United States Patent

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[54] **UNTIMED MECHANICAL TRANSFER MEANS FOR RIGHT ANGLE FOLDING MACHINES**
13 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** ..... **93/49 R,** 198/24, 271/49, 271/52, 271/59
[51] **Int. Cl.** **B31b 1/26**
[50] **Field of Search** ..... 93/49 R, 49 M, 52; 198/24; 271/49, 52, 59, DIG. 4

[56] **References Cited**
UNITED STATES PATENTS
3,111,885 11/1963 Perrelli ..... 93/49 R

Primary Examiner—Bernard Stickney
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ABSTRACT: An untimed, mechanical transfer apparatus, for resiliently flicking each successive box blank received from a first flap-folding apparatus laterally at right angles into the control of a second flap-folding section. Rotating nip roll means in a transfer zone retains a grip on each advancing blank while the side edge of the blank successively engages a row of individual spring members, the springs rebounding to flick the blank when the trailing edge of the blank is released from the roll nip.

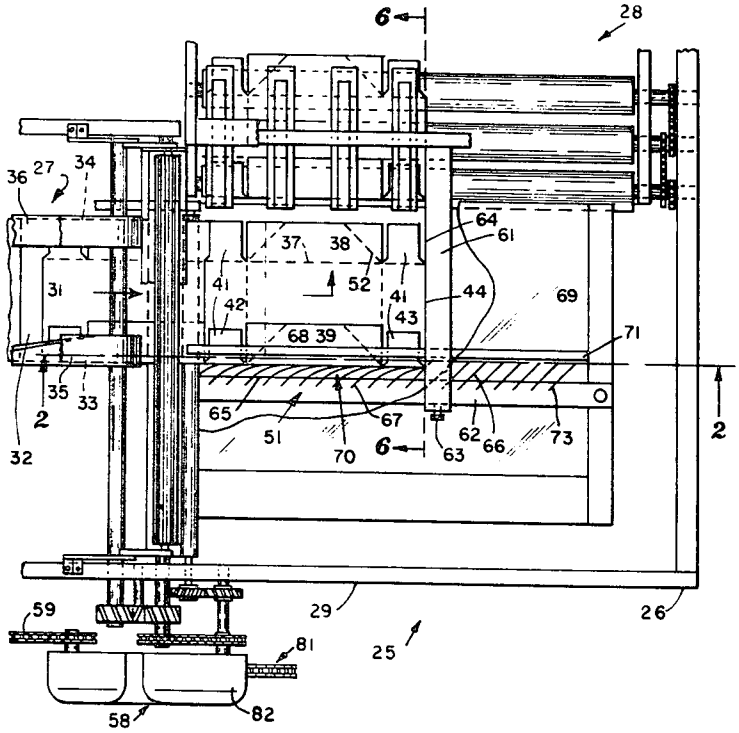
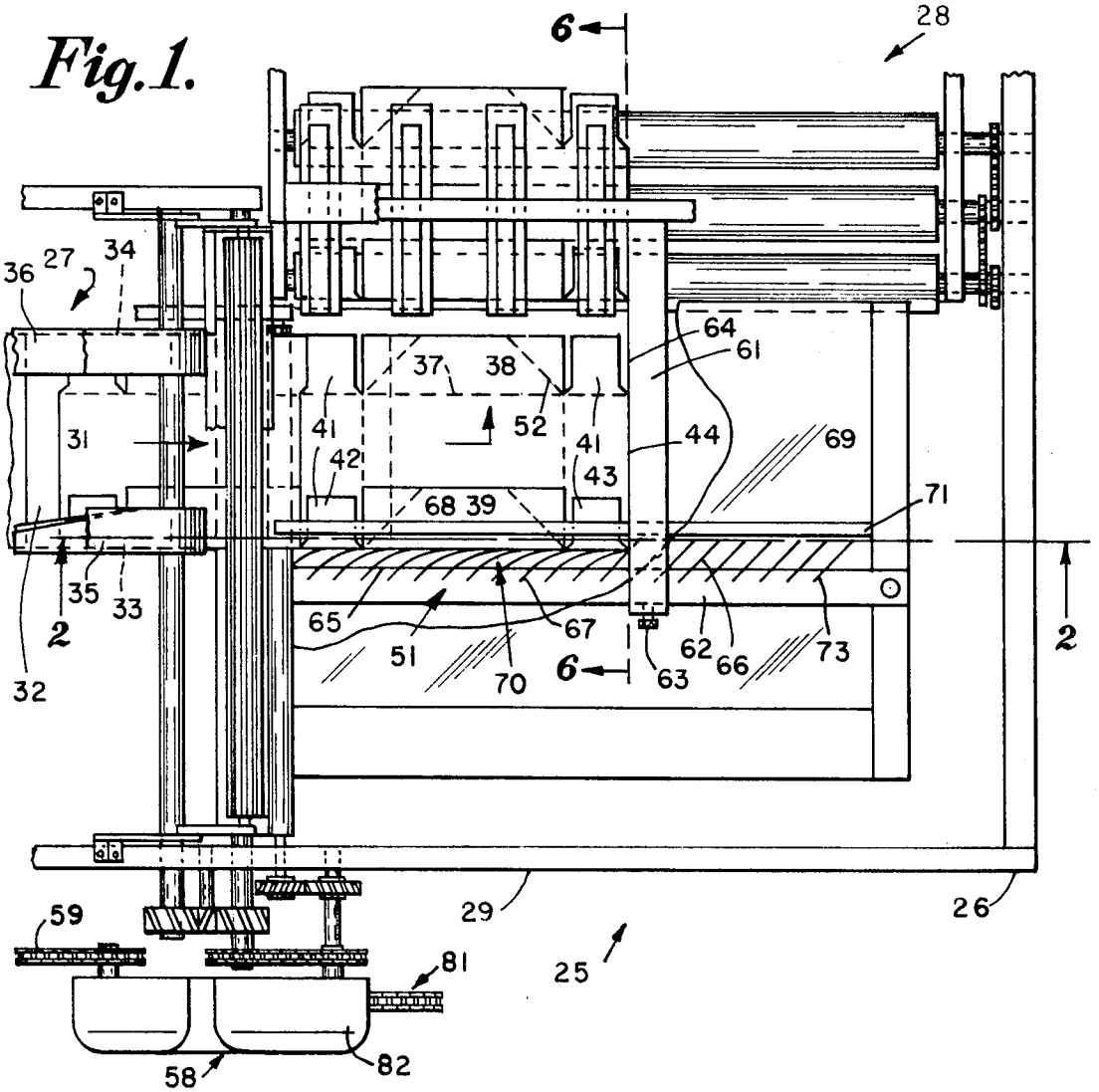


Fig. 1.



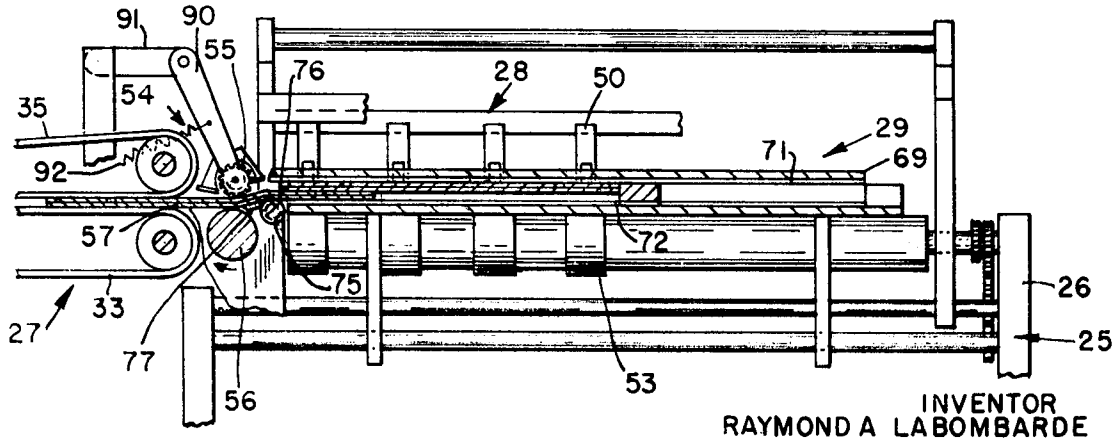


Fig. 2.

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Fig. 3.

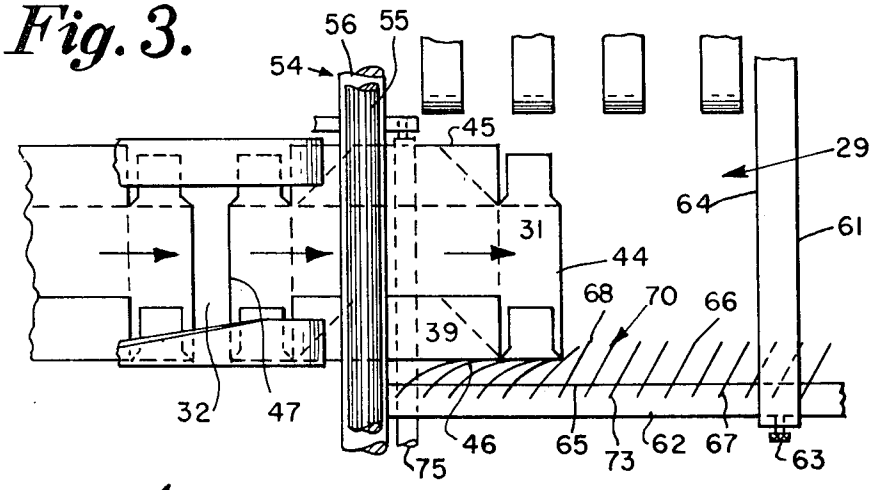


Fig. 4.

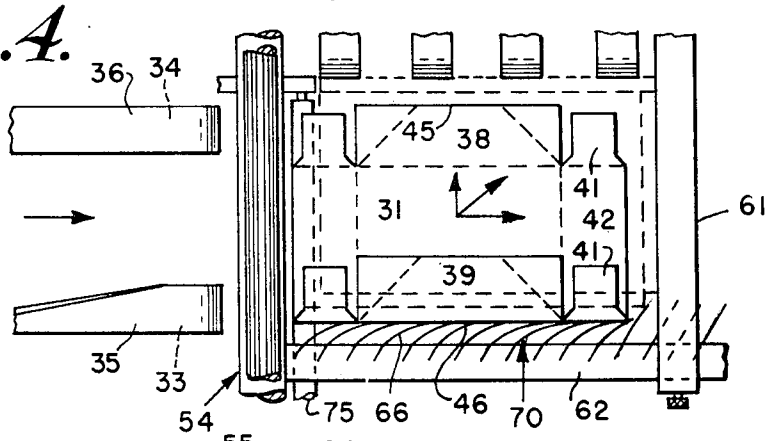


Fig. 5.

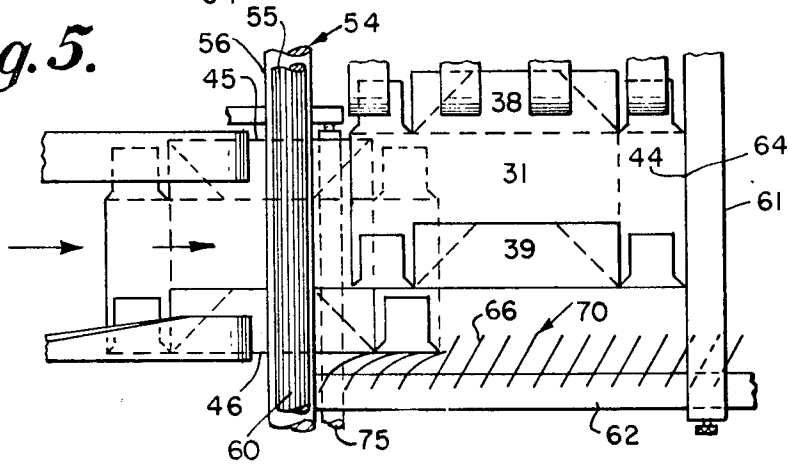
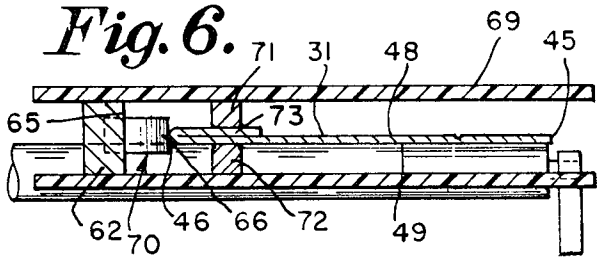


Fig. 6.



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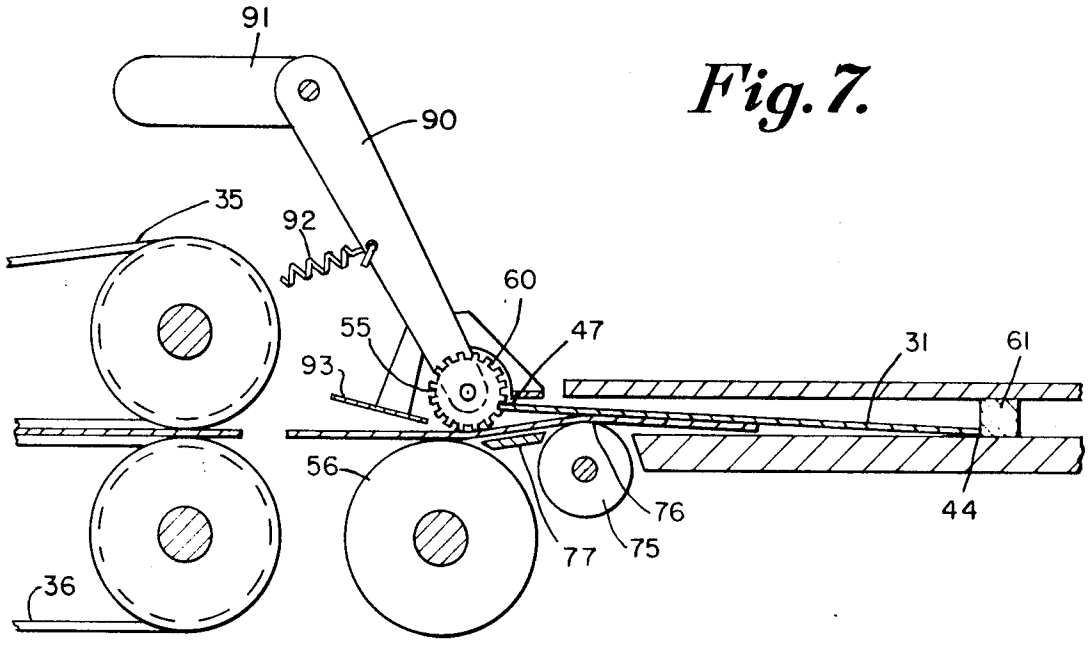

Fig. 7.

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UNTIMED MECHANICAL TRANSFER MEANS FOR RIGHT ANGLE FOLDING MACHINES

BACKGROUND OF THE INVENTION

Timed right angular paper box blank folding machines are well known, the blanks being advanced by register chains through various treatment zones and being under firm control in the relatively slow passage through the machine.

However, untimed right angular folding machines, capable of folding box blanks at the high speeds demanded by the trade, while disclosed in prior art patents are not available in commercially practical machines. The prior art patent most pertinent to this invention is believed to be U.S. Pat. No. 3,111,885 to Perilli of Nov. 26, 1963. The Perilli patent discloses an untimed right angular machine having a first flap-folding conveyor section, a second flap-folding conveyor section at right angles thereto, and a transfer station at the junction of the sections. Each successive blank is carried through the first section on conveyor belts, without upper holddown belts or upper pressure rolls, and delivered the full length of the transfer station by the momentum of the conveyor, while free of control. The leading edge of the blank then strikes a centrally located switch which closes a circuit to an electrically actuated kicker, located centrally of the side edge of the blank, the kicker propelling the blank laterally into the second flap-folding conveyor section.

It has been found that at high speeds, control is lost when a flat blank is thrown across a transfer zone without a firm grip thereon, when a central protruding switch is the target of the blank and when a central kicker is the propelling device for the side edge of the blank. It has also been found that electric switches and solenoid actuated kickers are unreliable at high speeds, being subject to breakdown in use, subject to delay in retraction, and that the kicker may not only damage the edge of the blanks but remain extended long enough to bar the advance of the next successive blank.

SUMMARY OF THE INVENTION

This invention relates to an improved transfer apparatus and method for use in an untimed, right angular, paper box folding machine of the type disclosed in the said U.S. Pat. No. 3,111,885. The invention includes the provision of pressure nip roll means at the end of the first flap-folding section for advancing each blank substantially the full length of the transfer zone, or station, under firm grip and control to assure its retention in a straight line path. It further includes a plurality of spaced, individual, resilient members, normally in the path of the side edge of the blank and arranged to be successively distorted by the blank with predetermined light resistance to blank passage in order to avoid damage or bending of the blank. Upon the release of the trailing edge of the blank from the pressure nip, the resilient members rebound jointly with sufficient force applied along the entire side edge of the blank to propel the blank laterally into the grip of the right angular, or second, flap-folding section. Preferably the resilient members are leaf springs arranged in comblike configuration, each spring being flexed out of the blank path by the blank. However, mechanical equivalents could be used, such as a slippery-surfaced inflated bag, a row of coil springs, a row of spring recoil arms of rigid material, or any other structure which will individually store small increments of energy, insufficient to damage the blank and jointly and simultaneously release the stored energy to propel the blank laterally.

The invention also resides in the provision of an adjustable register bar at the end of the transfer zone, to guide the blanks sidewise into the second section and a pair of holddown guides alongside the terminal tips of the leaf springs to prevent the spring resistance from upbending or downbending the blank, as well as to prevent the blank from going underneath, or on top of, the leaf springs.

The invention also includes the provision of a separate drive means for the pressure nip rolls, with an overrunning clutch, so that the blanks are advanced into the transfer zone at a predetermined speed sufficient to impact the register bar even if the machine is being slowly run, or inched. A friction roll is mounted in the transfer zone and driven with the pressure rolls with its surface above the level of the roll nip to urge the blanks toward the register bar by friction contact with the trailing portion of the underface while raising that portion to permit the next successive blank to be overlapped in the transfer zone.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the transfer zone of a right angular paper box blank folding machine, illustrating the preferred embodiment of the invention, with the blanks overlapping.

FIG. 2 is a side elevation in section on line 2—2 of FIG. 1.

FIG. 3 is a diagrammatic plan view similar to FIG. 1 showing a blank advancing into the transfer zone under firm nip control while flexing the leaf springs.

FIG. 4 is a view similar to FIG. 3, showing the blank released by the nip and fully in the transfer zone, the friction roll, blank momentum and spring recoil producing the composite path shown by the arrows.

FIG. 5 is a view similar to FIGS. 3 and 4 and showing the first blank being moved laterally under control of the second folding section while the next blank is being advanced thereunder into the transfer zone.

FIG. 6 is an end elevation on line 6—6 of FIG. 1 showing the holddown guides and plates in the transfer zone; and

FIG. 7 is an enlarged, fragmentary side elevation, similar to FIG. 2, showing the control of the blanks during transfer.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the drawings, **25** is a known type of right angular, untimed paper box blank folding machine having a frame **26**, a first flap-folding section **27**, a second flap-folding section **28**, at right angles to the first section, and a transfer zone, or station, **29**, at the juncture of the two sections. The first flap-folding section **27** includes a conventional, untimed magazine, not shown, for feeding flat paper box blanks **31** from a stack thereof, individually and successively along the first straight path of the first section **27**, the blanks being spaced apart by a gap **32**.

A pair of lower belt carriers **33** and **34** and a pair of upper belt carriers **35** and **36** convey the successive blanks **31** through the first section **27**, in a path parallel to the longitudinal fold lines **37**, the upper belts **35**, or suitable folding bars, overfolding the side flaps **39**, and the tabs such as **41** on the end flaps **42** and **43**, all in a manner well known, and shown in U.S. Pat. No. 3,111,885. The other side flaps **38** may be prefolded and unfolded by belts **36**, the side edges **45** of the blanks being unfolded in the transfer zone. Each blank **31** includes a leading edge **44**, folded side edges **46**, a trailing edge **47**, an upper face **48**, and a lower face **49**.

It will be understood that the purpose of the transfer apparatus **51**, of the invention, is to shift each successive blank **31** fully advanced into the transfer zone **29**, laterally into the second section **28**, so that the unfolded side edge **45** is engaged and advanced thereby for back folding of the diagonal tabs such as **52** on the side flaps **38** and **39**, the edge **45** becoming the leading edge of the blank in the second section.

The second flap folding section **28** includes carrier rolls **50**, upper and lower carrier belts **53**, hooked folding fingers, holddown and folding bars, all well known in the art for performing the desired operations on the blanks in an untimed, high-speed manner.

The transfer apparatus **51** is mechanical, untimed, and automatic and includes pressure roll means **54**, comprising a pair of pressure rolls **55** and **56** forming a pressure nip **57** extending transversely just in advance of transfer zone **29** at the terminus of the first folding section **27**. Upper roll **55** is driven by contact and lower roll **56** is friction faced and normally driven by the power train **58** (FIG. 1), from the drive **59** of the

machine, so that the surface speed of the carrier belts 33, 34, 35 and 36, and of the rolls 55 and 56 is identical. The belts are for the purpose of carrying and folding, but the rolls 55 and 56 are spring-pressed together with a predetermined force, to secure a tight grip at nip 57 on the upper and lower faces of the blank 31. Thus it will be seen that each blank 31 gripped in nip 57 will be advanced toward the register bar 61 at the end of zone 29, in a straight path, under a tight grip and firm control rather than by being thrown across the zone, until the trailing edge 47 emerges from, and is released by, the pressure nip 57. Rolls 55 and 56 may be sleeved with friction material, such as rubber or the like, to assure a firm grip and to prevent any lateral shift of the blank during advance by the nip 57. However, upper roll 55 is preferably provided with a multiplicity of longitudinally extending grooves 60, parallel to the axis of the roll, for the purpose of receiving the trailing edge 47 of each blank and keeping the blank registered against end stop 61 at all speeds. At slow speeds the axial grooves 60 in upper roll 55 engage the edges 47 and force the blank to reach the end stop 61 before it is transferred right-angularly. At high speeds the roll 55 prevents the blank from bouncing back after it strikes the end stop 61 and thereby maintains the blank in register.

The register bar 61 is mounted for slidable adjustment on the frame piece 62 and may be locked in position by setscrew 63 at a spaced distance from nip 57, slightly greater than the length of a blank 31. Bar 61 is free of protuberances on the face 64 thereof, which is engaged by the leading edge 44, to avoid twisting of the blank, and the face 64 serves as a side edge guide to direct the laterally moving blank 31 into the second section 28 in exact registration.

As shown in the drawing, (FIG. 7), the register bar, or end stop, 61, is fixed in such position that when the leading edge 44 of a blank is bearing thereagainst, the trailing edge 47 of the blank is riding in one of the grooves 60 of upper roll 55 at proximate the level of the center of the roll.

A plurality of individual, resilient means 70 is mounted along the side 65 of the transfer zone 29 which is opposite to the second section. Means 70 is preferably in the form of an elongated row of individual elastic resilient members 66, in parallelism, each independently operable and constituting a leaf spring having a base 67 anchored in frame piece 62, and a free terminal portion 68 obliqued at an angle of about 45° to the path of the blanks and normally extending into the path of the adjacent side edge portion 46 thereof. If the leaf springs 66 were unduly stiff, the leading corner edge of each advancing blank 31, held in nip 57, would tend to be deflected upwardly or downwardly by the spring, thereby jamming the blank between the spring and the transparent cover 69 mounted over the transfer zone. Similarly, unduly stiff springs would successively be engaged by the leading corner edge to damage the edge. Each leaf spring 66 is therefore of predetermined configuration and coefficient of elasticity so as to offer only light resistance to the passage of the blank as the spring is yieldably distorted from normal position to spring biased position. Upon release of the blank by the nip 57, however, the joint effect of rebounding of all of the springs is sufficient to propel the blank laterally for the short distance necessary to enter the advancing grip of the second section 28.

To further insure against deflection of the blank, a pair of upper and lower guides 71 and 72 are mounted along the side 65 of the transfer zone 29, the guides being spaced apart to form an elongated slot aperture 73 for receiving and slidably guiding the side edge portion 46 of the blank. The guides 71 and 72 are alongside the terminal tips of the leaf springs so that the slot 73 is about midway of the height of the spring tips, thereby assuring that the blank cannot ride over, or under, the leaf springs.

A third friction roll 75 is preferably provided as part of the pressure roll means 54, the roll 75 extending transversely of the first path 27 within the transfer zone 29, and just in rear of the nip 57. The upper portion of the friction face 76 of roll 75 is at a level slightly above the level of nip 57, there being a bridge element 77 between lower roll 56 and roll 75 to guide each blank 31 upwardly as shown in FIG. 2. When a blank 31 has emerged from nip 57, it is thus simultaneously urged laterally by the rebound of the leaf springs and urged toward the register bar 61 by the friction contact of driven roll 75 with the underface 49, which together with the momentum imparted by nip 57 results in the composite forces shown by the arrows in FIG. 4. The net result is that the blank is urged into contact with the register bar while it is being flicked sidewise parallel to the bar by the springs and any tendency of the blank to move away from the register bar is overcome.

While the pressure rolls 55 and 56 and the friction roll 75 are driven at appropriate surface speeds by the machine drive 59, through power train 58, an independent power source 81 including an overrunning clutch 82 is operably connected to the three rolls 55, 56 and 75. Thus, even when the machine is operated slowly, as in the setup for a new run, or when being inched for other reasons, the resulting slow rotation is not reflected at nip 57 to cause blanks to leave the nip with insufficient momentum. In such case of slow operation, the independent power source 81 through clutch 82 continues to rotate the rolls 55, 56, and 75 at a predetermined speed sufficient to advance any blank received in nip 57 up to the register bar 61. Upon resumption of normal machine speed, the overrunning clutch 82 permits the three rolls to operate at such normal speed.

The grooved roll 55 is carried at the end of a yoke 90, pivoted to the frame 91, and the frame 91 is spring-pressed by spring 92 against roll 56, with a predetermined pressure, sufficient to frictionally prevent the blanks from twisting under the influence of the leaf springs. Yoke 90 carries a stop 93 for retaining the trailing edge 47 of each blank at the height shown, the grooved face of the roll 55 being capable of slipping past the so-held edge 47 while causing a slight fluttering thereof.

Unlike prior art transfer devices, it is not necessary for a first blank 31 to clear the transfer zone before a second blank 31 can enter the transfer zone. In this invention, as best shown in FIGS. 2 and 5, a first blank may be moving laterally out of the zone 29 while the leading edge 44 of a second blank is guided by bridge 77 and roll face 76 up under the first blank to progressively advance thereunder. Thus operation of the device is speeded up without danger of loss of control of the blanks. Production of the machine is therefore doubled while decreasing the floor space required for such production.

What is claimed is:

1. An untimed, right-angular paper box blank folding machine having a first flap-folding section, a second flap-folding section at right angles to said first section, and a blank transfer zone at the junction of said sections, said machine characterized by

pressure roll means having a nip extending transversely of said first section, just in advance of said transfer zone, for advancing each successive blank, received from said first section, into said transfer zone while firmly gripping said blank to prevent lateral shift thereof until the trailing edge of said blank is released by said nip, and

a plurality of individual, resilient means, mounted along the side of said transfer zone opposite to said second flap-folding section, in the path of the adjacent side edge portion of each blank so advanced into said zone, said means jointly flicking said blank sidewise into said second section upon release of said blank by said nip.

2. A machine as specified in claim 1, wherein

each said resilient means is a leaf spring.

3. A machine as specified in claim 1, wherein

said plurality of individual resilient means comprises a row of individual leaf springs normally in parallelism and obliqued at an angle of about 45° to the path of blanks advancing into said transfer zone.

4. A machine as specified in claim 1, wherein

each said individual resilient means is a leaf spring having a base firmly anchored on said apparatus, alongside the path of a blank advancing into said transfer zone, and having a free terminal portion extending into said path, said free portion having a predetermined coefficient of elasticity insufficient to damage the leading edge of a blank when distorted by the passage thereof, but sufficient, when jointly and simultaneously released from such distortion, to shift said blank laterally partially out of said path.

5. A machine as specified in claim 1, wherein

said pressure roll means comprises an upper and lower roll and drive mechanism operably connected to at least one said roll, said drive mechanism being independent of the drive of said machine for rotating said rolls at a predetermined speed to impart a predetermined propelling force to each blank advanced thereby into said transfer zone even when said machine is being slowly operated or inched.

6. A machine as specified in claim 1, plus:

a friction roll extending transversely of said first flap-folding section, within said transfer zone just in rear of said pressure nip, said roll having its upper face at a level slightly above the level of said nip to elevate the trailing edge of a blank, discharged from said nip and moving laterally in said zone, while guiding the leading edge of the next successive blank under said trailing edge into overlapped position.

7. A machine as specified in claim 1, wherein

said pressure roll means includes an upper and a lower roll forming said nip and a friction roll in rear of said nip, having its upper face slightly above the level of said nip, drive mechanism, independent of the drive of said machine for rotating said rolls at a predetermined speed, and an overrunning clutch in said drive mechanism for permitting said rolls to pass without damage blanks advanced thereinto by said first flap-folding section at greater than said predetermined speed.

8. A machine as specified in claim 1, plus

a register bar extending transversely of said transfer zone in the path of the leading edge of each blank advanced into said zone, said bar being spaced a predetermined distance from said nip slightly greater than the length of a blank and free of protuberances to serve as a side edge guide leading to said second flap-folding section.

9. A machine as specified in claim 1, plus

a pair of upper and lower guides extending in parallelism along the said side of said transfer zone opposite to said second flap-folding section, said guides being spaced apart to form an elongated slot therebetween for slidably receiving the adjacent side edge portion of each blank so advanced into said transfer zone, said slot being positioned to guide the edge of each blank into the central portion of said resilient means to prevent vertical deflection of said blank.

10. A machine as specified in claim 1, wherein

said pressure roll means comprises an upper and lower roll forming said nip, said nip being at a predetermined level, and

a friction roll extending transversely of said first flap-folding section, within said transfer zone, just in rear of said pressure nip, said element having its upper face at a level slightly above the level of said nip to elevate the trailing edge of a blank discharged from said nip, thereby permitting the leading edge of the next blank to shingle thereunder.

11. A machine as specified in claim 10, wherein

said upper roll includes a longitudinally grooved surface arranged to receive the trailing edge of each successive blank discharged from said nip and guide the same as the blank travels sidewise into said second section, under the influence of said resilient means.

12. In a right-angular paper box folding machine of the type having a first flap-folding section extending along a first path, a transfer zone at the terminus of said first path and a second flap-folding section extending from said transfer zone in a second path at right angles to said first path, the combination of:

automatic, untimed, transfer apparatus in said transfer zone for laterally shifting folded paper box blanks from said first path into said second path, said apparatus comprising

a pair of driven pressure rolls forming a pressure nip extending transversely of said first path, just in advance of said transfer section, said rolls restraining each successive blank from lateral movement out of said first path until the trailing edge of the blank has emerged from said nip, and

a plurality of individually resilient members spaced along said transfer zone on the side thereof opposite to said second path, said members being normally in the path of the adjacent side edge portion of each blank advanced into said zone by said pressure roll nip and arranged to be individually and successively distorted thereby with a predetermined, relatively light, resistance to passage of said blank,

said distorted resilient members jointly recovering the normal shape thereof, and propelling said blank transversely of said path into said second path, upon the release of the trailing edge thereof by said pressure nip.

13. The untimed method of laterally shifting flat paperboard blanks, advancing individually and successively along a first path, into a second path at right angles to said first path by means of a row of independent, yieldable, resilient members, said method comprising the steps of:

successively feeding each blank along said first path into a position opposite said second path, while holding said blank against lateral movement out of said first path, and while individually and successively engaging the side edge of said blank opposite to said second path with said members to distort said members into spring biased condition, and

then releasing said blank to free lateral movement in the direction of said second path, thereby releasing said members to flick said blank laterally into said second path.