stack, yieldable rotatable feeding means engaging the upper end of foremost blanks of the stack at op-

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posite sides of the vacuum mechanism, and means for actuating said feeding means to force the blank next adjacent the foremost blank against said stop during the deflection of the foremost blank to position said next adjacent sheet properly for yieldable engagement by said vacuum mechanism upon the next operation thereof.

7. Blank-feeding mechanism having means for supporting a stack of flat blanks of stiff material inclined to the vertical in proximity to mechanism for forwarding individual blanks, movable vacuum mechanism having means operable upon application of suction to engage the face of the end portion of the foremost blank and operable upon application of suction to arch the same away from the next adjacent blank, means for actuating said vacuum mechanism to deflect and present the end of said foremost blank to said forwarding mechanism, a reciprocating stop member, and means for actuating the same to insert it in the arch of the foremost blank in contact with the face of the next adjacent blank and prevent deflection of the next adjacent blank from the stack, feeding means for advancing the upper ends of the foremost blanks of the stack comprising a shaft having mounted thereon rotatable spaced toothed cylindrical members engaging the upper ends of said blanks at opposite sides of the vacuum mechanism means for rotating said shaft, and frictional means on said shaft engaging said rotatable cylindrical members operable to advance and position the blank next to the deflected blank in a position properly to be engaged by the next operation of said vacuum mechanism.

8. Blank-feeding mechanism having means for supporting a stack of flat blanks of stiff material inclined to the vertical in proximity to mechanism for forwarding individual blanks, movable vacuum mechanism for deflecting and presenting the end portion of the foremost blank of the stack to said blank-forwarding mechanism and a reciprocating stop member for engaging and preventing deflection of the next adjacent blank from the stack, means for advancing the upper end of the stack comprising a shaft having mounted thereon annular rotatable toothed means engaging the upper end of the blanks of the stack at opposite sides of the vacuum mechanism, means for rotating said shaft, frictional means interposed between said shaft and said rotatable toothed means to advance the upper end portion of the next adjacent blank for engagement by said vacuum mechanism, and yieldable means intermediate of said frictional means and said annular rotatable toothed means for permitting a limited movement therebetween in response to the pressure of the vacuum mechanism against said blank.

9. Blank-feeding means for presenting the upper end of the foremost blank of a stack of blanks to individual blank forwarding mechanism having cooperating rotating gripping rolls, comprising stack supporting means, adjustable means for positioning the upper end of the stack properly in relation to the gripping rolls, means for deflecting the upper end portion of the foremost blank of the stack into the bite of the gripping rolls, guiding means engaging the face of the foremost blank of the stack over which the blank is bent by the deflecting means, and means for adjusting said guiding means lengthwise of the stack to produce the most effective curvature of the deflected portion of the foremost blank as it is being withdrawn from the stack by the gripping rolls.

10. Blank-feeding means for presenting the up-

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per end of the foremost blank of a stack of blanks to individual blank forwarding mechanism having cooperating upper and lower rotating gripping rolls, comprising stack supporting means having downwardly extending parallel bars pivotally suspended at their upper ends, means for adjusting the inclination of said bars relatively to the vertical, a support for the lower end of the stack slidably mounted on said bars, means for adjusting said support lengthwise of said bars cooperating with said pivotal adjustment to position the upper end of the stack properly in relation to the gripping rolls, rotatable guiding means mounted on said bars engaging the foremost blank of the stack, and means for adjusting said guiding means to produce the most effective curvature of the deflected portion of the foremost blank as it is being withdrawn from the stack by the gripping rolls.

11. Blank-feeding means for presenting the upper end of the foremost blank of a stack of blanks to individual blank forwarding mechanism having cooperating upper and lower rotating gripping rolls, comprising stack supporting means having downwardly extending parallel rack bars pivotally suspended at their upper ends, means for adjusting the inclination of said bars relatively to the vertical, a support for the lower end of the stack slidably mounted on said bars, means for adjusting said support lengthwise of said bars cooperating with said pivotal adjustment to position the upper end of the stack properly in relation to the gripping rolls, an upper guiding sleeve engaging the foremost blank of the stack rotatably mounted upon a shaft journaled in brackets slidably mounted on said rack bars, gears fixedly secured to said shaft and trains of gears mounted on the respective brackets engaging the gear on said shaft and engaging the teeth of said bars, and means for rotating said shaft to adjust said brackets lengthwise of said rack bar, and spring actuated pawls pivotally mounted on said brackets engaging the gears on said shaft for locking said shaft in a position to cause said rotatable sleeve to produce the most effective curvature of the deflected portion of the foremost blank as it is being withdrawn from the stack by the gripping rolls.

12. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism.

13. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as

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to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising means supporting the lower end of the stack having abutments in the paths of the respective longitudinal score lines, and means for forwarding the lower end of the stack including movable means engaging the respective lowermost flaps and bending them about said abutments away from the flaps of the next adjacent blank.

14. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising endless conveyors underlying and frictionally engaging the respective lowermost flaps, and means for actuating said conveyors to cause them to bend the flaps engaged thereby about said abutments away from the flaps of the adjacent blanks.

15. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising means for supporting the lower end of the stack having abutments in the path of the respective longitudinal score lines, and a central abutment intermediate of said abutments, endless conveyors underlying and frictionally engaging the respective lowermost flaps, means for actuating said conveyors to cause them to bend the flaps engaged thereby about said abutments away from the flaps of the adjacent blanks, and supplemental means engaging the central lower ends of said blanks for forcing the central portion of the foremost blank against said central abutment.

16. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is with-

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drawn from the stack by the individual blank forwarding mechanism comprising means for supporting the lower end of the stack having abutments in the path of the respective longitudinal score lines, and a central abutment intermediate of said abutments, endless conveyors underlying and frictionally engaging the respective lowermost flaps, means for actuating said conveyors to cause them to bend the flaps engaged thereby about said abutments away from the flaps of the adjacent blanks, supplemental means engaging the central lower ends of said blanks for forcing the central portion of the foremost blank against said central abutment, and frictional means on said central abutment adapted upon withdrawal of the foremost blank to engage the next adjacent blank and prevent its withdrawal from the stack along with the foremost blank.

17. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising means for supporting the lower end of the stack having abutments in the path of the respective longitudinal score lines, and a central abutment intermediate of said abutments, endless conveyors underlying and frictionally engaging the respective lowermost flaps, means for actuating said conveyors to cause them to bend the flaps engaged thereby about said abutments away from the flaps of the adjacent blanks, supplemental means for forcing the central portion of the foremost blanks against said central abutment comprising spring actuated reciprocable means having means releasably to engage the lower ends of the foremost blanks of the stack normally forcing the same toward said central abutment and intermittently operable means for retracting said spring actuated means when the blank engaging means thereof closely approaches said abutment.

18. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising means for supporting the lower end of the stack having abutments in the path of the respective longitudinal score lines, and a central abutment intermediate of said abutments, endless conveyors underlying and frictionally engaging the respective lowermost flaps, means for actuating said conveyors to cause them to bend the flaps en-

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gaged thereby about said abutments away from the flaps of the adjacent blanks, supplemental means for forcing the central portion of the foremost blanks against said central abutment comprising a plurality of spring actuated members each having a finger pivotally mounted thereon to engage the lower end of the forward blanks of the stack and acting to force the central portion of the blanks against said central abutment, and means for alternately retracting one of said members against the action of its spring while another spring actuated member is pressing the blanks toward the central abutment.

19. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising means for supporting the lower end of the stack having abutments in the path of the respective longitudinal score lines, and a central abutment intermediate of said abutments, endless conveyors underlying and frictionally engaging the respective lowermost flaps, means for actuating said conveyors to cause them to bend the flaps engaged thereby about said abutments away from the flaps of the adjacent blanks, supplemental means for forcing the central portion of the foremost blanks against said central abutment comprising parallel cylindrical members located centrally of the stack each having a spring actuated finger pivotally mounted thereon to engage the lower end of forward blanks of the stack and yieldable out of engagement with said blanks upon movement of said members in a direction away from said abutment, brackets upon the respective members, springs surrounding the respective members having one end engaging the bracket thereon and the other engaging a suitable anchorage, bell crank levers engaging the respective brackets, and means for actuating the respective levers alternately to withdraw said members against the tension of its spring thereby continuously to force the central portion of a foremost blank against said central abutment.

20. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of a box having means for positioning the stack with its end in proper relation to said gripping mechanism, and means for deflecting and presenting the end of the foremost blank to said gripping mechanism comprising means for so bending the flaps of the foremost blank relatively to those of an adjacent blank as to prevent a flap of the foremost blank from interlocking with a flap of another blank of the stack as the foremost blank is withdrawn from the stack by the individual blank forwarding mechanism comprising means for supporting the lower end of the stack having abutments in the path of the respective longitudinal

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tudinal score lines, endless conveyors underlying and frictionally engaging the respective lowermost flaps, means for actuating said conveyors to cause them to bend the flaps engaged thereby about said abutments away from the flaps of the adjacent blanks, supplemental means engaging the central lower ends of said blanks for forwarding the central portion of the blanks and means for adjustably positioning the respective brackets in registry with the score lines and of blanks of different widths.

21. Feeding mechanism for successively delivering to individual blank gripping and forwarding mechanism the foremost blank of a stack of slitted box blanks foldable upon longitudinal score lines to form the sides of the box having means for positioning the stack with its end in proper relation to said gripping mechanism, movable vacuum mechanism having a suction head provided with a flat face to engage the face of the end portion of the foremost blank of the stack and having an arcuate recess in the upper portion of the wall of said face, and a complementary yieldable valve member normally closing said recess operable upon application of suction to arch the engaged portion of the blank away from the next adjacent blank, a stop member movable into the arch of the foremost blank into engagement with the face of the next adjacent blank, rotatable toothed feeding mechanism yieldably engaging the upper ends of foremost blanks of said stack, and means for rotating the same in correlation to the operation of said stop member, means supporting the lower end of the stack having abutments in the paths of the respective score lines of said blanks, endless conveyor mechanism underlying and frictionally engaging the respective lower ends of the flaps, and means for actuating the conveyors to cause them to bend the flaps engaged thereby away from the flaps of adjacent blanks.

22. Feeding mechanism for successively delivering to individual blank forwarding mechanism having upper and lower rolls for successively delivering the foremost blank of a stack of blanks to individual blank forwarding mechanism having cooperating upper and lower gripping rolls comprising means for supporting the stack pivotally mounted to swing about the axis of the upper gripping roll, movable suction mechanism for deflecting the upper end of the foremost blank into the bite of said gripping rolls having a suction head provided with means for engaging and arching the upper end portion of the blank engaged thereby away from the next adjacent blank, a stop member, and means to cause the same to enter the arch of the blank and to engage the face of the next foremost blank, yieldably rotatable toothed feeding members mounted on said stack supporting means engaging the upper ends of the foremost blanks of the stack, and means for rotating said members in correlation to the movement of said stop mechanism to press the foremost blank against said stop during the deflection of the foremost blank by said vacuum mechanism, adjustable means on said stack supporting means engaging the lower end of the blanks of the stack having means for forwarding the lower ends to said blanks, means for actuating the same in timed relation to the feeding means for the upper ends of said blank, and means for pivotally adjusting the stack supporting means about the axis of said upper gripping roll.

23. Blank-feeding mechanism for box blanks

having suitably spaced slits extending inwardly from the edges thereof defining flaps forming the sides of the box comprising means for supporting the lower end of a stack of said blanks provided with an abutment for the lower end of the foremost blank and means engaging the foremost blank at a suitable distance from the upper end thereof to position the stack in suitably inclined relation to individual blank-forwarding mechanism, means for deflecting and presenting the end of the foremost blank of the stack to said forwarding mechanism, and means for preventing interlocking of the flaps of adjacent blanks comprising deflectors suitably inclined to the plane of the foremost blank of the stack engaging the flap portions thereof positioned to bend the flaps of the outermost blanks out of interlocking engagement with those of the next adjacent blank as the foremost blank is withdrawn from the stack by said forwarding mechanism.

24. Mechanism for feeding to individual blank forwarding mechanism box blanks having suitably spaced slits extending inwardly from the edges thereof defining flaps forming the sides of a box comprising means for supporting the stack of blanks in proper relation to the forwarding mechanism, means for deflecting the upper ends of the blank to the blank forwarding means, means for forwarding the lower end of the stack including means engaging and bending the lowermost flaps out of the plane of the respective blanks, deflectors suitably inclined to the foremost blank of the stack engaging the flaps thereof positioned to bend the flaps of the outermost blank in the opposite direction as the foremost blank is withdrawn from the stack thereby to prevent interlocking engagement of the flaps of the foremost blank with those of the next adjacent blank as the foremost blank is withdrawn from the stack by the forwarding mechanism.

25. A machine for feeding box blanks and the like having means for supporting a uniform stack of said blanks, means for transversely arching the end portion of the foremost blank and then deflecting it from the stack, means for engaging and forwarding individually the blanks thus deflected from the stack comprising cooperating rotating relatively yieldable cylindrical rolls, one of which is provided with a pointed yieldable segment to engage the end of the deflected blank in close proximity to the deflecting means and direct it progressively and smoothly into the bite of the cooperating cylindrical surfaces of the rolls, thereby to avoid abrupt engagement of the rolls with the end of the blank and consequent jumping of the rolls and to insure accurate registry of the blanks carried by the forwarding mechanism.

26. A machine for feeding box blanks and the like having means for supporting a uniform stack of said blanks, means for transversely arching the end portion of the foremost blank and then deflecting it from the stack, means for engaging and forwarding individually the blanks thus deflected from the stack comprising cooperating rotating relatively yieldable cylindrical rolls, one of which rolls is provided with a yieldable segment pivotally mounted upon the roll within its periphery and having a narrow roughened section normally positioned flush with the cylindrical periphery of the roll and having a pointed extension therefrom of slightly shorter radius than that of said periphery to engage the end

of the deflected blank in close proximity to said deflecting means and direct it progressively and smoothly into the bite of the cooperating cylindrical surfaces of the rolls.

27. A machine for feeding box blanks and the like having means for supporting a uniform stack of said blanks, means for transversely arching the end portion of the foremost blank and then deflecting it from the stack, means for engaging and forwarding individually the blanks thus deflected from the stack comprising cooperating rotating relatively yieldable cylindrical rolls, one of which rolls is provided with a yieldable segment pivotally mounted upon the roll within its periphery and having a narrow roughened section normally positioned flush with the cylindrical periphery of the roll and having an extension therefrom of slightly shorter radius than that of said periphery to engage the ends of the blank in close proximity to the deflecting means, the cooperating roll having a shallow peripheral recess complementary to said segment to insure unimpeded engagement of said segment extension with the end of the blank thereby to avoid abrupt engagement of the cylindrical peripheries of the rolls with the end of the blank and resultant jumping of the roll and to insure accurate registry of the blanks carried by the forwarding mechanism.

28. A machine for feeding box blanks and the like having means for supporting a uniform stack of said blanks, means for successively deflecting the end portion of the foremost blank from the stack, means for engaging and forwarding individually the blanks thus deflected from the stack comprising cooperating rotating relatively yieldable cylindrical rolls, one of which rolls has a central web and a cylindrical peripheral flange provided with a segment having a slot fitting said web and pivotally mounted at one end upon the inner periphery of said flange and extending along and engaged by the same and having a circumferentially narrow section normally positioned flush with the outer periphery of the roll, and an extension therefrom of slightly shorter radius than that of said periphery to engage the end of the blank in close proximity to the deflecting means, a cylindrical radial boss on said web, a coiled compression spring in said boss engaging said segment, and means for adjusting the force of said spring.

29. A machine for feeding box blanks and the like having means for supporting a uniform stack of said blanks, means for successively deflecting the end portion of the foremost blank from the stack, means for engaging and forwarding individually the blanks thus deflected from the stack comprising cooperating rotating relatively yieldable cylindrical rolls, the rolls of one of said pair having a central web and a cylindrical peripheral flange provided with a segment having a slot fitting said web and pivotally mounted at one end upon the inner periphery of said flange and extending along and engaged by the same and having a circumferentially narrow roughened section normally positioned flush with the outer periphery of the roll, and an extension therefrom of slightly shorter radius than that of said periphery to engage the ends of the blank in proximity to said deflecting means, a cylindrical radial boss on said web, a coiled compression spring in said boss engaging said segment, a screw extending through said segment in said boss and axially through said coiled spring having a head engaging said segment and abutting at its end

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upon the base of said cylindrical boss, a nut on said screw, and means for preventing rotation of said nut upon rotation of said screw, whereby the pressure of the spring applied to said segment may be adjusted.

30. A machine for feeding box blanks and the like having means for supporting a uniform stack of said blanks, means for successively deflecting the end portion of the foremost blank from the stack, means for engaging and forwarding individually the blanks thus deflected from the stack comprising cooperating rotating relatively yieldable cylindrical rolls, the rolls of one of said pair having a central web and a cylindrical peripheral flange provided with a segment having a slot fitting said web and pivotally mounted at one end upon the inner periphery of said flange and extending along and engaged by the same and having a circumferential section normally positioned flush with the outer periphery of the roll, and an extension therefrom of slightly shorter radius than that of said periphery to engage the ends of the blank in proximity to said deflecting means, a cylindrical radial boss on said web, a coiled compression spring in said boss engaging said segment, a screw extending through said segment in said boss and axially through said coiled spring having a head engaging said segment and abutting at its end upon the base of said cylindrical boss, a nut on said screw, and means for preventing rotation of said nut upon rotation of said screw, whereby the pressure of the spring applied to said segment may be adjusted, and said cooperating roll having a shallow peripheral recess complementary to

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said segment cooperating with said segment to insure uninterrupted engagement of the segment with the end of the blank.

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