United States Patent

Hartbauer et al.

[15] **3,648,431**

[45] **Mar. 14, 1972**

[54] IN-LINE BANDING APPARATUS

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[73] Assignee: **Crown Zellerbach Corporation**, San Francisco, Calif.

[22] Filed: **May 5, 1969**

[21] Appl. No.: **821,774**

[52] **U.S. Cl.** ....**53/124 CC,** 53/124 C, 53/139.3, 93/36.9

[51] **Int. Cl.** **B65b 1/24,** B65b 63/02, B65b 13/04

[58] **Field of Search** ....53/124 R, 124 C, 124 D, 124 CC, 53/124 A, 139.3; 93/93 DP, 36.9

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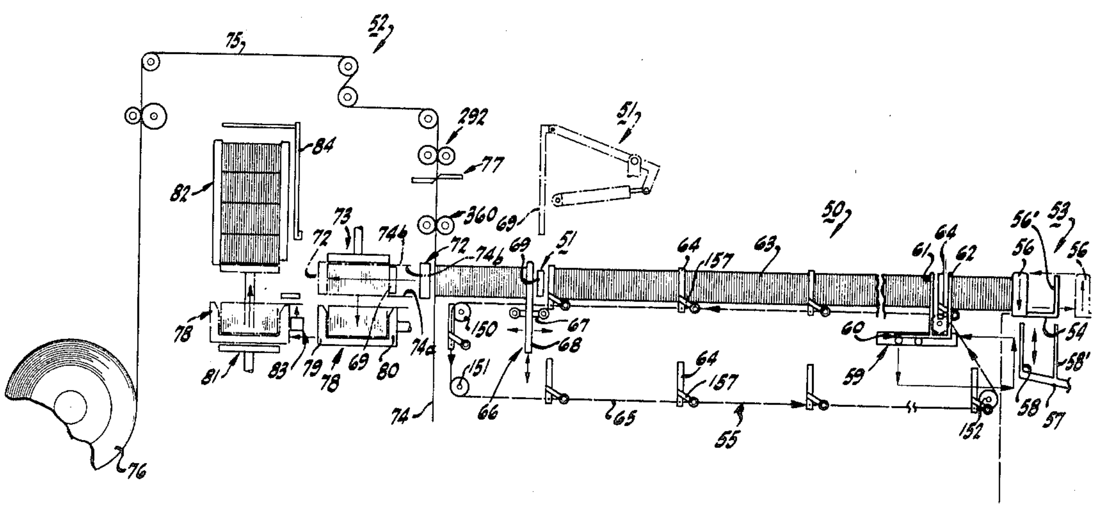
Primary Examiner—Wayne A. Morse, Jr.
Attorney—Stanley Bialos

[57] **ABSTRACT**

A machine for and method of accepting the group-by-group discharge from a bag collator and for forming such groups into bundles each of which constitutes a predetermined number of bags. After formation, the bag bundles are compressed by application of forces thereto adequate to develop high-bag friction within the interior of each bundle. Each compressed bundle is advanced into and through banding apparatus in a step-by-step progression during which a band is wrapped or folded about the bundle and has adhesive applied to its overlapping flaps, and the band-equipped bundle is then maintained under compressional constraint through a plurality of cycles of the machine to enable the adhesive to cure before the bundle is ejected therefrom.

33 Claims, 34 Drawing Figures



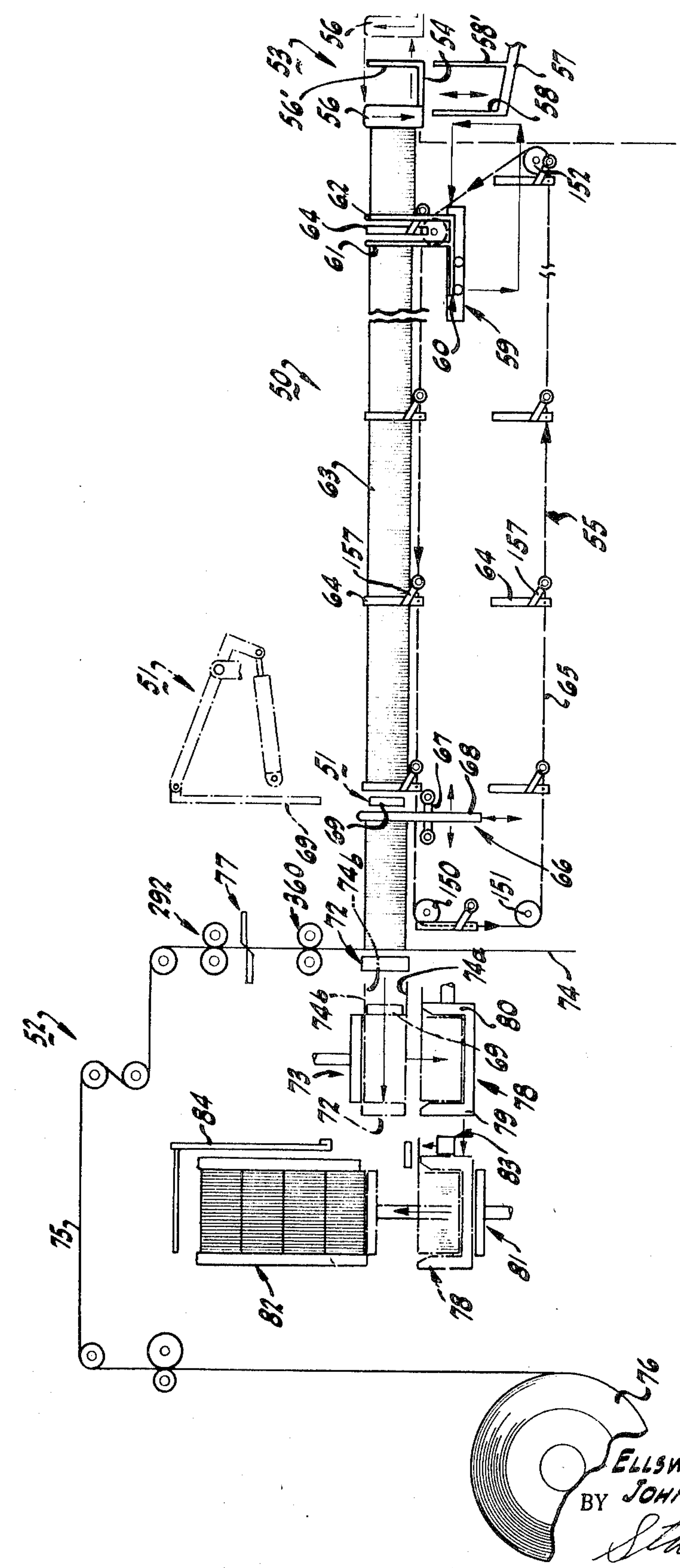


FIG. 1

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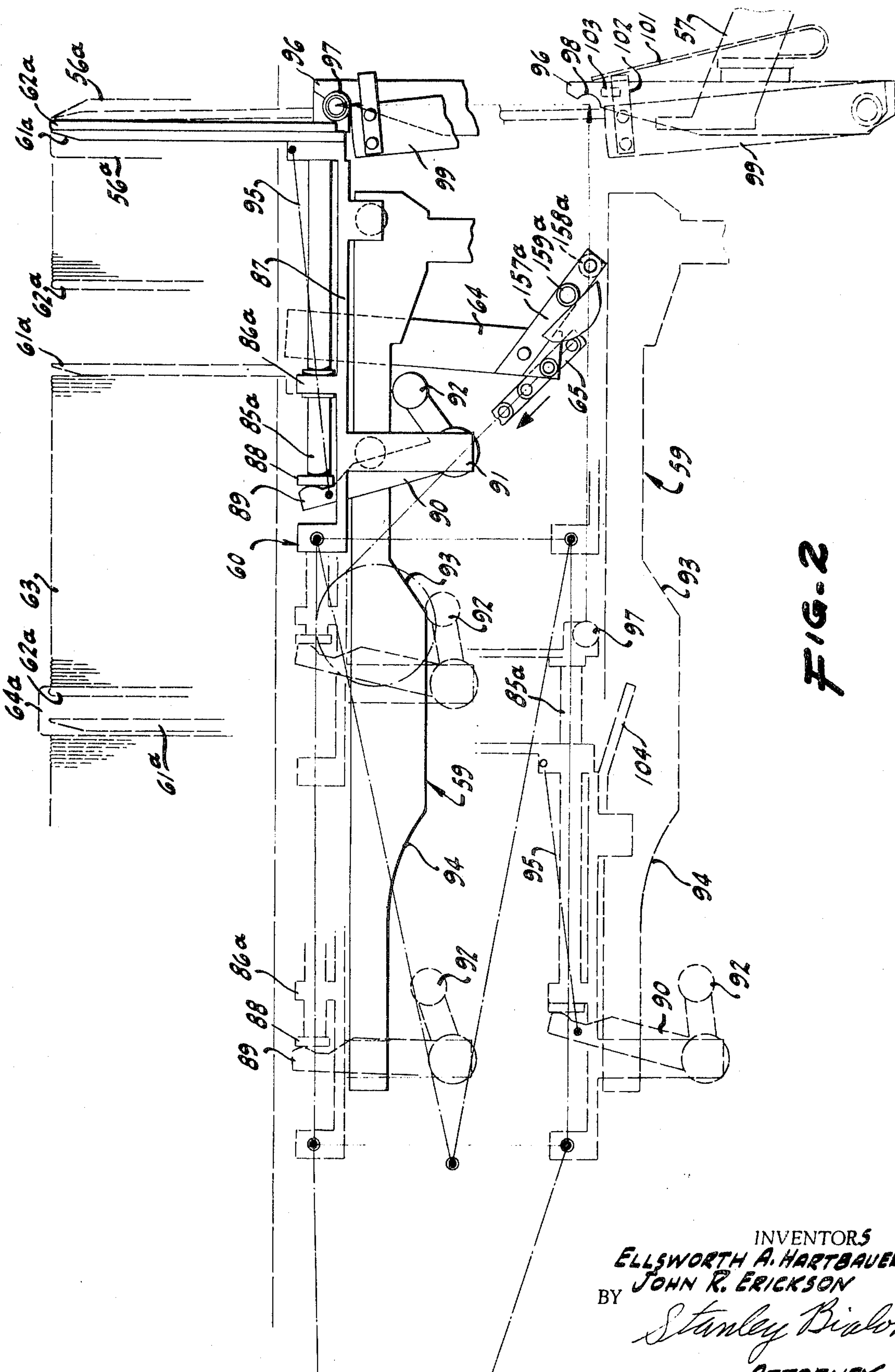

FIG. 2

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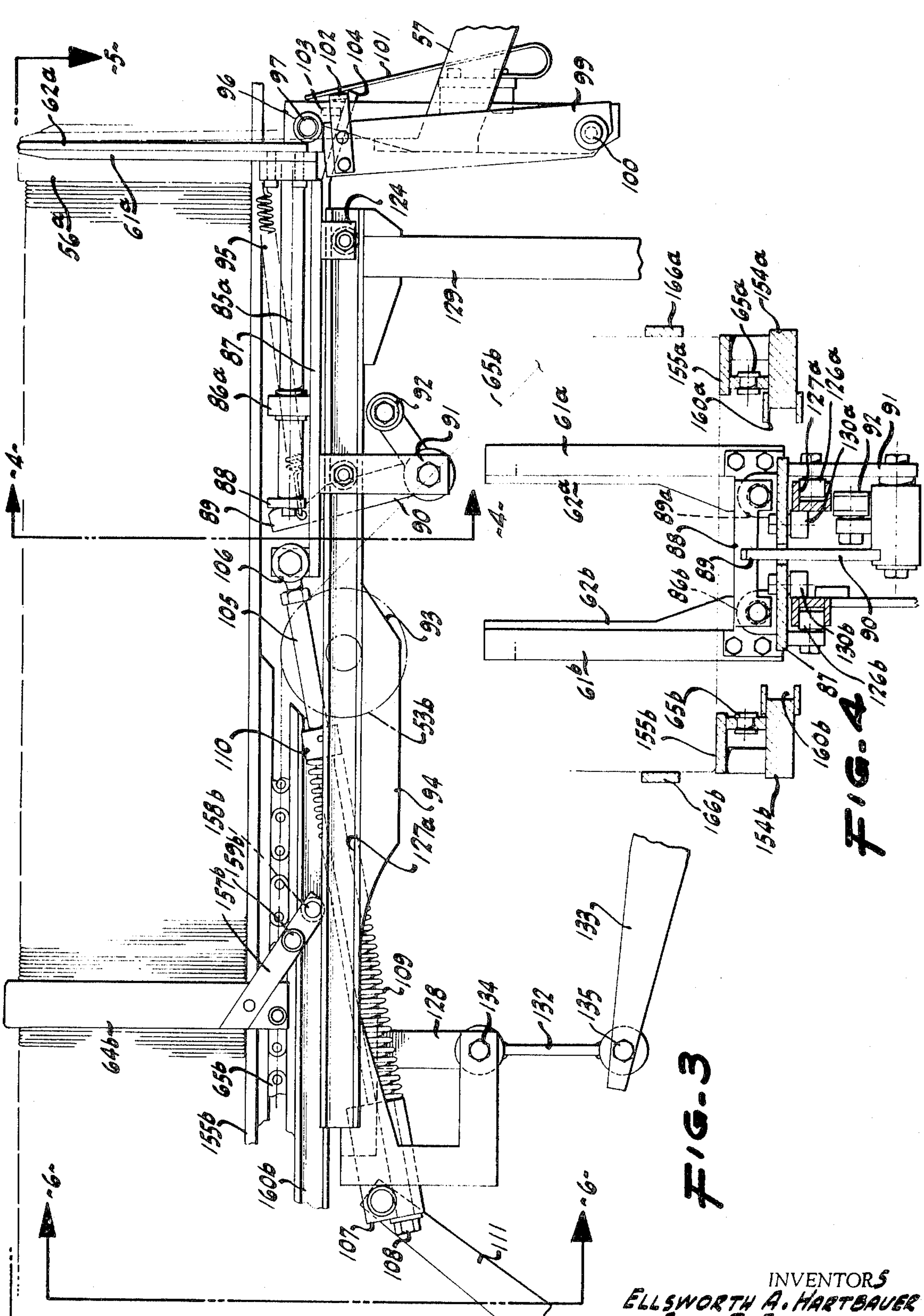

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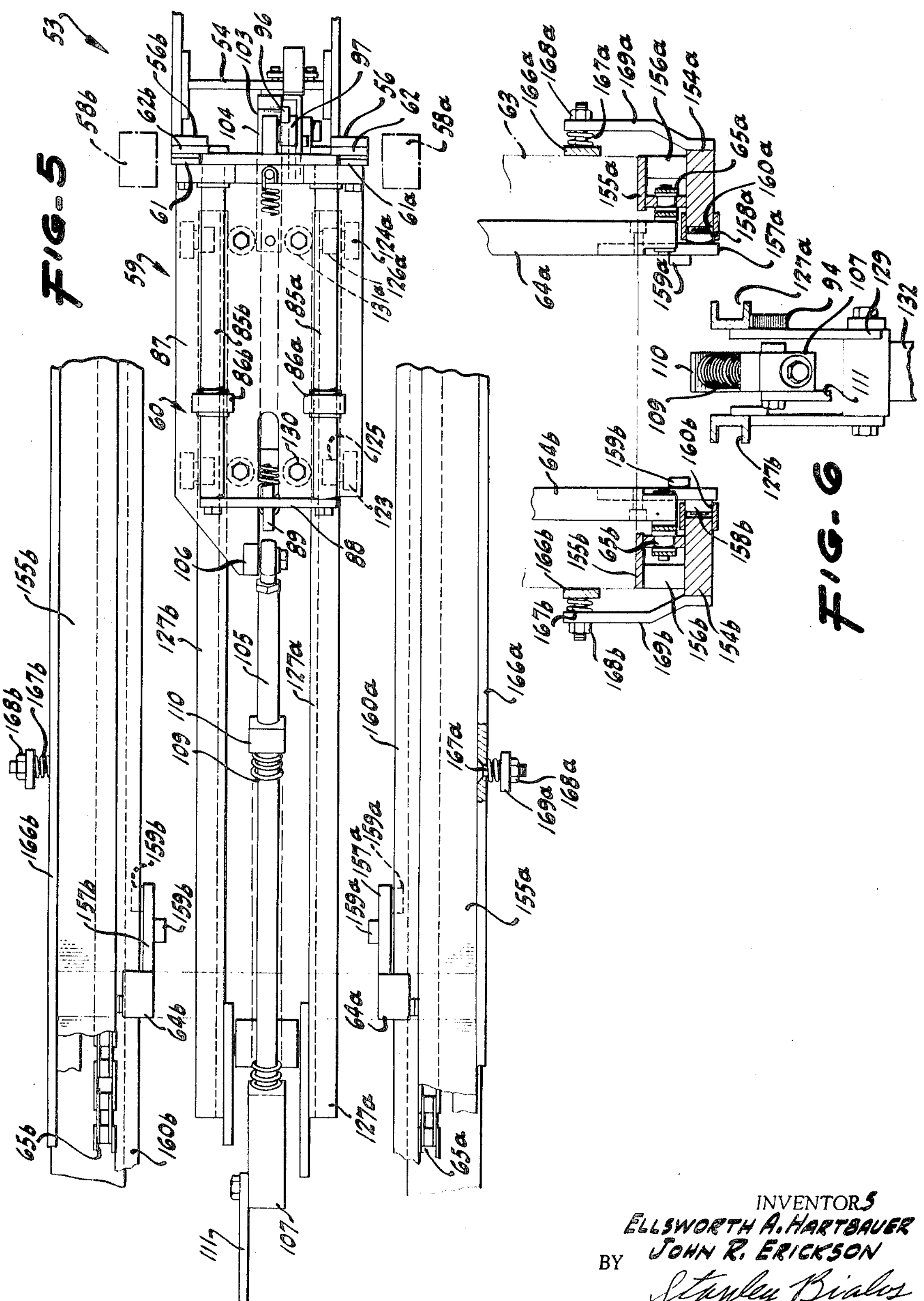

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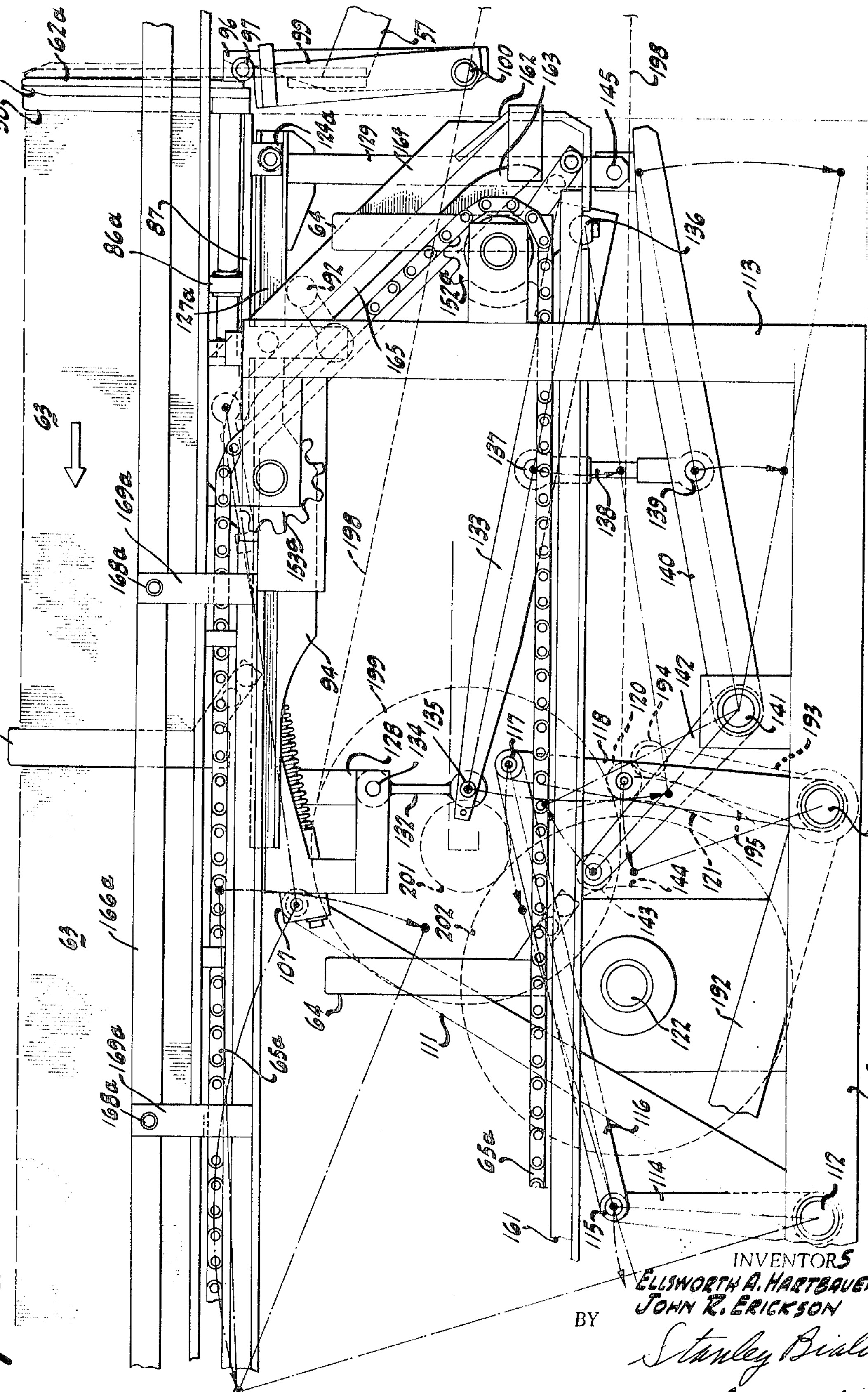

FIG-7

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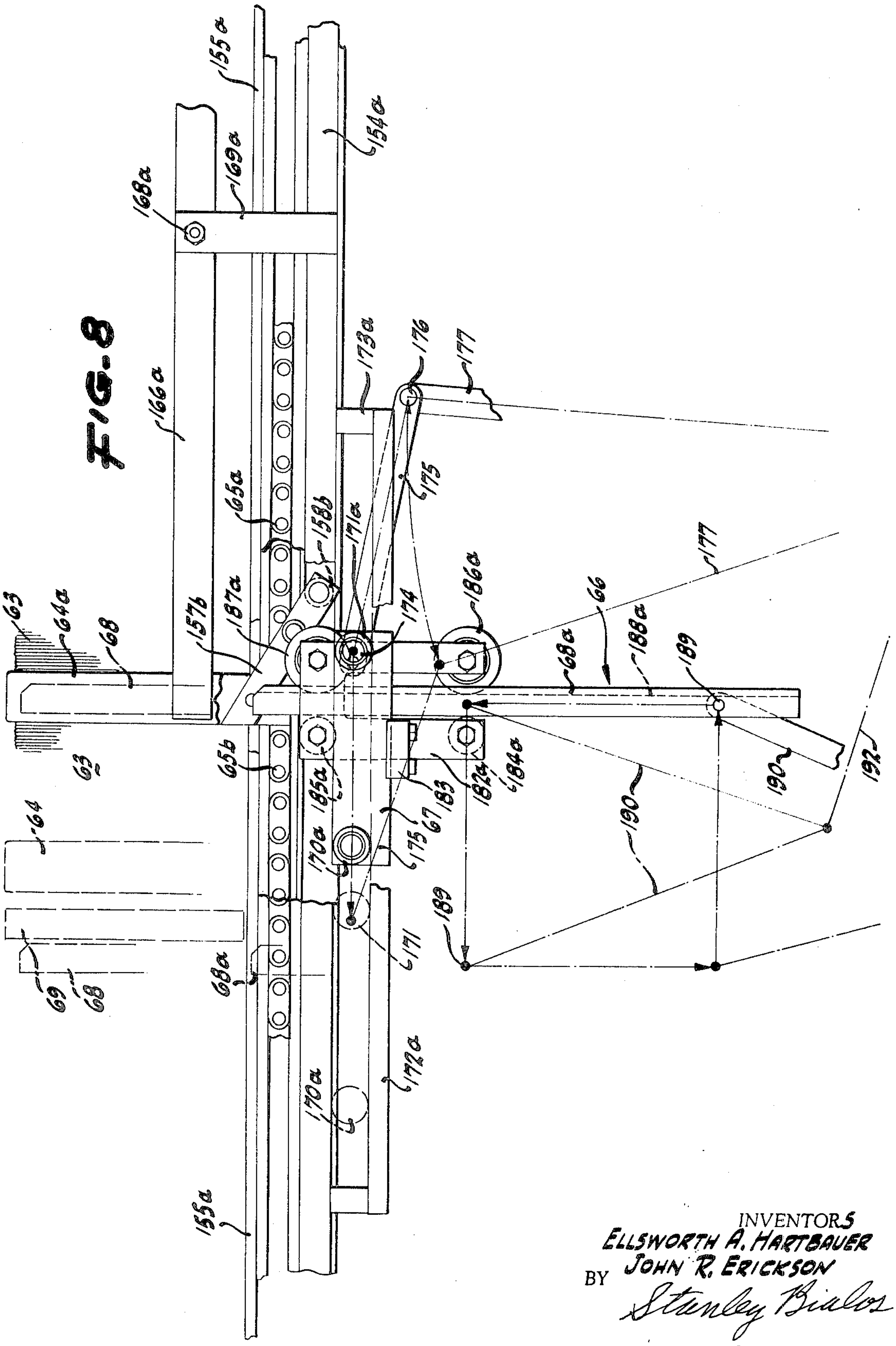

FIG. 8

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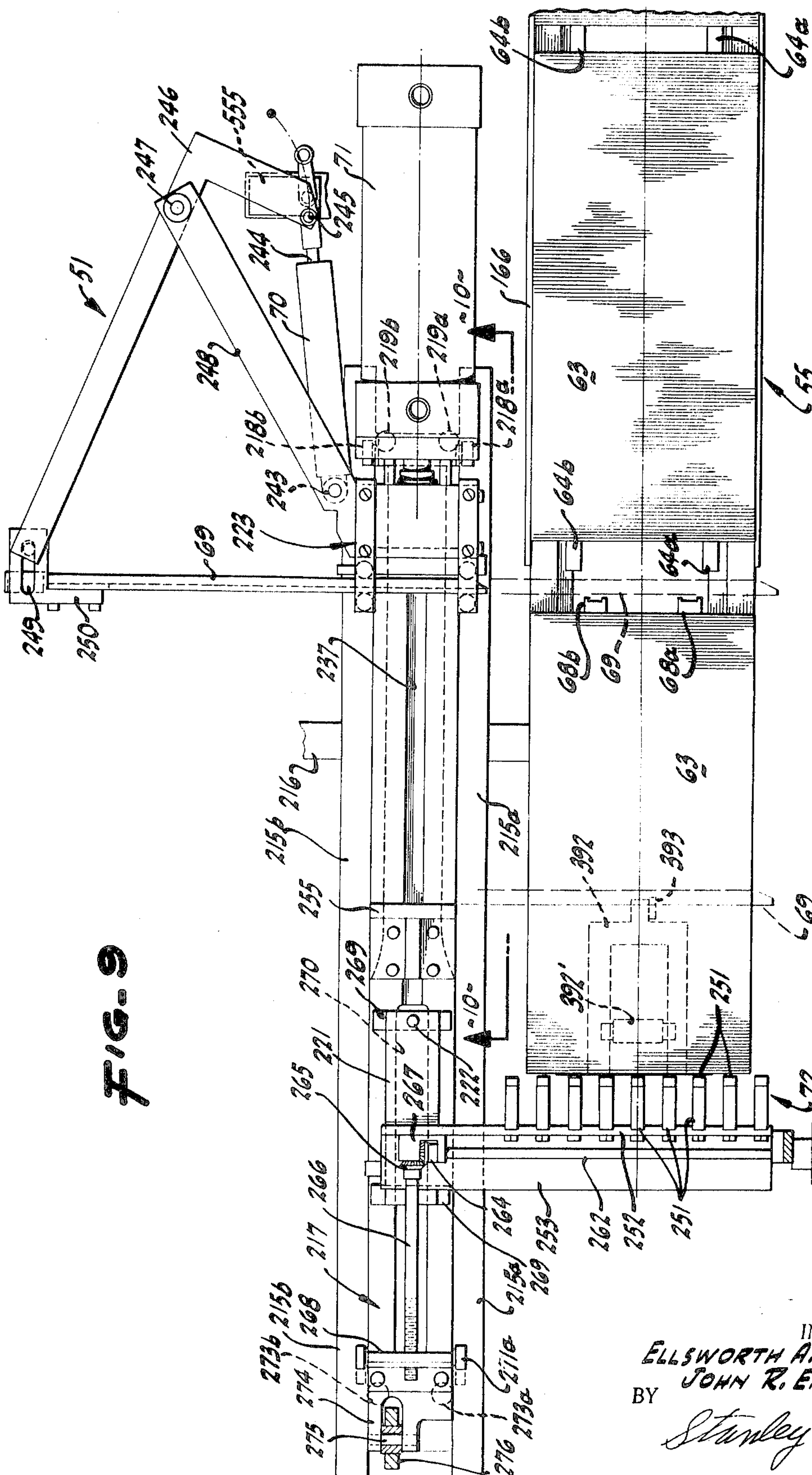
FIG. 9



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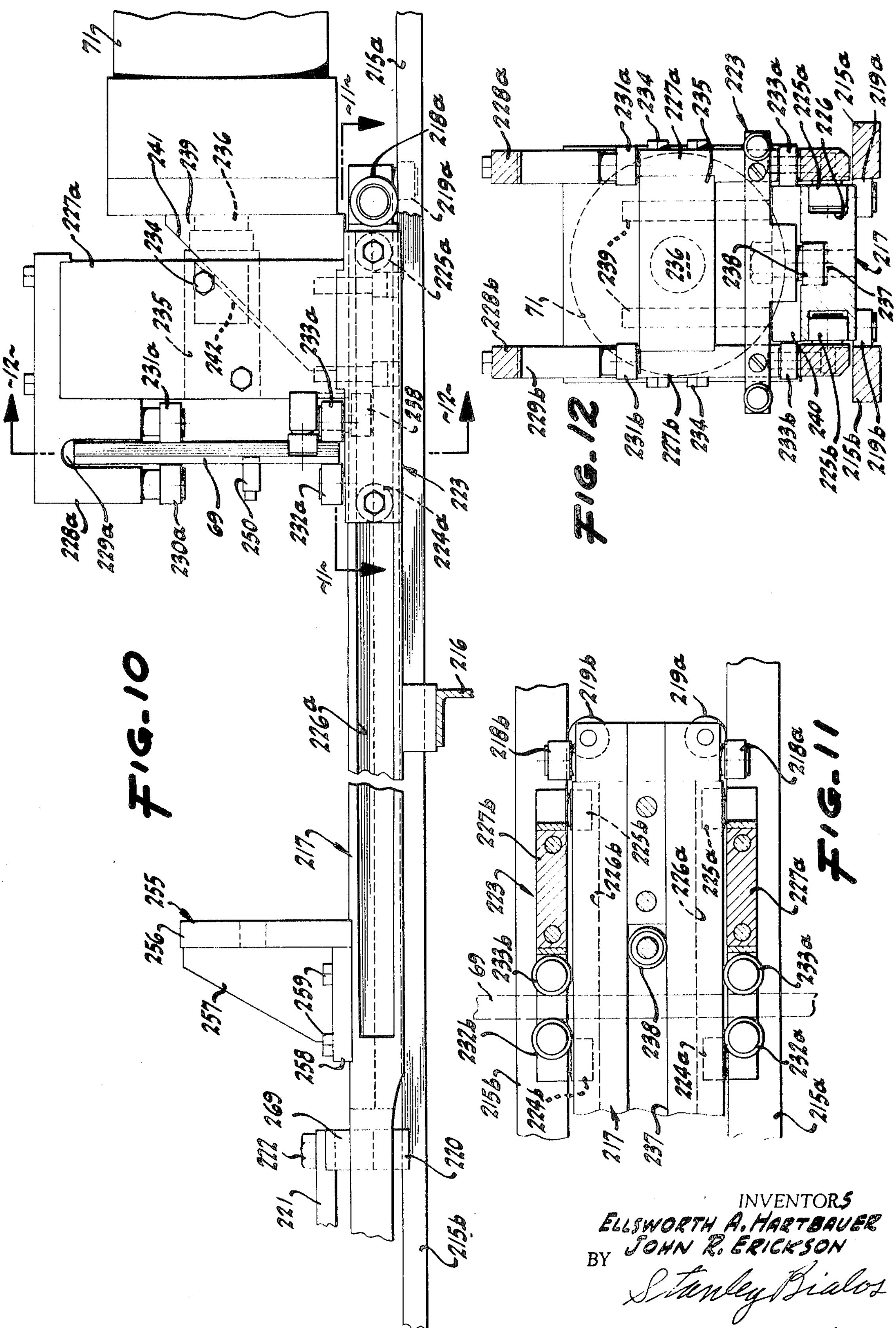

FIG. 10

FIG. 11

FIG. 12

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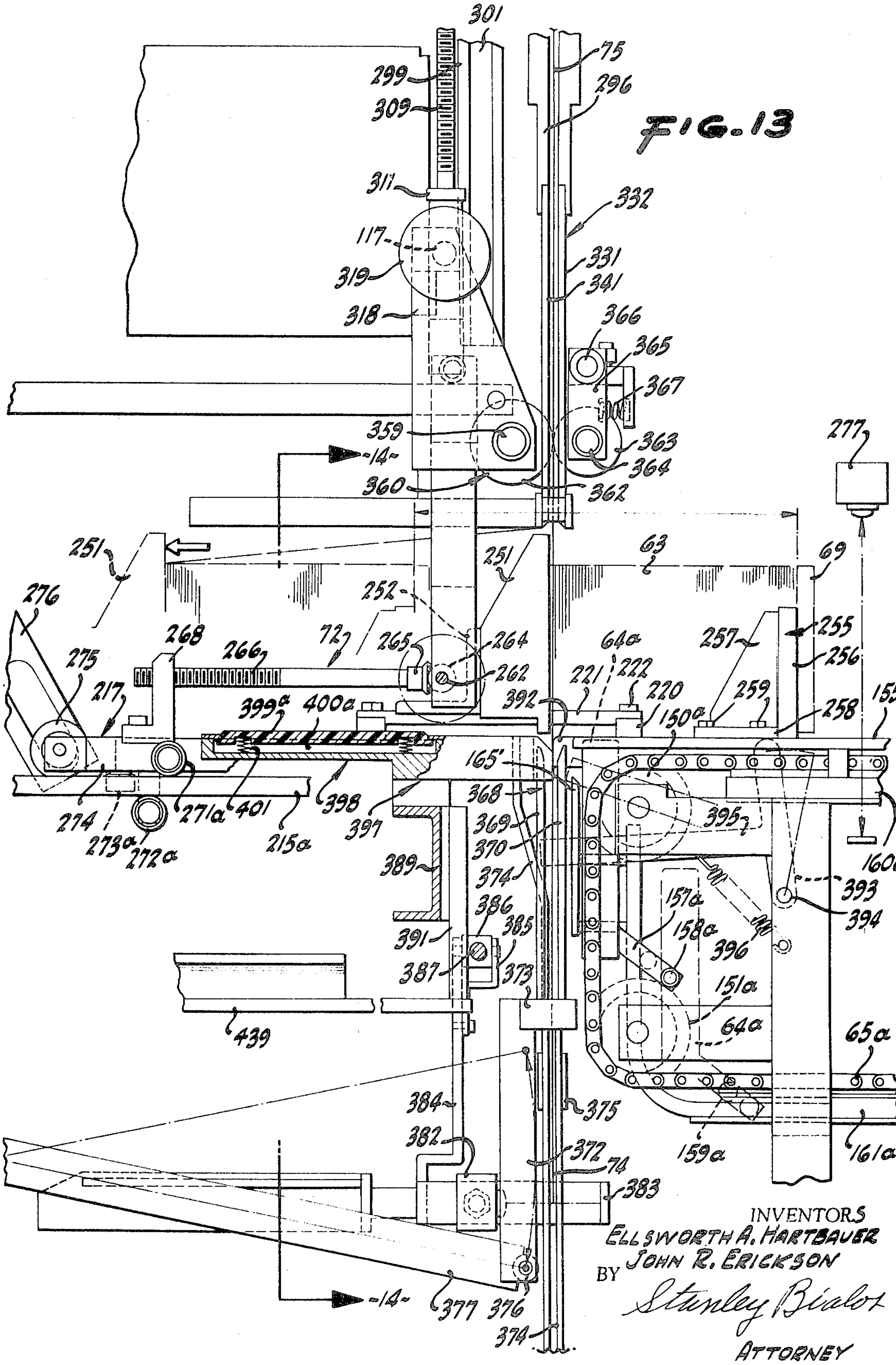

FIG. 13

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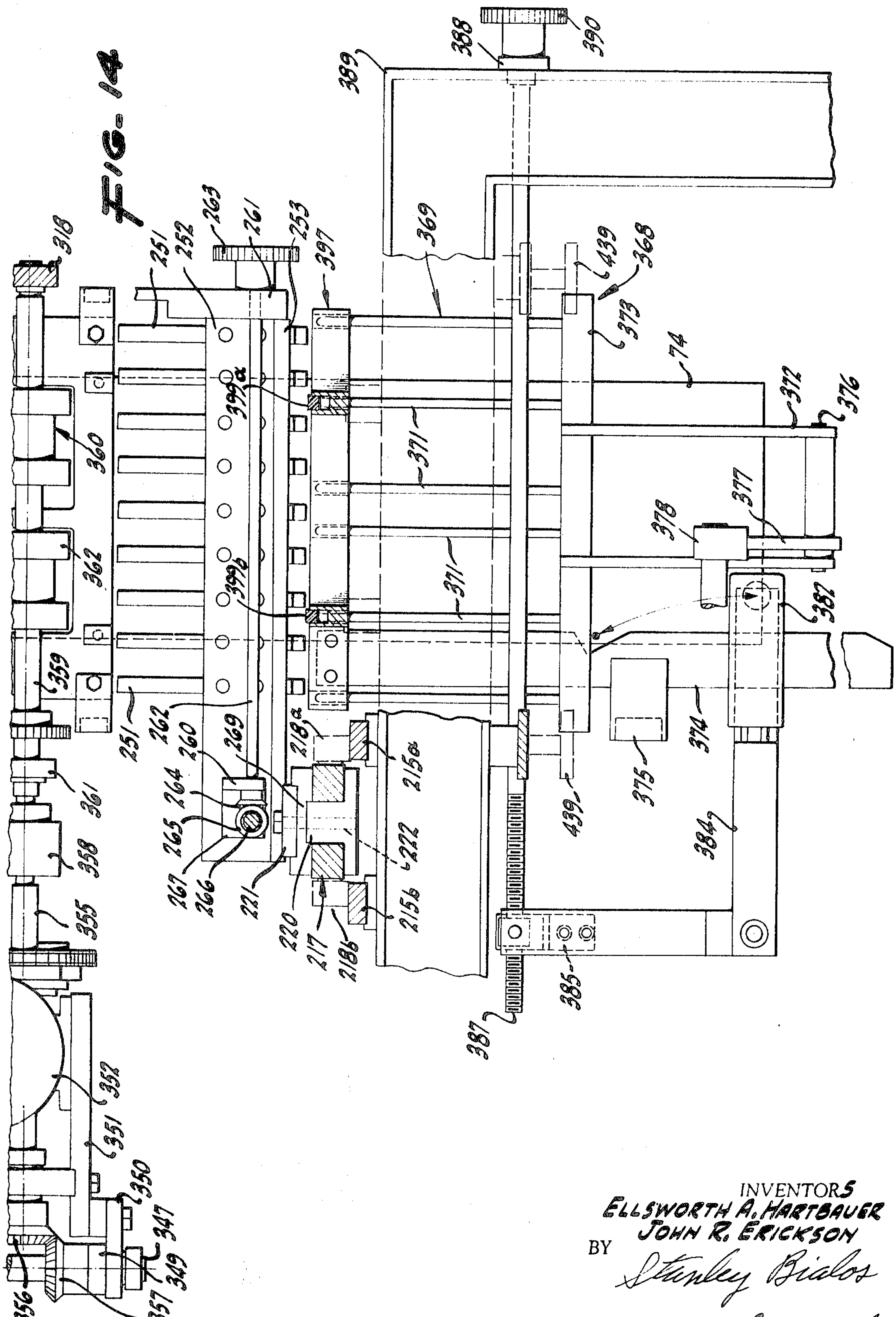

FIG. 14

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FIG-15

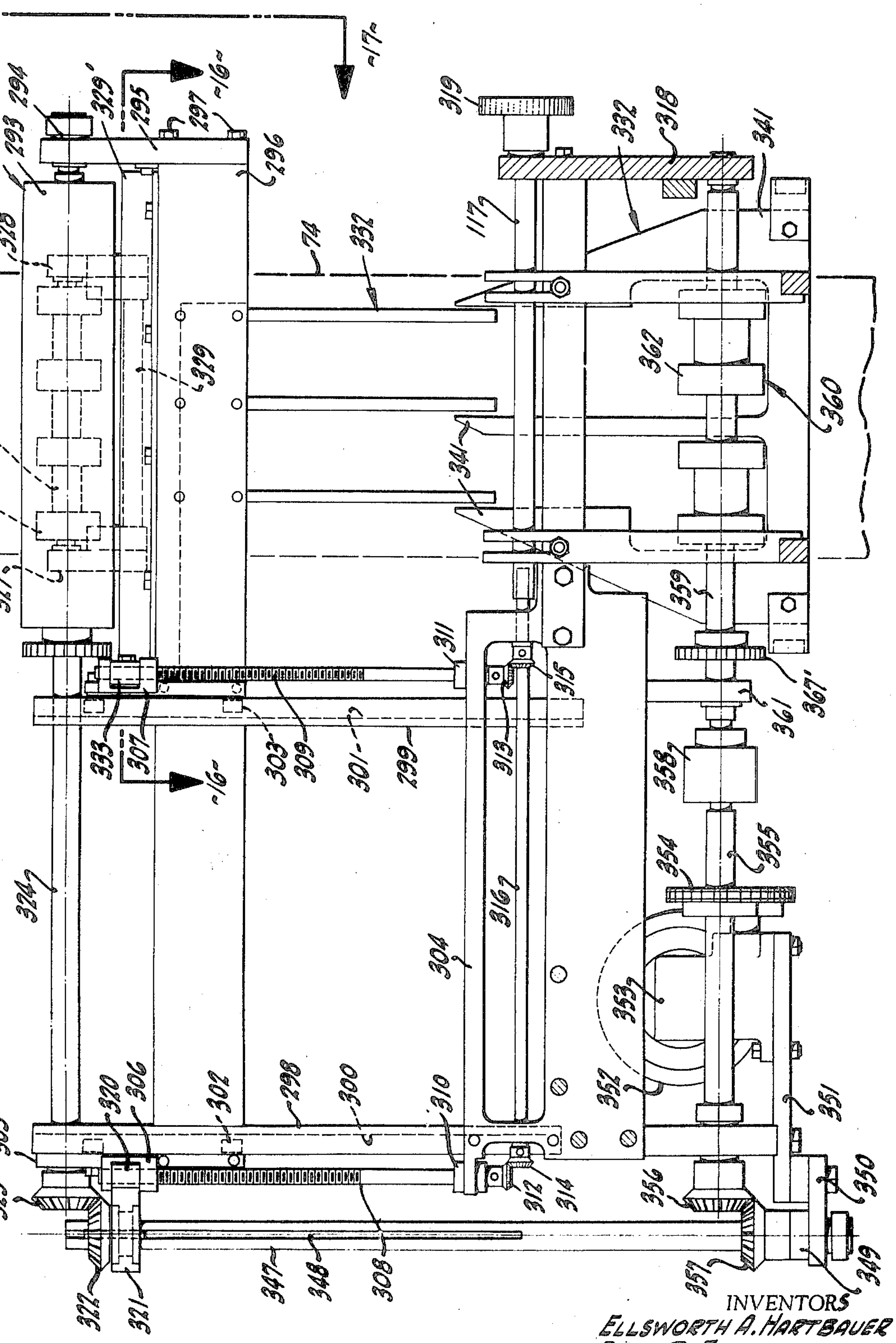

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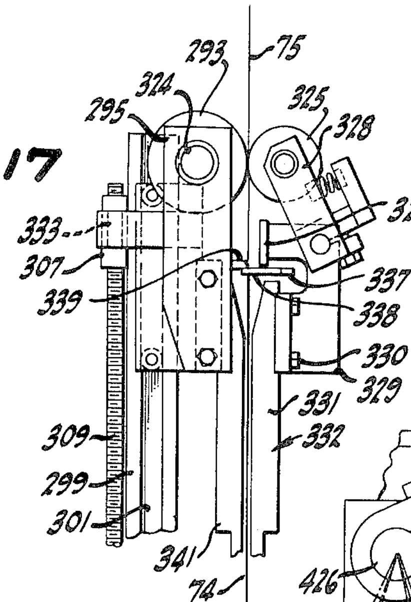
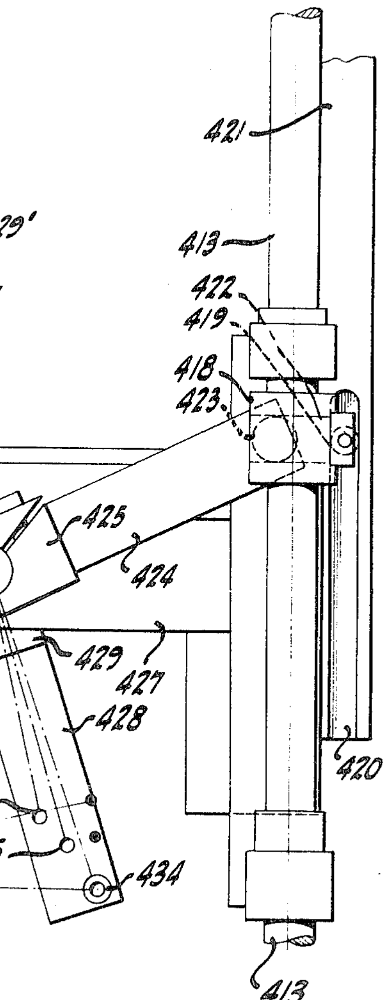
FIG-17





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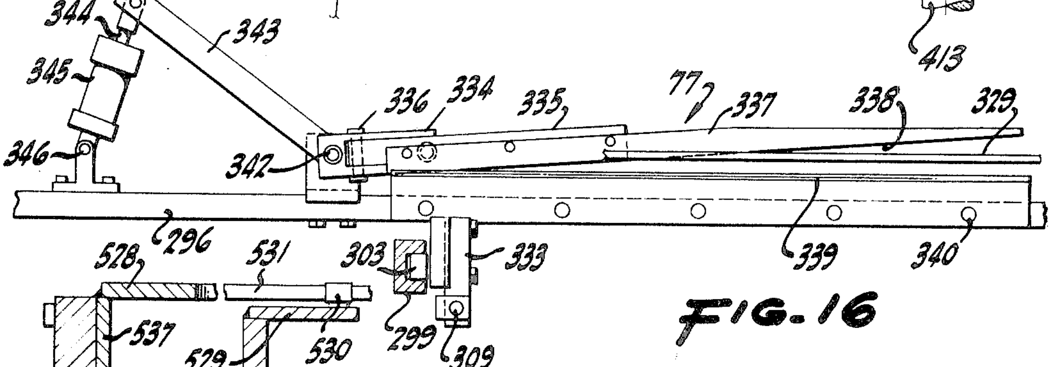

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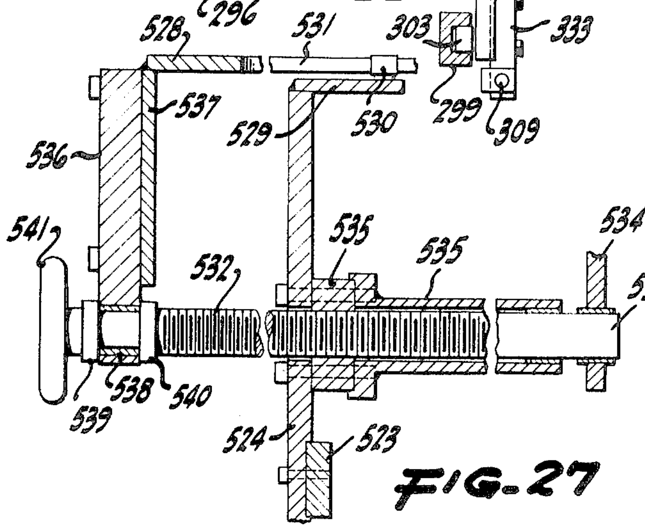

FIG-27

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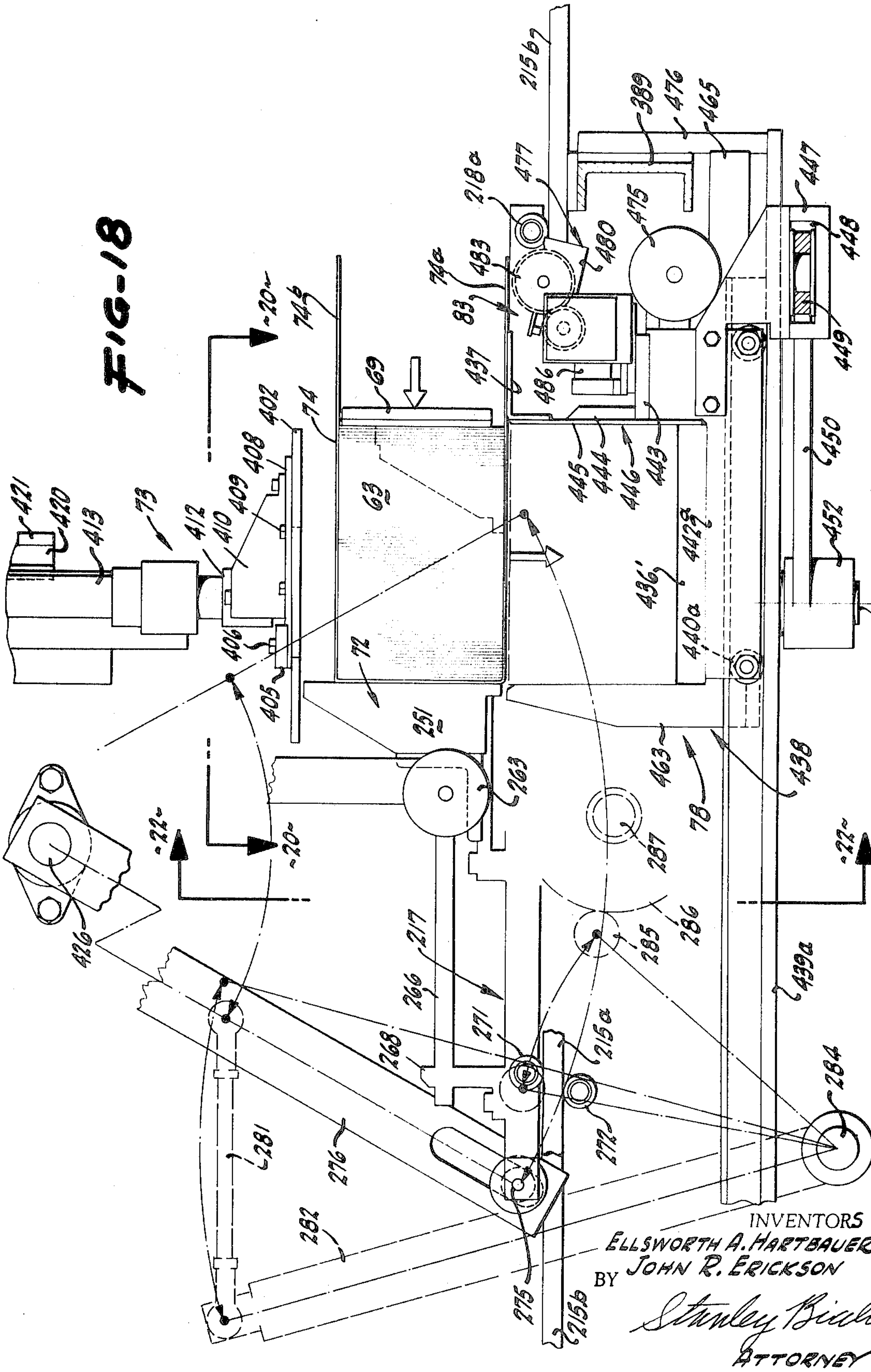

FIG-18

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FIG. 20

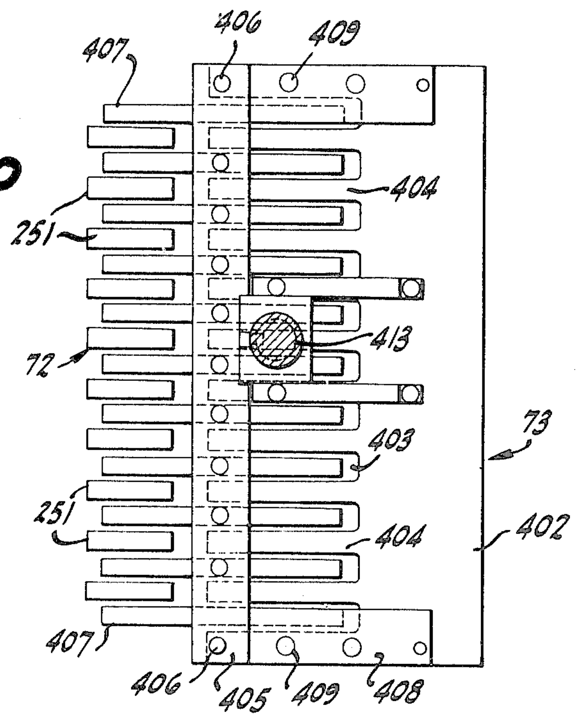
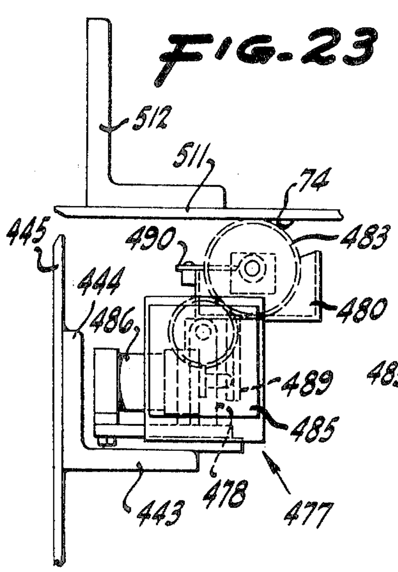


FIG. 23



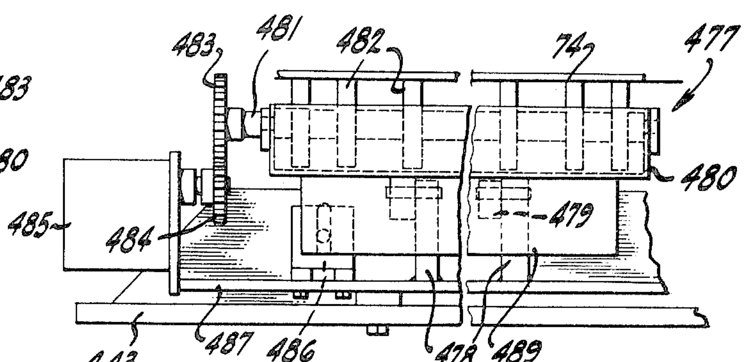


FIG. 24

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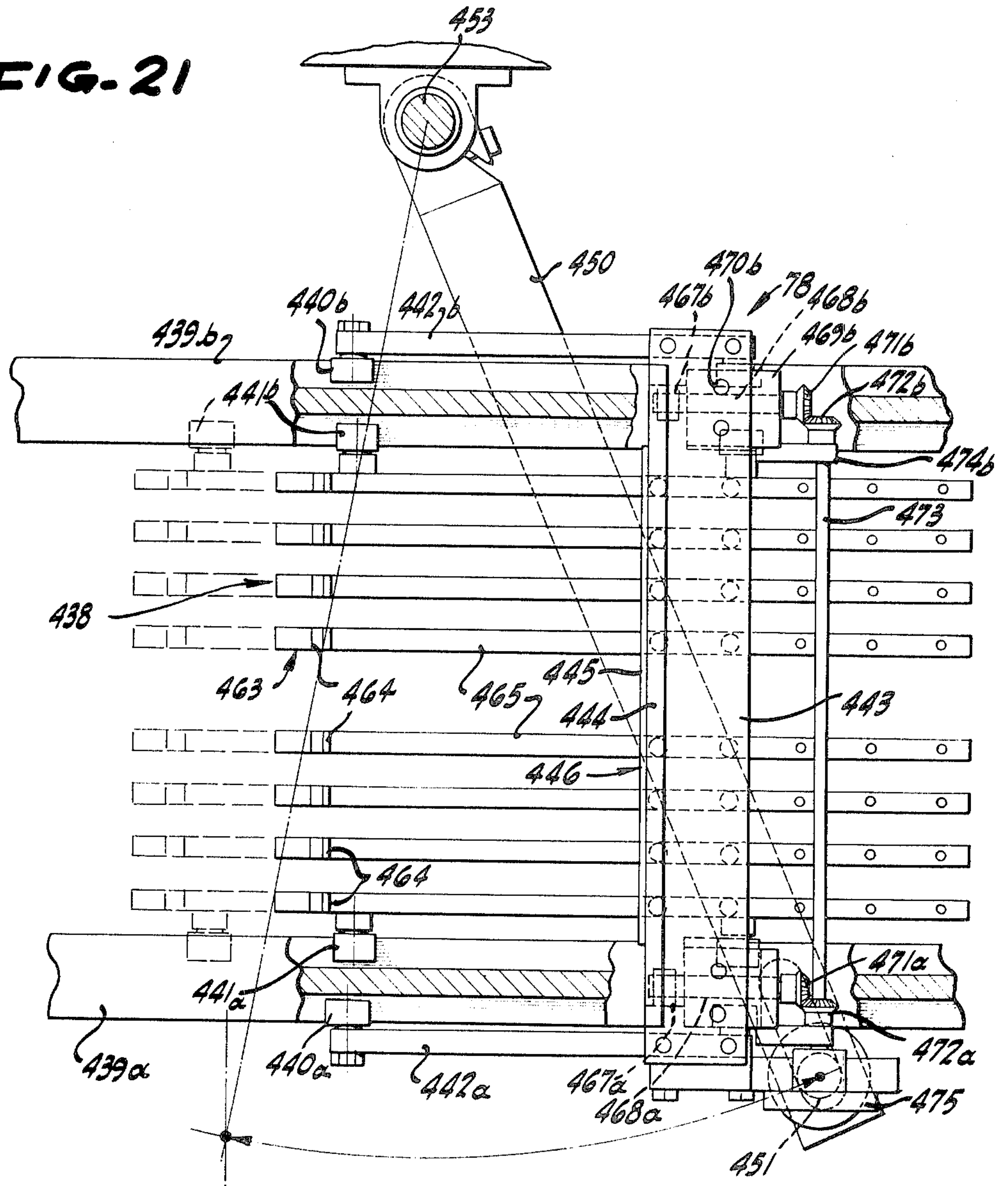
FIG-21



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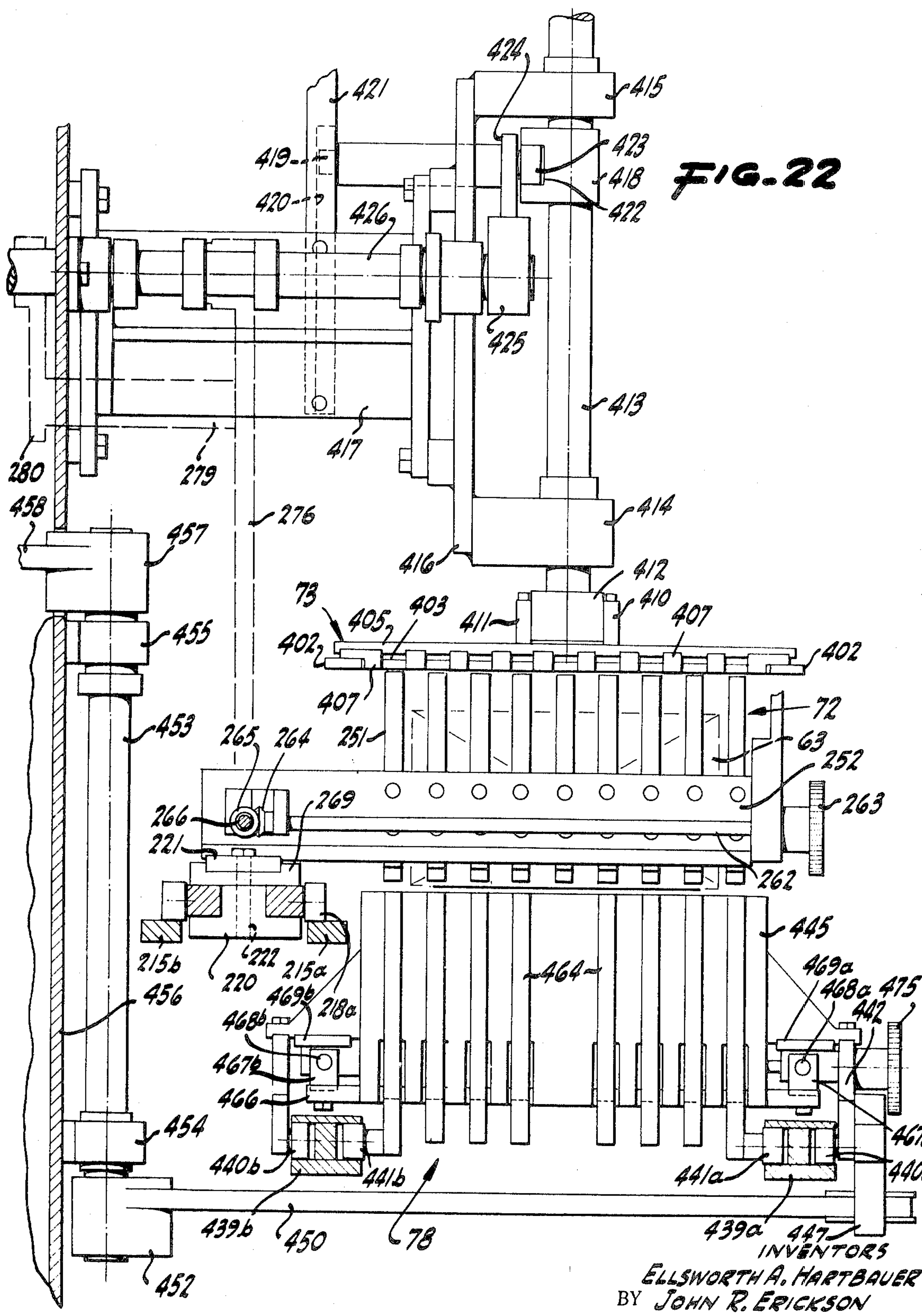

FIG. 22

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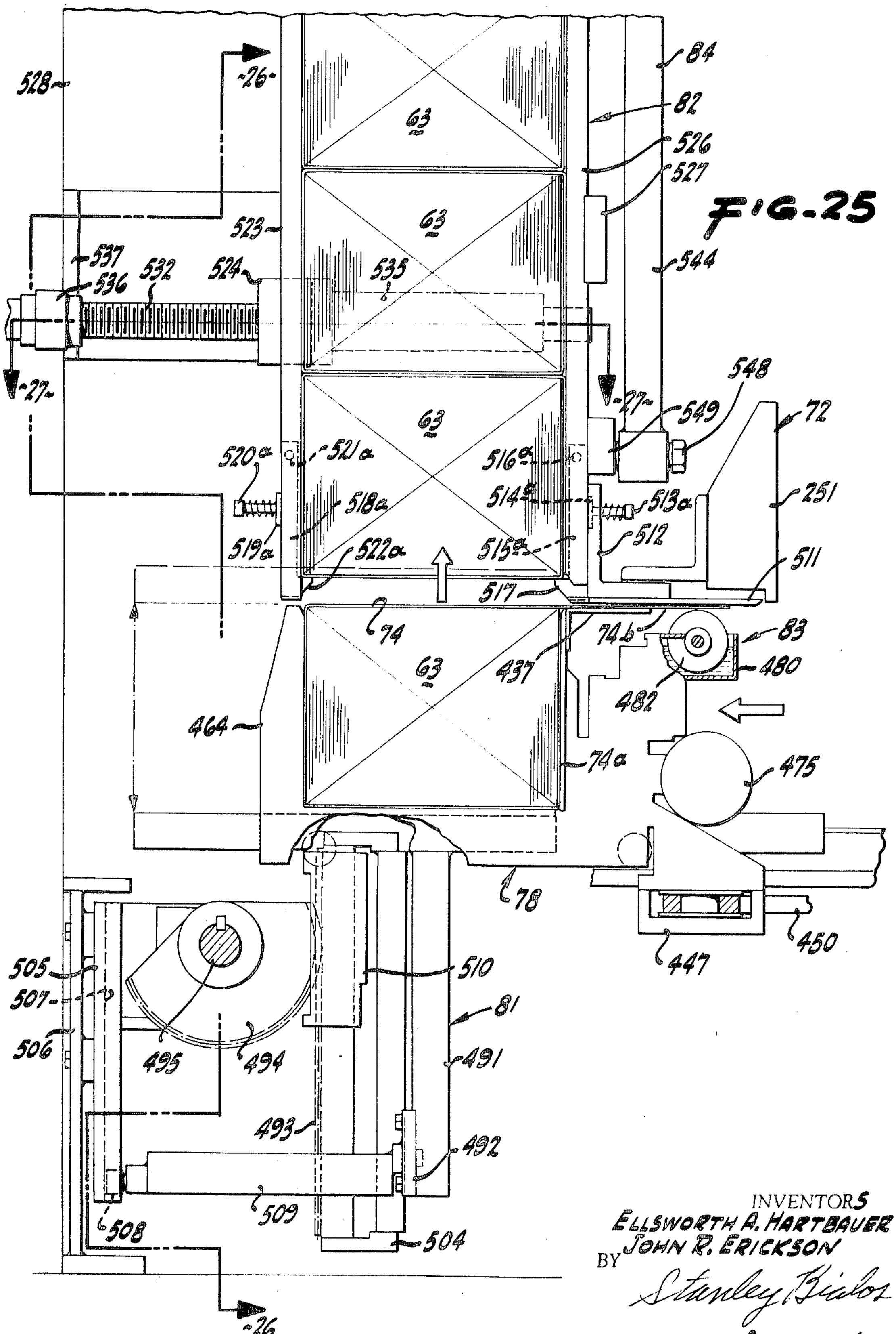

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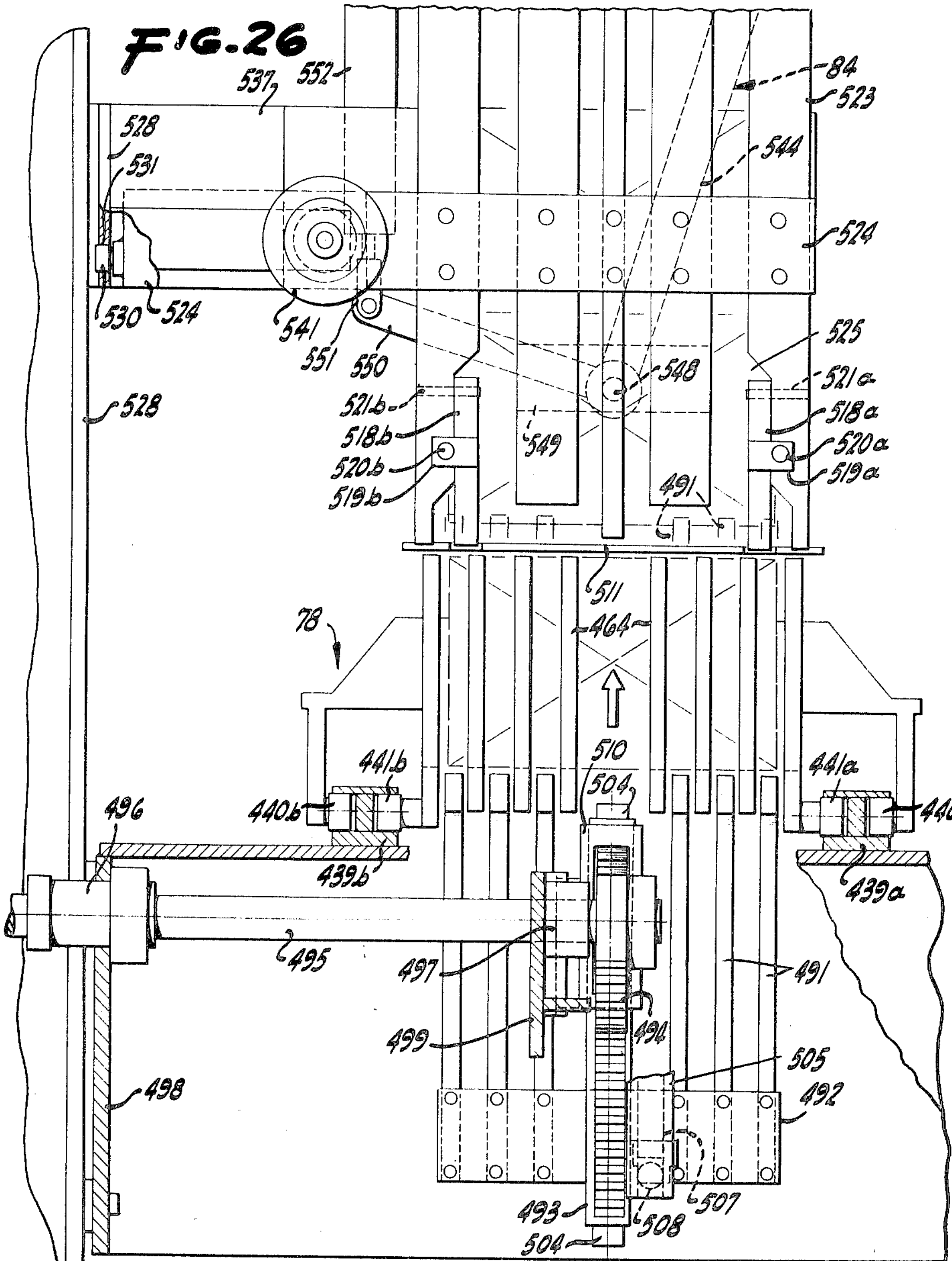
FIG. 26



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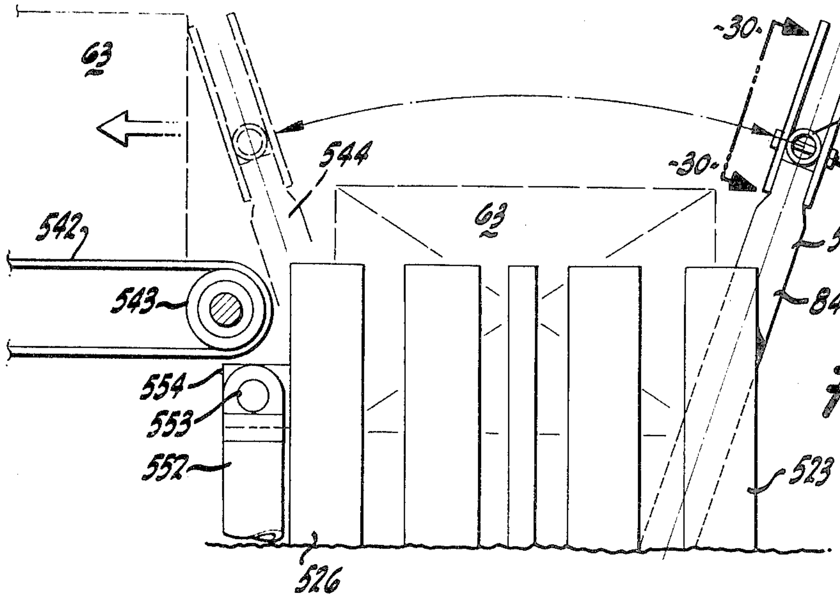
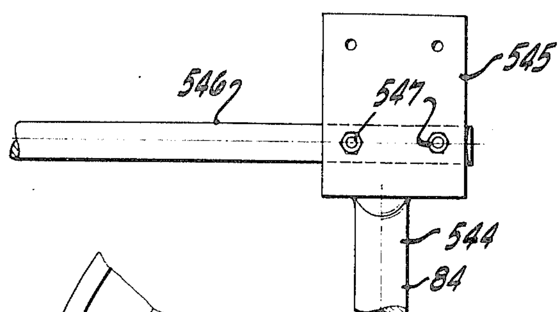


FIG. 29

FIG. 30



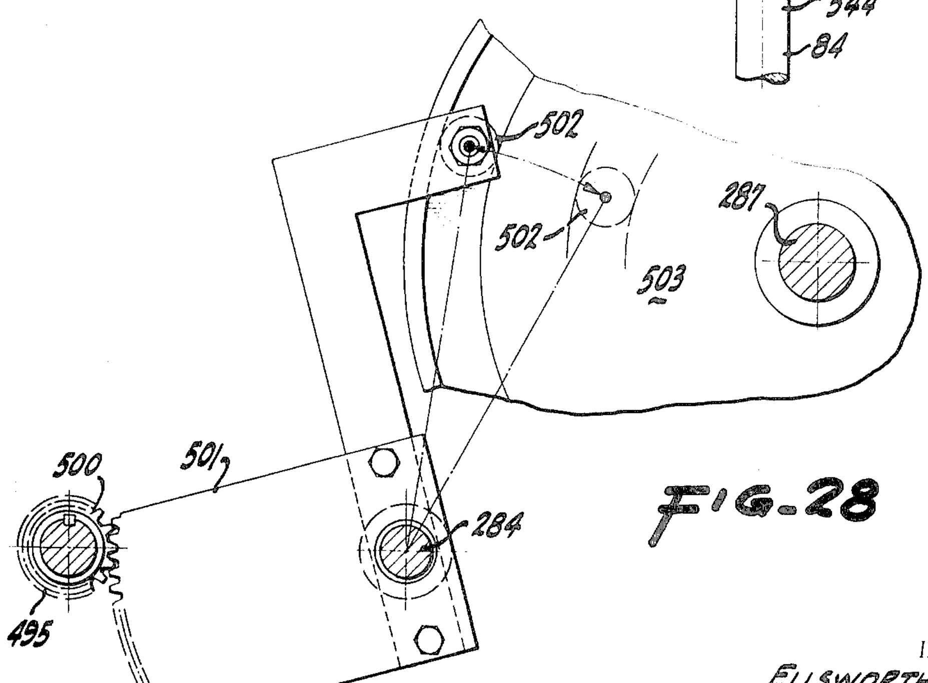


FIG. 28

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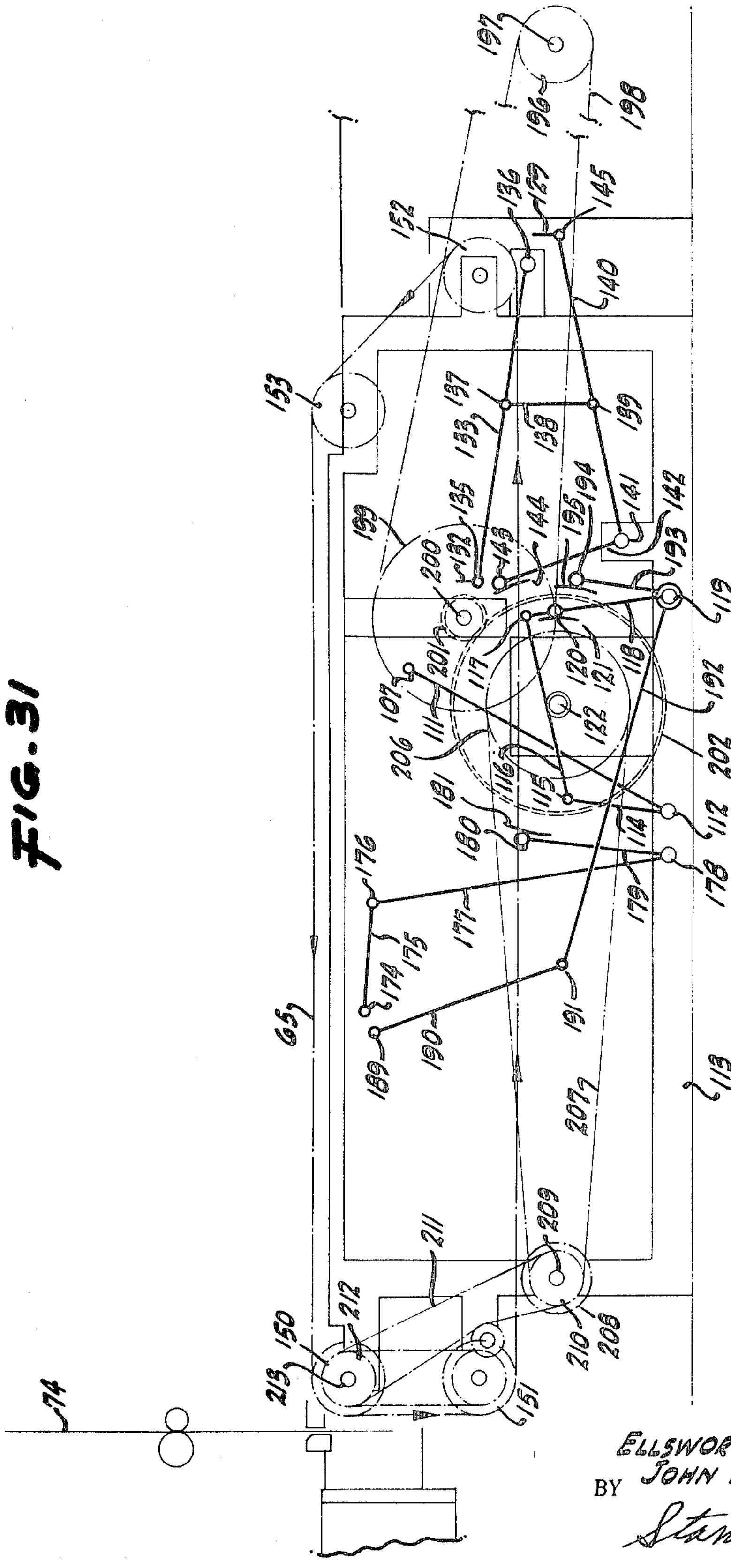

FIG. 31

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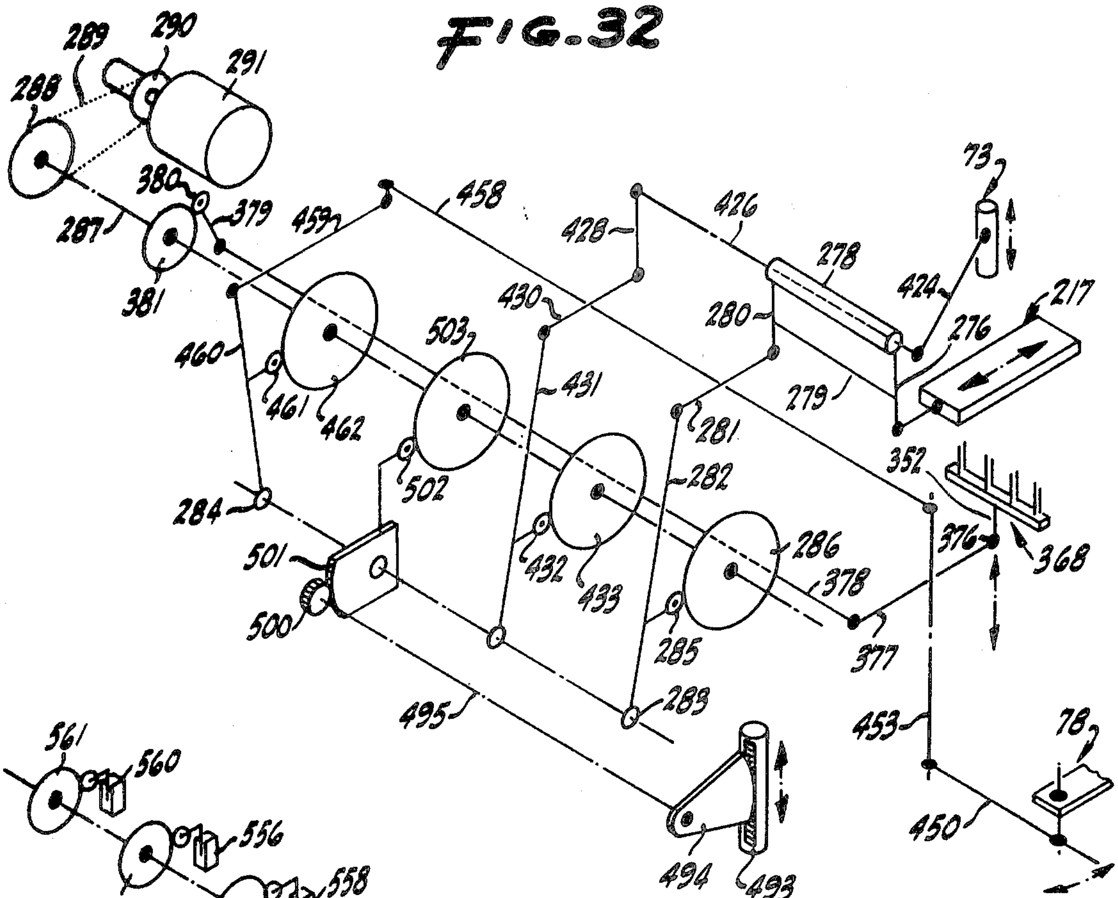
FIG. 32



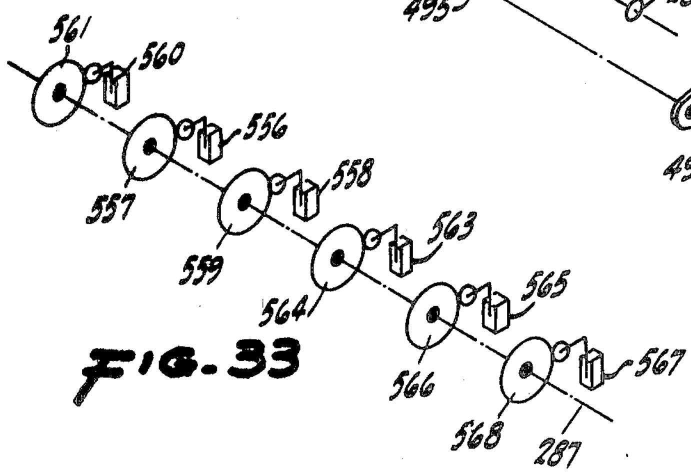


FIG. 33

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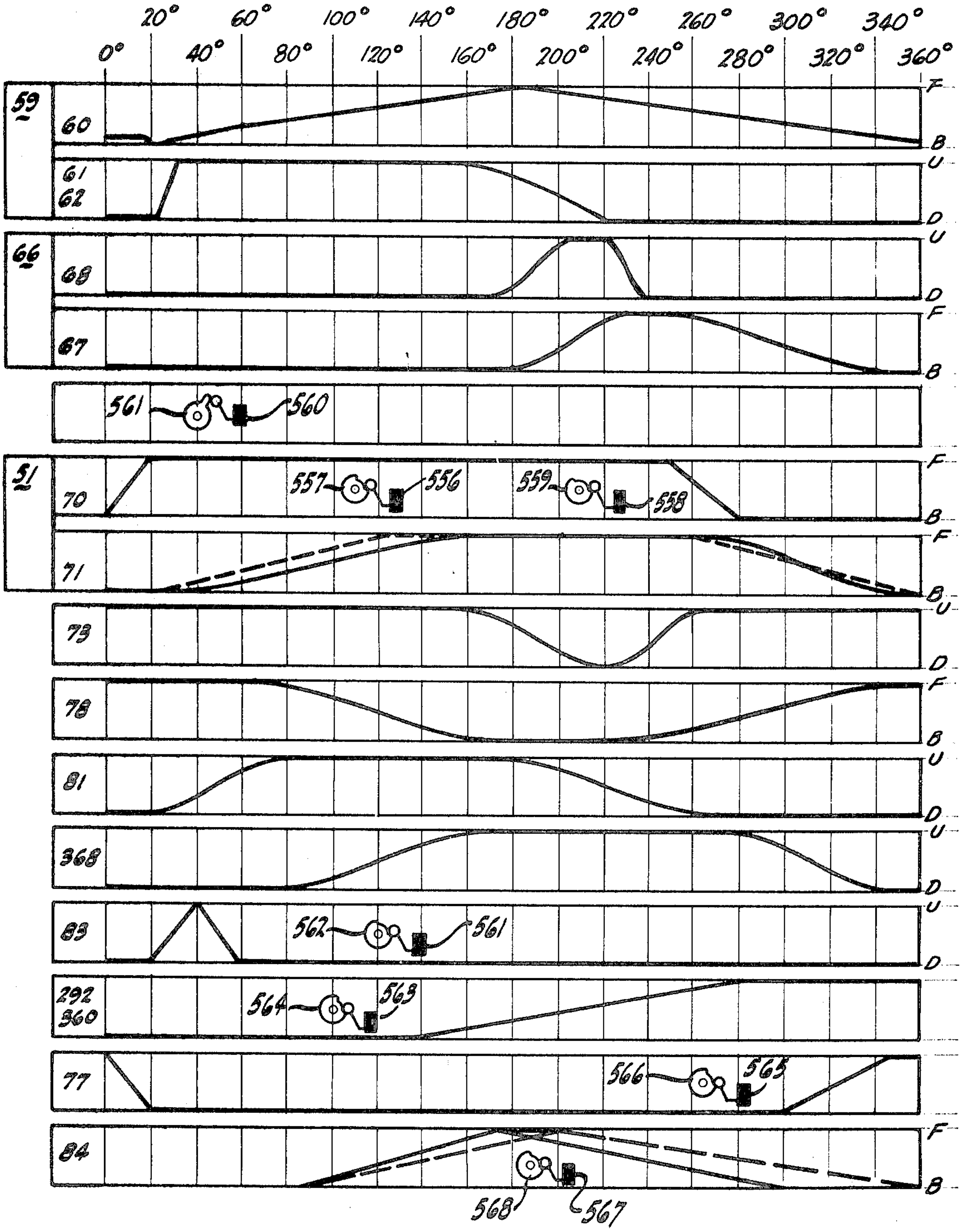

FIG. 34

F = FOWARD
B = BACK
U = UP
D = DOWN

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IN-LINE BANDING APPARATUS

This invention relates to article-bundling machinery and, more particularly, to apparatus for and a method of forming articles such as paper grocery bags and the like into bundles, compressing the same, and the equipping each bundle with a band or wrapper to maintain it in its compressed state.

Considering use of the invention with paper grocery bags, it will be observed that the bag articles are fabricated at relatively high speeds and are discharged in essentially uninterrupted, continuous succession from the bag-making machinery. Each bag is much thicker adjacent its bottom end than elsewhere therealong because of the overlapped layers of material required to close the bag bottom and also because the closed bottom of each bag is, in part, folded against the side wall thereof in overlapping relation therewith. Consequently, as the bags are discharged from the bag-making machinery with their closed and folded bottoms all oriented in the same direction, any direct grouping or collation of the bags would result in a bundle of irregular dimensions unsuitable for storage and shipment.

Accordingly, it is customary for bags discharged from bag-making machinery to be collated or processed in a manner such that successive bags or groups thereof are alternatively turned in opposite directions in order that certain of the bags have the bottoms thereof facing in one direction and other of the bags have their bottoms facing in the opposite direction. Thus, any bundle comprising a plurality of such collated bags is of relatively uniform dimensions and is therefore conveniently handled during banding of the bundle and subsequent shipment and storage thereof.

The present invention is concerned with the formation of bags into bundles each of which constitutes a predetermined number of bags collated so that the dimensions of any bundle are generally uniform, and it is further concerned with compressing each such bundle and with banding the same so that it will be maintained in a compressed state during subsequent shipment and storage. By way of example, a bag bundle might typically comprise 500 standard weight paper grocery bags arranged in 10 individual groups or hands, each constituting 50 bags, alternately oriented with the bag bottoms thereof oppositely disposed. It should be appreciated, however, that bundles may contain any desired number of bags, and to some extent the number of bags in a bundle thereof will depend upon the weight and size of the bags. In this respect, and as another example, a typical bundle of heavy weight paper grocery bags may total 250 arranged in 10 groups or hands each consisting of 25 bags.

The exemplary embodiment of the invention illustrated and described herein includes a bundle-forming apparatus or section in which bags delivered thereto from a collator are separated into bundles each constituting a predetermined number of bags. It further includes a compression-transfer apparatus in which each bag bundle is compressed by the application of a relatively high value compressional force thereto and is then transferred into a banding apparatus or section. In the banding apparatus, the compressed bag bundle is displaced from the grip of the compression-transfer apparatus and into a bundle-transfer mechanism by a first flap-folder mechanism. The bundle-transfer mechanism then advances the bundle seated therein into alignment with a second flap-folder mechanism operative to engage the bag bundle and displace the same into a compression-drier mechanism. As each bag bundle is advanced into and through the banding apparatus, a band is wrapped or folded thereabout in progressive steps and finally, adhesive used to secure overlying flaps of the band to each other is permitted to cure while the bundle is retained in the compression-drier mechanism so that upon ejection therefrom, the bundle is ready for storage and shipment.

A number of objects and advantages are inherent in the invention including the provision of machinery for and a method of processing bags and like articles at relatively high rates of speed as, for example, speeds of the order of 2,000 bags per minute; the provision of machinery operative to handle or process a great variety of bag sizes without the requirement for major change or parts replacement, and which machinery is readily adjustable to accommodate variations in the bulk of the paper (basis weight); and the provision of machinery in which the band or wrapper used to encircle each bag bundle is continuously controlled and progressively folded by a plurality of separate but simple motions, thereby contributing to the speed of the machine, in which a number of compound linear displacements aggragative or serially related in a dimensional sense are, in terms of mechanism, arranged in parallelism so as to maintain the distinct mechanical movements short and the structure responsible therefore lightweight, in which each bag bundle is compressed to the extent that the internal bag friction therein enables the bundle to be displaced bodily from one mechanism to another without the necessity of the displacement devices being in engagement with all of the bags of a bundle during such displacement thereof.

Additional objects and advantages of the invention, especially as concerns specific features and characteristics thereof, will become apparent from the following detailed description of the embodiment illustrated in the accompanying drawings in which:

FIG. 1 is a diagrammatic view depicting the overall operational sequence and general steps in the bundle-forming, compression-transfer and bundle-banding procedures;

FIG. 2 is a somewhat schematic side view in elevation of the hand-transfer mechanism showing the same in various positions assumed thereby in a cycle of operation;

FIG. 3 is a broken side view in elevation of the hand-transfer mechanism shown schematically in FIG. 2;

FIG. 4 is a vertical sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a broken top plan view taken along the line 5—5 of FIG. 3;

FIG. 6 is a broken vertical sectional view taken along the line 6—6 of FIG. 3;

FIG. 7 is a side view in elevation of the infeed end portion of the bundle-conveyor mechanism in association with the hand-transfer mechanism located thereat;

FIG. 8 is a broken side view in elevation of a portion of the bundle-conveyor mechanism illustrating in particular the bundle-locator mechanism associated therewith;

FIG. 9 is a broken top plan view of the discharge end portion of the bundle-conveyor mechanism and of the compression-transfer mechanism located thereat;

FIG. 10 is essentially a side view in elevation of the compression-transfer apparatus taken along the line 10—10 of FIG. 9;

FIG. 11 is a broken horizontal sectional view taken along line 11—11 of FIG. 10;

FIG. 12 is a broken vertical sectional view taken along the line 12—12 of FIG. 10;

FIG. 13 is generally a side view in elevation of the discharge end portion of the bundle-conveyor mechanism and the band guide and band-delivery mechanism located thereat, and also of the compression-transfer mechanism which is shown in full lines in the position assumed thereby when first receiving a bundle of bags and is shown in broken lines in its forward or bundle-transfer position;

FIG. 14 is a broken vertical sectional view taken along the line 14—14 of FIG. 13;

FIG. 15 is a broken vertical sectional view essentially constituting a continuation of FIG. 14 to illustrate the structural composition located thereabove;

FIG. 16 is a broken transverse sectional view taken along the line 16—16 of FIG. 15;

FIG. 17 is a broken side view in elevation taken along the line 17—17 of FIG. 15;

FIG. 18 is a broken side view in elevation of the first band flap-folder and bundle-transfer mechanisms, each of which forms a part of the banding apparatus;

FIG. 19 is a broken side view in elevation of the operating linkage for the first band-flap folder mechanism shown in FIG. 18;

FIG. 20 is a broken horizontal sectional view taken along line 20—20 of FIG. 18;

FIG. 21 is a broken horizontal sectional view taken along the line 21—21 of FIG. 18;

FIG. 22 is a broken vertical sectional view taken along the line 22—22 of FIG. 18;

FIG. 23 is a side view in elevation of the glue assembly carried by the bundle-transfer mechanism;

FIG. 24 is a broken top plan view of the glue assembly;

FIG. 25 is a side view in elevation of the second flap-folder mechanism and lower end portion of the compression-drier and ejector mechanism, each of which forms a part of the banding apparatus;

FIG. 26 is a broken vertical sectional view taken along the line 26—26 of FIG. 25;

FIG. 27 is a broken transverse sectional view taken along the line 27—27 of FIG. 25;

FIG. 28 is a broken transverse sectional view illustrating a portion of the drive assembly for reciprocating the second band flap-folder mechanism;

FIG. 29 is a side view in elevation showing the upper end portion of the compression-drier and ejector mechanism;

FIG. 30 is a broken side view in elevation taken along the line 30—30 of FIG. 29;

FIG. 31 is a schematic diagram of the drive mechanism for the bundle-forming apparatus;

FIG. 32 is a schematic diagram depicting the drive assembly for the compression-transfer apparatus and banding apparatus;

FIG. 33 is a schematic diagram essentially constituting a continuation of FIG. 32 and depicting the cam-controlled switch assembly; and

FIG. 34 is a chart or graph showing the timing interrelationships of various components and mechanisms of the entire apparatus.

GENERAL DESCRIPTION

Prior to describing the entire machine in detail, it may be convenient to consider a general explanation thereof and in this connection, particular reference will be made to FIG. 1.

The machine in its entirety may be thought of as comprising three sections identifiable as a bundle-forming apparatus or section 50, a compression-transfer apparatus or section 51 (shown out of position in FIG. 1, it being rotated upwardly through approximately 90° to enable the same to be illustrated in this figure), and a banding apparatus or section 52. The particular machine being considered is adapted to receive paper grocery bags delivered thereto in collated disposition from a bag-collating machine, the discharge end of which is shown in FIG. 1 and is designated with the numeral 53. Such collating machine may be a group collator of the type disclosed in Hartbauer and Weinert, U.S. Pat. No. 3,404,609, issued Oct. 8, 1968, which is operative to receive a continuous succession of bags constituting the discharge from a bag-making machine, divide such bag discharge into groups or hands each of which comprises a predetermined number of bags, 50 for example, displace alternate bag groups in opposite angular directions so that the closed ends of successive groups are oppositely oriented, and discharge the successive groups in such collated orientation thereof.

In effecting such hand-by-hand discharge from the collator 53, a group-advancing unit constituting a component thereof receives each such hand and advances the same onto the infeed end of a bundle-conveyor mechanism comprising a part of the bundle-forming apparatus 50. The group-advancing unit includes a transfer carriage 54 generally in line with the bundle-conveyor mechanism 55 and equipped with front holder fingers 56 and rear pusher fingers 56′ spaced therefrom by a distance sufficient to receive a bag hand therebetween. The transfer carriage 54 is reciprocable in longitudinal directions between a hand-receiving position within the interior of the collator 53 and a hand-discharge position generally adjacent the conveyor mechanism 55, as shown.

The group-advancing unit further includes a constraining structure 57 equipped with front and rear holder fingers 58 and 58′ spaced apart longitudinally by about the same hand-receiving distance as the holder and pusher fingers 56 and 56′. The constraining structure 57 is vertically reciprocable between the lower position shown in FIG. 1 (and in FIG. 2 by broken lines) and an elevated position, show in FIGS. 2 and 3, in which it is at about the same vertical position as that of the carriage 54 and with the fingers 58 and 58′ in essentially the same longitudinal and vertical orientations, respectively, as those of the fingers 56 and 56′ illustrated.

Each bag hand processed by the collator 53 is received by the carriage 54 within the space defined between the holder and pusher fingers 56 and 56′ thereof, and is advanced by forward displacement of the carriage into the position shown in FIG. 1. The constraining structure 57 is then displaced upwardly to position such hand between the holder fingers 58 and 58′ whereupon the holder fingers 56 of the carriage 54 are retracted downwardly to a position beneath the bag hand, and the carriage is returned to the interior of the collator 53. The holder fingers 56 are again extended into the upper position shown to prepare the carriage for receipt of the next successive hand being processed by the collator 53.

During the period that the carriage 54 returns to the collator interior to receive the next hand and advance it to the bundle-conveyor mechanism 55, the constraining structure 57 remains elevated to hold the prior hand in the appropriate location, and it is retracted as the carriage advances in order to provide an open path of movement therefor. These steps are repeated cyclically for each hand of bags processed by the collator 53. The carriage 54 and constraining structure 57 comprise a part of the collator 53, and for complete details concerning their structural assemblage and precise operation, reference may be made to the aforementioned U.S. Pat. No. 3,404,609.

Upon a predetermined number of hands (10, for example) being advanced onto the bundle-conveyor mechanism 55, a hand-transfer mechanism 59 moves upwardly in mechanically enforced synchronism with the constraining structure 57 to divide or form the bag hands into bundles composed of fixed numbers of hands. The hand-transfer mechanism 59 includes a carriage 60 that traverses a generally rectangular path of travel indicated by the broken line arrows associated therewith, and it further includes front and rear holding fingers 61 and 62 which are mounted upon the carriage 60 and travel therewith. The front fingers 61 are essentially stationary as respects the carriage 60, but the rear fingers 62 are longitudinally displacable with respect to such front fingers and are movable relative thereto from a position of substantially contiguous juxtaposition therewith (FIGS. 2, 3 and 6) in which they together have a width somewhat less than that of the holder fingers 58 so as to be insertable into the space defined thereby between the successive bag hands to a position shown in FIG. 1 in which the fingers 62 are spaced rearwardly from the fingers 61 and thereby establish a relatively wide space between successive bag hands.

The space thus defined between the forward and rear fingers 61 and 62 separates successive bundles 63 of bags sufficiently to permit insertion of conveyor flights or pushers 64 therebetween. It will be appreciated that the bundle conveyor 55 includes a pair of transversely spaced endless chains 65 each of which is equipped at longitudinal intervals therealong with a plurality of flights 64 organized into transversely aligned pairs having a distance between successive pairs adequate to receive a bundle 63 of bags therebetween as, for example, a bundle of 500 bags arranged in 10 hands each of 50 bags and collated by groups or hands so that the bag ends of successive hands are disposed in opposite directions.

The hand-transfer mechanism 59 travels forwardly for a short distance with the conveyor 55 and is then displaced downwardly so that the fingers 61 and 62 are withdrawn from their upper position intermediate successive bag groups, thereby enabling the same to expand into engagement with the interposed flights 64. Thereafter, the carriage 60 is displaced rearwardly into adjacency with the constraining structure 57 and it then moves upwardly therewith to insert the fingers 61 and 62, closed or juxtaposed at such time, between the trailing bag of one bundle and leading bag of the next successive bundle, whereupon a cycle of operation of the hand-transfer mechanism 59 has been completed.

The conveyor 55 advances each bundle 63 defined between successive flights 64 forwardly toward the discharge end of the conveyor adjacent which is disposed a bundle-locator mechanism 66. The mechanism 66 includes a carriage 67 reciprocable longitudinally along the conveyor as indicated by the arrows in FIG. 1, and further includes separator fingers 68 vertically reciprocable between the upper extended position shown in which they are disposed between successive bundles 63 and a lower retracted position beneath such bundles. The locator mechanism 66 is operative to accelerate transiently the rate of movement of at least certain bags along the conveyor 55 by slightly compressing the bag bundle lying forwardly of the fingers 68 to displace it away from the flight 64 adjacent thereto and thereby establish between such flight and forward bundle (sometimes referred to hereinafter as being between successive bundles) a relatively large space adequate to permit insertion thereinto of a compression plate 69 forming a part of the compression-transfer apparatus 51. Following such insertion of the plate 69 into the large space provided therefor, the finger 68 is retracted into its lower position and the carriage 67 then displaced rearwardly to orient it for initiation of a subsequent cycle of operation.

Evidently, the compression plate 69 during certain intervals throughout a cycle of operation of the apparatus must be withdrawn to a position remote from the bundles 63 being advanced by the conveyor 55 so as not to interfere with such advancement, and the retracted position of the plate is illustrated by broken lines in FIG. 1. Motor means in the form of pneumatic piston-cylinder structure 70 connected with the plate 69 is operative to displace the same into the gap formed between successive bundles 63 by the locator mechanism 66; and subsequent to such insertion, additional motor means in the form of pneumatic piston-cylinder structure 71 is effective to compress the bundle of bags forwardly of the plate 69 against stop or constraining structure 72. The compression plate 69, motor means 70 an 71, and constraining structure 72 constitute components of the compression-transfer mechanism 51, and it further includes carriage structure to be described hereinafter by means of which the compression plate 69, constraining structure 72 and a bundle 63 compressed therebetween are transferred into the banding apparatus 52.

During compression of a bundle 63 between the plate 69 and structure 72 they are displaced concurrently in a forward direction, as indicated by the arrow associated with the structure 72, to transfer the compressed bundle 63 into alignment with the first band-flap folder 73 comprising a part of the banding apparatus 52. It will be appreciated that such bodily displacement of the compressed bundle of bags causes a length 74 of banding material to be wrapped about the bundle, as indicated by broken lines, so as to cover the bottom, top and leading end thereof. The length 74 of banding material is severed from a continuous strip or web 75 thereof which is withdrawn from a supply or parent roll 76 by means of drive rolls to be described subsequently. Knife structure 77 severs the banding web 75 prior to translational displacement of the compressed bundle into the banding apparatus to provide the free length 74 to be wrapped about the bundle.

The first flap-folder mechanism 73 is reciprocable in vertical directions between the upper dormant position illustrated in FIG. 1 and a lower operative position therebelow to displace a bag bundle 63 then compressed between the plate 69 and structure 72 into a bundle-transfer mechanism 78 located therebelow and which is equipped with longitudinally spaced bundle holders 79 and 80 adapted to receive such bundle therebetween. As the compressed bundle is displaced into the transfer mechanism 78, the bottom flap 74*a* of the band length 74 is folded upwardly by engagement with the holder 80 into covering relationship with the trailing end of the compressed bundle 63. Once the bundle is within the transfer mechanism 78, it is displaced thereby forwardly or toward the left, as viewed in FIG. 1, into a position of alignment with a second flap-folder mechanism 81 operative to push the compressed bundle 63 upwardly from between the holders 79 and 80 and into a compression-drier and ejector mechanism 82.

As the bundle 63 is displaced upwardly by the folder mechanism 81, the upper flap 74*b* of the band length 74 has adhesive or glue applied to the under surface thereof by a glue assembly 83 mounted upon the bundle-transfer mechanism 78, and the flap is folded downwardly by engagement with side walls of the mechanism 82 and is pressed against the underlying flap 74*a* of the band with the result that the flaps are secured one to the other by the adhesive after it sets.

The compression-drier and ejector mechanism 82 is elongated vertically and is adapted to hold a plurality of successive bundles 63 so as to afford time for the adhesive applied to each encircling band length 74 to set or cure and thereby enable the band to retain the bundle in its compressed condition after being ejected from the mechanism. In the form shown, the mechanism 82 accommodates four successive bundles 63 and as the fifth bundle is displaced upwardly thereinto by operation of the second folder mechanism 81, the upper bundle is displaced from the mechanism 82 and is ejected or removed therefrom by an ejector assembly 84.

The bundle-forming apparatus 50 including the bundle-conveyor mechanism 55, hand-transfer mechanism 59 and bundle-locator mechanism 66 operates continuously in enforced synchronism with the collator mechanism 53 as being driven directly therefrom. The compression-transfer apparatus 51 is separately driven and is energized on demand, i.e., only when a bundle 63 is in position to be pushed forwardly of the bundle-locator mechanism 66. Similarly, the continuous strip of banding 75 is withdrawn from the parent roll 76 on demand by independent drive means and in response to operation of the compression-transfer mechanism 51. The first flap-folder mechanism 73, bundle-transfer mechanism 78, and second flap-folder mechanism 81 are mechanically energized by drive mechanism separate from that of the bundle-forming apparatus 50, and in the particular embodiment being considered, such drive mechanism is the same as that used to energize translational displacement of the compression-transfer apparatus 51.

It will be apparent that several bundles 63 are processed concurrently by the overall machine so that as one such bundle is being displaced by the compression-transfer apparatus 51, other bundles are being formed by the apparatus 50, and one or more additional bundles are being processed by the banding apparatus 52. The entire machine is capable of high speed processing of bags and, by way of example, it can readily bundle bags at a rate of the order of 2,000 bags per minute in the case of ordinary standard weight paper grocery bags (Nos. 4, 6, 8, or 12, for example) arranged in hands of 50 bags each and assembled into bundles of 10 hands.

In the following detailed description of the various mechanisms and components thereof, it should be observed that for the most part each mechanism, and the apparatus providing the same, is essentially symmetrical about a longitudinal center line therethrough so that there is a duplication of parts as between the opposite sides thereof. For purposes of simplifying the description, such duplication is largely ignored and the component parts of each mechanism are considered in the singular. However, in the drawings distinction is maintained between each element and its counterpart by use of the letter suffixes "*a*" and "*b*" in association with the identifying numeral which is the same in each instance.

HAND-TRANSFER MECHANISM

In describing the hand-transfer mechanism **59** of the bundle-forming apparatus **50** reference will be made in particular to FIGS. 1 through 7.

As stated hereinbefore, the hand-transfer mechanism **59** includes a carriage **60** and front and rear or leading and trailing separator fingers **61** and **62**. The carriage **60** is bodily displaceable in longitudinal directions along the bundle-conveyor mechanism **55**, and is also vertically displacable between the raised and retracted positions respectively shown in FIG. 2 in full and broken lines. The fingers **61** and **62** are mounted upon the carriage **60** so as to move therewith, and the trailing fingers **62** are displacable relative to both the carriage **60** and leading fingers **61** between the position shown by full lines in FIG. 2 in which the fingers **61** and **62** abut and the position shown by broken lines in this figure in which the fingers **62** have been displaced rearwardly relative to the fingers **61** and to the carriage **60**.

Such relative movement of the fingers **62** is accomplished by mounting the same upon a reciprocable rod or shaft **85** supported for axial displacements in one or more bearings **86** fixedly secured to the carriage **60** via a support plate **87** forming a part thereof. Adjacent its forward end the rod **85** is equipped with a head **88** (a crosspiece interconnecting the two rods **85*a*** and **85*b***) that bears against the upper end **89** of a bell crank **90** pivotally supported intermediate the ends thereof on a depending bracket **91** secured to the plate **87** and equipped at its opposite end with a cam follower **92**. The cam follower **92** rollingly engages the configurated surface **93** of a cam **94** that is fixed with respect to longitudinal displacements of the carriage **60**. A helical tension spring **95** is secured at one end to the bell crank **90** adjacent the terminus **89** thereof, and at its other end the spring is secured to the stationary leading finger **61**. Accordingly, the spring **95** imparts a biasing force to the bell crank **90** tending to rotate the same in a clockwise direction as viewed in FIGS. 2 and 3, thereby tending to displace the rod **85** and trailing finger **62** rearwardly relative to the leading finger **61**.

The cam follower **92** and trailing finger **62** are adapted to be displaced in the opposite direction against the biasing force of the spring **95** (the cam **94** forces the cam follower and trailing finger in the same direction as the spring bias) by engagement of the rod assembly with a latch **96** carried by the collator-constraining structure **57**. More particularly, the rod assembly adjacent the rear end thereof is provided with a generally cylindrical latch pin **97** adapted to be inserted into an arcuate recess **98** provided by the latch pin **96** whenever the carriage **60** is displaced from left to right, as viewed in FIG. 2 into its extreme right-hand position. Since the latch **96** is substantially stationary as respects longitudinal movements of the rod **85** and latch pin **97**, the pin and rod are displaced relative to the carriage **60** toward the left, as viewed in FIG. 2, by abutment of the pin with the latch whereupon the trailing finger **62** is thereby displaced into substantially contiguous relation with the leading finger **61**. The hand-transfer mechanism **59** and constraining structure **57** are thus conditioned for concurrent upward displacement to effect insertion of the fingers **61** and **62** into the space between successive bundles **63** established by the collator holder fingers **56**.

The latch **96** is rigidly mounted upon the collator component **57**, and not only does it serve to cause the fingers **61** and **62** to assume the adjacency required thereof for insertion between bag bundles but it also serves to structurally unite the hand-transfer mechanism **59** and collator-constraining structure **57** so as to enforce aligned and concurrent upward movement thereof. Such enforced interrelationship is desirable because the collator mechanism **53** may be a separate piece of machinery and the component **57** thereof has a cantilever design which might result in misalignment as respects the transfer mechanism **59** in the absence of an alignment-enforcing arrangement of the type being considered. As shown in FIG. 3, the pin **97** tends to be constrained within the recess **98** by a lock lever **99** which at its lower end is pivotally supported at **100** by the collator component **57** and is biased in a counterclockwise direction by a leaf spring **101** which at its lower end is fixedly secured to the component **57** and at its upper end bears against a stop **102** secured to the lock lever **99** and extending rearwardly therefrom.

Further contributing to the interaction of the collator component **57** and transfer mechanism **59** is a type of wedge or cam assembly including a cam follower **103** carried by the latch **96** and extending transversely from one side thereof, as is most evident in FIG. 5. The carriage **60** of the mechanism **59** is provided with a downwardly and rearwardly inclined cam or wedge **104** adapted to move beneath the cam follower **103** whenever the carriage **60** is displaced into its maximum rearward position which is shown in both FIGS. 4 and 5. Apparently, the cam **104** engages the cam follower **103** and tends to displace it upwardly (or the carriage downwardly) relative thereto. Evidently, then, the combination of the recess **98** in association with the lock lever **99**, and the association of the cam and cam follower **104**, **103** integrate or unify the collator component **57** and transfer mechanism **59** as they move upwardly from the lowermost positions thereof shown in FIG. 2 by broken lines into the full line positions shown in this same figure.

After the transfer mechanism **59** has been displaced upwardly to insert the fingers **61** and **62** between successive bag bundles **63**, the carriage **60** is advanced longitudinally toward the left, as viewed in FIGS. 2 and 3, thereby withdrawing the pin **97** from the recess **98** in the latch **96**. Upon such withdrawal, the biasing force of the spring **95** tends to displace the trailing fingers **62** rearwardly so as to provide a large open space between successive bag bundles **63**. However, a positive mechanical arrangement is included to enforce the requisite spacing between the fingers **61** and **62**, and such arrangement includes the aforementioned bell crank **90**, cam follower **92** and cam **94**. In this respect, as the carriage **60** is displaced forwardly or toward the left, as viewed in FIG. 2, the cam follower **92** traverses the surface **93** of the cam **94** which causes the bell crank **90** to be displaced in a clockwise direction, thereby positively displacing the rod **85** and finger **92** carried thereby in a rearward direction relative to the leading finger **61**. Such rearward displacement of the finger **62** necessarily increases the spacing between the successive bundles **63** so as to permit insertion of a flight **64** therebetween as will be described subsequently.

Longitudinal displacements are imparted to the transfer mechanism **59** and, in particular, to the carriage **60** thereof, by drive mechanism that includes a rod or shaft **105** pivotally secured adjacent one end thereof to a connector **106** carried by the carriage plate **87** and extending forwardly and upwardly therefrom. At its lower end the rod **105** projects through an opening provided therefor in a connector **107** which is sufficiently large to enable the shaft **105** to be displaced axially relative thereto. The shaft is threaded at its lower end and is equipped thereat with a nut **108** which bears against the connector **107** and thereby establishes a positive interaction between the shaft and connector in one axial direction.

In the opposite axial direction a resilient or yieldable connection is established between the shaft **105** and connector **107** by a helical compression spring **109** which is coaxially circumjacent the shaft and is pinned thereto at one end, as shown at **110**, and at its other end bears against the connector **107**. Therefore, the connector **107** can move relative to the shaft **105** toward the right, as viewed in FIG. 3, against the biasing force of the spring **109** but relative movement therebetween in the opposite direction is limited by abutment of the nut **108** with the connector **107**. Such permissible relative movement toward the right obviates rigid, non-yielding impact of the pin **97** against the latch **96** when the transfer mechanism **59** and collator component **57** are coupled, as heretofore described.

As shown best in FIG. 7, the connector **107** is pivotally secured to the upper end of a crank arm **111** which at its lower end is secured to a shaft 112 in a manner preventing relative rotation therebetween, and the shaft is journaled for rotation in frame structure 113 of the machine. Also mounted upon the shaft 112 so as to rotate therewith is one end of an arm 114 which is pivotally connected at 115 to one end of an elongated link 116 pivotally connected at its opposite end, as shown at 117, to an upwardly extending crank arm 118 that at its lower end is pivotally mounted upon a support shaft 119. Intermediate its ends, the arm 118 is equipped with a cam follower 120 that ridingly engages a cam 121 supported by a shaft 122 so as to be rotatably driven thereby. As a consequence of this construction, whenever the shaft 122 is rotatably driven, the cam 121 rotates therewith and because of its configuration causes the cam follower 120 to displace the arm 118 alternately in opposite angular directions about the axis of the shaft 119. Accordingly the link 116, arm 114 and crank arm 111 will be displaced alternately in opposite directions with the result that the carriage 60 which is secured to the crank arm 111 via the connector 107 and shaft 105 will be alternately reciprocated in opposite directions along the bundle-conveyor mechanism 55 as generally indicated in FIGS. 1 and 7 and as shown in FIG. 2.

As respects such displacements of the carriage 60, it is carried for longitudinal displacements upon rollers that ride in longitudinally extending track structure that is vertically displaceable between the raised and lowered positions thereof shown in FIG. 2. For purposes of positive identification, the plate 87 of the carriage 60 is equipped with depending front and rear brackets 123 and 124 that respectively carry forward and rear rollers 125 and 126 that ride within a rail 127. The aforementioned cam 94 is secured to the rail 127 along the lower surface thereof and the carriage is displacable with respect to both the rail and cam. As shown most clearly in FIG. 4, the carriage plate 87 is also provided with additional or interior rollers 130 and 131 that engage the rail 127 along the inner vertical surface thereof so that the front and rear rollers 125 and 126 together with the interior rollers 130 and 131 positively locate the plate 87 in both vertical and horizontal directions relative to the rail 127.

Secured to and extending downwardly from the rail 127 at the front and rear end portions thereof are straps or brackets 128 and 129. The depending bracket 128 has a link 132 pivotally secured thereto adjacent its upper end, and such link at its lower end is pivotally connected to one end of an elongated arm 133 extending longitudinally along the conveyor 55 and pivotally connected adjacent its rear end to the aforementioned frame structure 113 so as to be fixedly located relative thereto. For convenience hereinafter in describing the drive mechanism for the apparatus, the described points of connection for the link 132 and arm 133 are respectively denoted with the numerals 134, 135, and 136. Intermediate its ends, the arm 133 is pivotally connected at 137 to a vertically oriented connector 138 which at its lower end is pivotally connected, as shown at 139, to an elongated arm 140 at a point intermediate the ends thereof. The arm 140 forms one branch of a bell crank mounted upon a shaft 141 that is journaled for rotation in the frame structure 113. The other arm of the bell crank is denoted 142, and at its forward end it is equipped with a cam follower 143 that ridingly engages a cam 144 mounted upon the aforementioned shaft 122 so as to rotate therewith. At its rear end portion the arm is pivotally connected, as shown at 145, to the lower end of the strap or bracket 129.

As a result of this structural assemblage, rotation of the shaft 122 and cam 144 connected therewith causes the bell crank comprising the arms 140 and 142 to oscillate or reciprocate alternately in opposite directions about the axis of the shaft 141 and as a result thereof angular displacements in a clockwise direction, as viewed in FIG. 7, will cause the strap 129 to be drawn downwardly and concurrently therewith the link 132 will be drawn downwardly as a consequence of its connection with the arm 140 through the connector 138 and arm 133. Accordingly, the rail 127 will be displaced downwardly and it will carry therewith the plate 87 and entire carriage 60 comprising the same. The rail 127 is maintained in an essentially horizontal orientation as it is displaced upwardly and downwardly by the straps 128 and 129 because of the described interconnection of the arms and linkages therewith.

It will be apparent that in any cycle of operation of the hand-transfer mechanism 59 two distinct movements are described thereby and they constitute vertical reciprocations of the track defined by the rails 127 and longitudinal reciprocations of the carriage 60 along the rails 127. Considering such a cycle in detail, the carriage 60 may be assumed to have initially the lower forward position shown by broken lines in FIG. 2 wherefore the rail 127 is in its lower position. As the carriage 60 is displaced along the rail 127 toward the right, or rearwardly, it ultimately comes into adjacency with the constraining structure 57 of the collator mechanism 53, and the pin 97 of the carriage then seats within the recess 98 of the latch 96 whereupon the mechanism 59 and structure 57 are coupled for subsequent upward displacement into the full line position shown in FIGS. 2 and 3.

Upward displacement is effected in part by means (not shown) within the collator mechanism 53 controlling the structure 57 and in part by the cam 144 and linkage associated therewith which displaces the rail 127 along a vertical path into adjacency with the conveyor mechanism 55. Such upward movement of the mechanism 59 causes insertion of the abutting spreader fingers 61 and 62 into the space between successive bag bundles defined by the width of the holder fingers 56 of the collator mechanism 53, and upon such insertion, the carriage 60 is displaced forwardly along the rail 127 under the influence of the drive mechanism heretofore described which includes the crank arm 111 and cam 121. Such forward movement of the carriage 60 is effected in timed relationship with the conveyor mechanism 55, and as the cam follower 92 is moved into engagement with the cam 94, the rear fingers 62 are displaced rearwardly relative to the fingers 61 so as to open a space between successive bag bundles 63 sufficiently wide to enable easy insertion thereinto of a conveyor flight 64.

Following such interposition of a flight 64 between the successive bag bundles 63, the cam follower 92 rides off of the cam 94 and the carriage 60 begins to decelerate whereupon the fingers 61 and 62 tend to contract into the smaller space defined by the longitudinal limits of the flight 64 so as to become free from the bags adjacent thereto. When this condition obtains, the rail 127 commences to be displaced downwardly so as to withdraw the fingers 61 and 62 from the space between the bag bundles to an elevation below the upper limits of the conveyor mechanism 55, thereby enabling the bag bundles to pass freely thereover. At the termination of such cycle of operation, the carriage 60 and rail 127 will again have the lower left-hand position shown in FIG. 2 and which was assumed as the starting condition of the mechanism.

BUNDLE CONVEYOR

In describing the bundle-conveyor mechanism 55 reference will be made in particular to FIGS. 1, 3 through 7, and 13.

The bundle-conveyor mechanism 55 includes the aforementioned spaced-apart chains 65 which are endless link chains entrained about a plurality of sprockets respectively denoted with the numerals 150, 151, 152, and 153. As is most evident in FIGS. 1 and 7, the sprockets 150 and 151 are essentially aligned in a vertical direction but the sprockets 152 and 153 are offset so that the chain 65 traverses an upwardly and forwardly directed path in moving therebetween. The conveyor mechanism 55 is driven from the collator mechanism 53 and in this respect, and as will be explained hereinafter, the sprocket 150 is driven and the remaining sprockets are idlers. Referring to FIG. 6, it will be seen that each chain 65 is confined in a vertical sense between a relatively narrow longitudinally extending support plate 154 rigidly related to the frame structure 113 of the apparatus and an upper plate or rail

155 rigidly secured to the plate 154 in vertically spaced parallelism therewith by means of a plurality of spacers or supports 156. The rails 155*a* and 155*b* define a track that supports the bundles 63 thereon as indicated in FIG. 6.

Pivotally secured to each chain 65 at spaced-apart locations therealong are the aforementioned flights 64, and they are so arranged with the associated chains that a substantially vertical orientation is maintained by each flight irrespective of the location thereof along the path of travel traversed by the chain. In this respect, and considering particularly FIGS. 3 and 6, each flight 64 at a lower corner portion there of is pivotally secured to its associated chain 65 and is equipped with a downwardly and rearwardly inclined bracket or strap 157 which is secured thereto. The lower end portion of each strap 157 extends downwardly below the chain 65 and is provided thereat with a pair of spaced-apart rollers 158 and 159. Each roller 158 faces outwardly and is confined within a trackway 160 defined by a pair of flat plates or runners fixedly secured to the associated plate 154 along the inner edge thereof. The trackway 160 extends along the conveyor 55 at its upper edge or reach, and a counterpart trackway 161 is disposed along the lower edge or reach of the conveyor, and is perhaps shown most clearly in FIG. 13. Evidently each of the trackways 160 and 161 confines the roller 158 therewithin and thereby maintains the associated flight 64 in an essentially vertical orientation.

The trackways 160 and 161 are discontinuous and terminate at the ends of the conveyor. Adjacent the rear end of the conveyor, it is provided with an upwardly and forwardly inclined track section 162 having spaced-apart components 163 and 164 defining a passage or channel 165 therebetween which is traversed by the inwardly turned roller 159 of each flight moving therealong, as seen in FIG. 6. Accordingly, as each such flight 64 travels upwardly and forwardly between the sprockets 152 and 153, it is positively maintained in a vertical orientation so as to be readily inserted into the relatively large space defined between successive bag bundles 63 by the fingers 61 and 62 of the hand-transfer mechanism 59, as heretofore described. A stationary guide 165' is located at the front of the conveyor 55 and is engaged by each flight roller 158 to keep the flight in a vertical orientation in traveling between the sprockets 150 and 151.

The conveyor 55 (FIGS. 6 and 7) includes longitudinally extending guides 166 along the edges thereof, each resiliently supported at spaced-apart intervals therealong through compression springs 167 and bolt-type fasteners 168 that attach the guides to brackets 169 welded or otherwise fixedly secured to the associated plate 154. The guides 166 define the transverse extent of the path of travel defined along the conveyor 55 for the bundles 63, and such transverse extent can be increased or decreased selectively by suitable adjustment of the fasteners 168.

The sprocket 150 is continuously driven by the collator mechanism 53 whenever it is operating and, therefore, the chains 65 continuously traverse the path of travel defined therefor by the sprockets 150 through 153. The conveyor 55 is timed with the transfer mechanism 59 and operates in mechanically enforced synchronism therewith so that at the time that the transfer mechanism 59 has provided a relatively large opening or space between successive bag bundles 63 as explained hereinbefore, the conveyor provides an upwardly and forwardly moving flight 64 at a location for insertion thereof into such space.

In this reference, and considering the condition of the apparatus as illustrated in FIG. 7, a flight 64 in substantial alignment with the sprocket 152 is being advanced upwardly and forwardly by the chain 65. At a location generally adjacent the upwardly extending component of the frame structure 113 depicted in this figure, the flight 64 will have reached an elevation at which it is in substantial alignment with the plane defined by the tracks 155 carrying the bag bundles 63. At about this same location, the transfer mechanism 59 will have caused the fingers 61 and 62 thereof to provide between successive bundles the space required for such flight 64 to rise into the space therefor as it is carried upwardly and forwardly from such position toward the sprocket 153. When the fingers 61 and 62 are retracted by downward displacement of the transfer mechanism 59, the bag bundles 63 along each face of the flight 64 will expand into engagement therewith, and the bundle forwardly thereof will be pushed along the track 155 toward the discharge end of the conveyor 55.

BUNDLE-LOCATOR MECHANISM

In describing the bundle-locator mechanism 66 reference will be made in particular to FIGS. 1, 8 and 9.

The bundle-locator mechanism 66 is disposed generally adjacent the discharge end of the conveyor mechanism 55 and, as indicated hereinbefore, it comprises the carriage 67 movable in longitudinal directions along the conveyor and further comprises fingers 68 movable in vertical directions between lower retracted and upper extended positions which are respectively shown in full and broken lines in FIG. 9. The carriage 67 is provided adjacent the front and rear ends thereof with rollers 170 and 171 that ride within a track 172 secured to and depending from the aforementioned plates 154. The track 172 confines the rollers 170 and 171 in a vertical sense, and also in horizontal directions because the upper portion of each roller is disposed between and constrained by depending lips formed along the upper edge of the track. The track 172 may be secured to the plate 54 by any suitable means as, for example, being rigidly attached thereto through a plurality of spacers 173.

The carriage 67 is pivotally connected, as indicated at 174, to one end of a link 175 which at its opposite end is pivotally fastened at 176 to a downwardly extending elongated link or arm 177. Referring to FIG. 31, the arm 177 at its lower end is mounted upon a shaft 178 journaled for rotation in the frame structure 113 of the apparatus, and also connected to such shaft 178 so as to rotate therewith is a crank arm 179. At its upper end, the arm 179 is equipped with a cam follower 180 that ridingly engages a cam 181 mounted upon and driven by the aforementioned shaft 122. Evidently, then, as the cam 181 is driven, the described linkage effects longitudinal reciprocations of the carriage 67 along the track 172, and such reciprocations are effected in timed relation with operation of the conveyor 55.

The carriage 67 is equipped with an inverted, generally U-shaped bracket 182 welded or otherwise rigidly secured to a cross piece 183 that is bolted to the carriage, as shown. The forward leg of the bracket member 182 is provided with vertically spaced rollers 184 and 185 that rollingly engage the forward edge of the finger 68. The rear leg of the bracket member 182 is similarly equipped with vertically spaced rollers 186 and 187 that ride within a channel 188 defined along the rear edge of the finger 68 and rollingly engage the same. It will be apparent that the rollers 184, 185, 186, and 187 confine the finger 68 against translational displacements in both longitudinal and transverse directions but permit the fingers to reciprocate vertically. The diametral difference between the rollers 184 and 185 relative to the rollers 186 and 187 accommodates the inertial loadings imparted to the finger 68 by the bag bundle 63 being advanced forwardly thereby along the conveyor 55.

The finger 68 is pivotally connected adjacent its lower end, as indicated at 189, to a downwardly extending link 190 which at its lower end (FIG. 31) is pivotally supported upon the aforementioned shaft 119. The arm 192 forms one component of a bell crank having as the other component thereof an arm 193 equipped at its upper end with a cam follower 194 that ridingly engages a cam 195. The cam 195 is mounted upon the shaft 122 so as to be driven thereby, and as it rotates it causes the bell crank 192, 193 to reciprocate about the axis of the shaft 119 so as to alternately raise and lower the finger 68.

In a cycle of operation, the bundle-locator mechanism 66 first has each of the fingers 68 thereof retracted to a position beneath the bag bundles 63 and the carriage 67 is displaced rearwardly toward the end of the track 172. As the conveyor 55 advances bag bundles 63 therealong, each successive flight 64 is brought into general alignment with the fingers 68 of the locator mechanism whereupon the drive linkage for the fingers 68 displaces the same upwardly and into the space between the successive bundles as provided by the interposed flight 64. At the same time, the drive mechanism for the carriage 67 initiates forward displacement thereof and it is rapidly accelerated to a velocity that is essentially the same as that of the conveyor to enable the fingers 68 to be readily displaced upwardly into interposition between such bundles.

This upward displacement of the fingers is effected quite rapidly, and at about the time that they are fully extended the carriage 67 is accelerated to a velocity somewhat greater than that of the conveyor 55. As a result thereof, the bundle 63 forwardly of such fingers 68 is compressed slightly and a relatively wide spacing or gap is thereby provided between the two successive bundles 63 (i.e., between the adjacent flight 64 and bundle immediately forward thereof) for the purpose of accommodating entrance thereinto of the compression plate 69 forming a part of the compression-transfer apparatus 51. Following such insertion of the compression plate 69, the fingers 68 are retracted and the carriage 67 then returned to the rear end of the track 172 so as to be in proper position to initiate a subsequent cycle of operation.

As heretofore stated, the entire bundle-forming apparatus 50 is driven from the collator mechanism 53, and the overall drive assembly by which this is accomplished is shown diagrammatically in FIG. 31. Referring thereto, a sprocket 196 is shown which is mounted upon a shaft 197 either forming a part of or directly driven by the collator mechanism depending upon the conveniences of any particular installation. Entrained about the drive sprocket 196 is an endless chain 198 which is also entrained about a large sprocket 199 supported on a shaft 200 journaled for rotation in the frame structure 113. The shaft 200 is equipped with a gear 201 meshingly engaging a gear 202 carried by the shaft 122 and operative to drive the same. Accordingly, whenever the drive sprocket 196 is driven, the shafts 122 and 200 will be driven concurrently therewith.

The shaft 122 has the aforementioned cams 121, 144, 181, and 195 mounted thereon which are therefore driven thereby, as explained heretofore; and the shaft 122 carries a sprocket 206 having an endless chain 207 entrained thereabout which is also entrained about a sprocket 208 driving a shaft 209 journaled for rotation in the frame structure 113. Adjacent each end thereof, the shaft 209 has a sprocket 210 mounted thereon which through a chain 211 drives a sprocket 212 mounted upon a shaft 213 carrying the aforementioned drive sprocket 150 for the bundle conveyor 55. Evidently, then, whenever the sprocket 196 is driven by the collator mechanism the conveyor sprockets 150 are driven so as to energize the conveyor.

COMPRESSION-TRANSFER APPARATUS

In describing the compression-transfer apparatus 51 reference will be made in particular to FIGS. 1 and 9 through 13.

The compression-transfer apparatus 51 includes the aforementioned compression plate 69, motor means 70 and motor means 71, which motor means are operative in association with the plate 69 to compress a bundle 63 for displacement from the conveyor mechanism 55 into the banding apparatus 52. The compression-transfer apparatus 51 further includes a pair of rails 215 that are spaced apart transversely and are carried by frame structure 216 in parallel alignment. Mounted upon the track defined by the rails 215 is a compression carriage 217 longitudinally reciprocable with respect thereto. For this purpose the carriage 217 is equipped with a plurality of rollers 218 having horizontally disposed axes that ridingly engage the upper surfaces of the rails 215; and the carriage is further provided with a plurality of stabilizing rollers 219 having vertically disposed axes that ridingly engage the inner edges of the rails 215, as shown best in FIG. 12. Adjacent its forward end, the carriage 217 is provided with a connector 220 to which is secured a drive component 221 which may be bolted thereto as shown at 222. The drive component 221 is connected with drive structure operative to reciprocate the carriage 217 along the rails 215, as will be described in detail herein.

Mounted upon the carriage 217 for reciprocal displacements relative thereto is a dolly 223 equipped with a plurality of inwardly extending front and rear wheels or rollers 224 and 225 that project into and ride along a channel or groove 226 formed in the longitudinal edges of the compression carriage 217. The dolly 223 is provided with upwardly extending wall components 227 equipped at their upper ends with forwardly projecting supports 228 that may be bolted or otherwise secured thereto. The forward ends of the supports 229 are bifurcated to define a slot or recess 229 therebetween that receives therein the upper edge of the compression plate 69. The compression plate is guided for translational displacements in transverse directions by spaced-apart guide rollers 230 and 231 mounted upon the support 228 and respectively depending from the bifurcated legs thereof. The plate 69 is further guided for such translational displacements along its lower edge by front and rear rollers 232 and 233 that are mounted upon the dolly 223 adjacent the upper edge of the carriage 217.

Extending between the wall components 227 in rigid relation therewith, as by means of a plurality of bolts 234 is a buttress member 235 to which is attached a reciprocable piston rod 236 which is actuated in properly timed relationship by the aforementioned pneumatic motor 71. Piston rod 236 actuates the dolly 223 on which compression plate 69 is carried. As can be seen best from FIG. 12, to guide the dolly, a trackway in the form of a longitudinally extending channel or recess 237 is provided in carriage 217, in which a guide roller 238 rides, the guide roller being journalled on dolly 223 for rotation about an upright axis.

Means is provided for rigidly supporting motor 71 on carriage 217 comprising triangularly shaped upright spaced apart abutments 239 which are rigid with a base plate 240, as can be seen from FIG. 12, which in turn is secured to carriage 217. The underside of plate 240 is formed with an integral key which fits in channel 237. To conserve space, the leading edges 241 (FIG. 10) of abutments 239 are inclined downwardly, and they face complementary upwardly inclined surfaces 242 in buttress member 235.

From the foregoing, it is seen that dolly 223 is actuated by motor structure 71 mounted on the carriage 217. However, compression plate 69 is actuated by another pneumatic motor structure 70 (FIG. 9) the cylinder casing of which is pivotally connected at 243 to the dolly 223. Piston rod 244 of motor 70 is pivotally connected at 245 to a generally L-shaped bell crank 246 pivotally mounted intermediate its ends, as shown at 247, upon an arm or bracket 248 that extends rearwardly and laterally outwardly from the dolly 223 to which it is fixedly secured. At its outer end, the bell crank 246 is coupled by means of a slip connection 249 (i.e., slot and pin) and bracket 250 to the compression plate 69. In the condition shown in FIG. 9, the piston rod 244 is completely retracted as is the compression plate 69 which, therefore, is in a position remote from the bag bundles 63. Whenever the motor means 70 is energized, the rod 244 thereof will be displaced outwardly whereupon the bell crank 246 will be angularly displaced in a counterclockwise direction as viewed in FIG. 9 with the result that the compress ion plate 69 will be moved transversely into the position thereof shown by broken lines in which it is interposed between successive bag bundles 63.

During such displacements of the compression plate 69, it is guided by the various rollers 230 through 233; and after the plate 69 has been inserted between successive bag bundles, the motor means 71 is energized whereupon the piston rod

236 thereof is displaced outwardly and the dolly 223, together with the compression plate 69 and bag bundle 63 engaged thereby, are displaced longitudinally in a forward direction relative to the conveyor 55 and relative to the track defined by the rails 215. During such displacement of the compression plate 69, the bundle 63 forwardly thereof is compressed against the aforementioned stop or constraining structure 72 which is mounted for longitudinal adjustment upon the carriage 217 and extends laterally therefrom across the bundle conveyor 55. Referring particularly to FIGS. 9 and 14, constraining structure 72 is in form of a plurality of laterally spaced abutments or tooth-like components 251 which are fixedly secured to a web 252 of a mounting plate 253 which is secured to the aforementioned component 221 which forms a part of drive carriage 217. Constraining structure 72 is movable with carriage 217 but is, however, manually adjustable longitudinally of the carriage by means to be subsequently described. Such longitudinal adjustment is for the purpose of accommodating the apparatus to bags of varying thickness.

In operation, compression member 69 is movable with carriage 217 but relative movement between the carriage and compression member 69 is effected to cause the bundle to be compressed against constraining teeth 251. As can be seen best from FIGS. 9 and 10, a stop 255 is provided on carriage 217 to limit forward movement of compression member 69. The stop 255 comprises an upwardly extending plate 256 and a reinforcing web 257, all rigidly secured to horizontal base plate 258 fixedly secured to carriage 217 by means of bolts 259. When compression plate 69 is displaced forwardly, or toward the left as viewed in FIGS. 9 and 10, it will ultimately abut the stop 255 and particularly the upwardly extending plate 256 thereof as indicated by the broken line position of the compression plate, as shown in FIG. 9.

Further considering adjustability of the constraining structure 72, the mounting plate 253, as shown best in FIGS. 9 and 14, is provided at spaced-apart intervals with bearing structures 260 and 261 in which is journalled a shaft 262 projecting at one end from the bearing structure 261 and equipped thereat with a knurled knob 263 by means of which it can be manually rotated. At its opposite end adjacent the bearing structure 260 the rod is equipped with a bevel gear 264 that engages a mating bevel gear 265 mounted upon one end of an actuating shaft 266 rotatably supported at one end thereof in bearing structure 267 mounted upon the plate 253, and threadedly engaging at its opposite end a nut 268 fixedly secured to the carriage 217.

Referring again to FIGS. 9 and 14, it will be observed that the plate 253 is secured to member 221 which in turn is connected at its ends to block structure 269 slidably mounted in an elongated bearing slot 270 in the aforementioned carriage 217. Thus, it is seen that as the knob 263 is turned in one direction the threaded rod 266 is rotated in a direction such that component 221 and the slidable block structure 269 together with the plate 253 and teeth 251 are displaced toward the left, as viewed in FIG. 9, to increase the compression space defined between the teeth 251 and compression plate 69; and rotation of the knob 263 in the opposite direction causes the entire assemblage including the teeth 251 to be displaced toward the right so as to decrease the spacing defined thereby with the compression plate 69.

In addition to the compression plate 69 being movable transversely relative to the bundle conveyor 55 (and dolly 223 and carriage 217), and further being movable longitudinally together with the dolly 223 relative to the bundle conveyor (and carriage 217), the compression plate together with the dolly and carriage are movable longitudinally relative to the bundle conveyor. This latter displacement of the compression plate (i.e., the carriage 217 and compression plate assemblage supported thereon) is effective to transport a compressed bag bundle 63 into the banding apparatus 52 for processing therein by the first flap-folder mechanism 73. In this respect, the carriage 217 is equipped at spaced-apart locations therealong (FIG. 13) with a plurality of upper rollers 271 that

rollingly engage the upper surface of the associated rail 215 and with lower rollers 272 that ridingly engage the lower surface of such rail. Further, the carriage is provided with a plurality of guide rollers 273 having vertical axes that rollingly engage the inner edge of the associated rail 215. Consequently the carriage 217 is constrained upon the rails 215 so as to be displacable longitudinally therealong but immovable in transverse and vertical directions relative thereto.

At its forward end, the carriage 217 is equipped with a bifurcated extension 274 having rotatably supported thereat a coupling 275 to which one end of an elongated link 276 is secured. The link 276 at its opposite end is connected with cam and cam follower mechanism operative to positively displace the carriage 217 longitudinally along the rails 215 in a predetermined time relationship with the compression of each bag bundle 63 by operation of the compression plate 69. In this reference, and as indicated generally in FIG. 13, a sensing means 277 which may constitute a photo responsive detector is located adjacent the terminal end portion of the bundle conveyor 55 and is operative to sense the presence of a bag bundle in proper position to be processed by the compression plate 69 and to energize motor means in response to such presence. Accordingly, the compression-transfer apparatus 51 may be said to operate on demand and in timed relation with the bundle-conveyor mechanism 55 in the sense that each cycle of operation of the apparatus 51 is initiated by the presence of a bag bundle at a predetermined location along the conveyor mechanism.

Considering FIGS. 13 and 18 in particular, it will be observed that the compression plate 69 together with the carriage 217 and components carried thereby including the teeth 251 of the constraining structure 72 are displaceable between the full-line and broken-line positions thereof shown in FIG. 13, and in the latter position the compressed bag bundle is aligned with the first flap-folder mechanism 73. The linkage 276, which at its lower end is pivotally connected to the coupling 275, is pivotally supported at its upper end (as indicated diagrammatically in FIG. 32 by the elongated tube 278 shown circumjacent a shaft 426 described hereinafter), as is most apparent in FIG. 18.

Referring to FIGS. 22 and 32, the link 276 is seen to be rigidly connected by a strap 279 to a short link arm 280 (pivotally supported at its upper end as indicated by the tube 278 in FIG. 32) which is pivotally secured to one end of a rigid connector 281, FIG. 18, that at its opposite end is pivotally secured to a crank arm 282 pivotally supported at 283 upon a bearing shaft generally denoted 284, and which arm 282 is arranged with a cam follower 285 that engages and is controlled by a cam 286 mounted upon a shaft 287 so as to rotate therewith. The shaft 287 is suitably journaled for rotation in the frame structure of the apparatus and is equipped with a sprocket 288 having an endless chain 289 entrained thereabout that is driven by a sprocket 290 and electric motor 291 drivingly connected therewith. The motor 291 is controlled by the aforementioned sensor 277 and is actuated through one complete cycle of operation upon each successive energization thereof.

Summarizing a cycle of operation of the compression-transfer apparatus 51, it functions on demand and therefore cycles only when a bag bundle 63 is being advanced by the bundle conveyor 55 into a position generally in front of the compression plate 69 and, accordingly, in engagement with the fingers 68 of the bundle-separator mechanism 66. The presence of such a bag bundle is sensed by the photoelectric sensor 277 which (in conjunction with a limit switch, described hereinafter, actuated by forward movement of the bundle-locator mechanism 66) causes the motor means 70 to have compressed air supplied to one end of the cylinder thereof to energize its power stroke and thereby displace the compression plate 69 transversely into the space defined between the then adjacent flight 64 of the bundle conveyor 55 and separator fingers 68 of the locator mechanism 66. A limit switch (considered subsequently) actuated by such displacement of the compression plate 69 causes energization of the motor 291.

Immediately thereafter, compressed air is supplied to one end of the cylinder of the motor means 71 to energize its power stroke whereupon the rod 236 is displaced outwardly to advance the dolly 223 forwardly and thereby urge the compression plate 69 against the trailing bag of a bundle 63 then having its leading bag in engagement with the teeth 251 of the constraining structure 72. Such translational displacement of the dolly 223 and compression plate 69 relative to the carriage 217 will effect compression of the bag bundle since the teeth 251 are fixedly related at such time to the carriage. At approximately the same time that the motor means 71 is being energized to compress such bag bundle, the carriage 217 begins to be displaced along the rails 215 so as to transfer the compressed bundle from the conveyor 55 into the banding apparatus 52 to enable the bundle to be processed by the first flap-folder mechanism 73 thereof.

Following such processing by the flap-folder mechanism 73 which will result in the compressed bag bundle 63 being removed from the compression-transfer apparatus (namely, from between the compression plate 69 and teeth 251 thereof), the cylinder of the motor means 70 is energized in the opposite direction by appropriate supply of compressed air thereto so as to retract the piston rod 244 and thereby return compression plate 69 to its retracted position. Also, at about the same time the motor means 71 is operated in the opposite direction by appropriate supply of compressed air to the cylinder thereof so as to retract the rod 236 and thereby return the dolly 223 (and compression plate) to its initial position relative to the carriage 217. Concurrently therewith, the cam 286 (FIG. 32) returns the cam follower 285 and shaft 278 to their initial position whereupon the carriage 217 is returned to its starting location because of its connection through the link 276 with the shaft 280. A cycle of operation of the compression-transfer apparatus 51 has then been completed, and it is deactuated to await a subsequent cycle of operation which will be initiated by the next energization of the sensor 277.

BANDING APPARATUS

In describing the banding apparatus 52 the band-delivery mechanism thereof will first be considered, and in this connection reference will be made in particular to FIGS. 1 and 13 through 17.

As illustrated generally in FIG. 1, the banding material which, by way of example, may be an endless web 75 of kraft paper, is withdrawn from the parent roll 76 thereof and such web is severed periodically by the knife structure 77 to provide web lengths 74 each of which is wrapped about a compressed bag bundle 63 and secured in place so as to contain such bundle in its compressed state. To a great extent, the delivery mechanism for the band web 75 may be conventional and in this respect, the details of the back stand for the roll 76 and of the various guide rollers and random printer (when used) have been omitted.

Two sets of driven rollers are used with the band web 75 in withdrawing the same from the parent roll 76, but one such set (shown below the knife structure 77 in FIG. 1) is used primarily to control the severed length 74 and will be discussed in this reference subsequently. The principal drive rollers are shown in FIG. 15 in association with the web 75 which is illustrated by the broken lines, and with reference to FIG. 1 such drive rollers are located above the knife structure 77, and in their entirety are denoted 292.

Such roller assembly 292 includes a relatively large drive roller 293 having a center shaft journaled for rotation at one end in bearing structure 294 mounted at the upper end of a bracket 295 rigidly affixed to a support plate 296 by a plurality of cap screws 297. The plate 296 is supported for vertical movement by a pair of uprights 298 and 299, and in this connection the uprights are respectively provided with longitudinally extending channels 300 and 301 in which a plurality of rollers 302 and 303 respectively ride. At their lower ends the uprights 298 and 299 are mounted upon a generally horizontal support assembly 304 attached to frame components of the banding apparatus and fixedly located relative thereto. The rollers 302 and 303 are mounted upon the plate 296 through ears or brackets 305 affixed thereto; and, accordingly, the plate 296 is vertically reciprocable relative to the uprights 298 and 299 and carries therewith the drive rollers 292 and the knife structure 77, as will be more apparent hereinafter.

As shown in FIG. 15, the brackets 305 adjacent their upper ends are respectively equipped with bifurcated nuts 306 and 307 respectively associated with screw-equipped rods 308 and 309 that are rotatably supported at their lower ends by bearings 310 and 311 mounted upon the support structure 304. The rods 308 and 309 are respectively equipped with bevel gears 312 and 313 respectively engaging bevel gears 314 and 315 mounted in spaced-apart relation upon an elongated control shaft 316 journaled for rotation in the support structure 304 and extending into the inner end portion of a somewhat larger shaft 317 supported in a bracket 318 that is mounted upon the support structure 304 and is equipped at its end with a knurled knob 319 by which it is manually adjustable.

The nut 306 has a collar 320 mounted between the spaced legs thereof that slidably passes the rod 308 therethrough, and at its outer end the collar 320, which is fixedly attached to the support 296, rotatably supports the hub 321 of a bevel gear 322. The bevel gear 322 is in engagement with a mating bevel gear 323 rotatably supported by the aforementioned brackets 305 through a shaft 324 upon which the large drive roller 293 is mounted so as to rotate therewith.

Cooperative with the large roller 293 in advancing the band web 75 downwardly, as viewed in FIG. 15, are a plurality of spaced-apart rollers 325 each having a smaller diameter than that of the drive roller 293 and being spaced axially therealong. The smaller rollers 325 are mounted upon a shaft 326 rotatably supported at spaced-apart locations by upwardly extending journals 327 and 328 (FIG. 15) mounted upon a support 329 (also FIG. 17) bolted or otherwise secured by cap screws 330 to the rear guides 331 of web guide structure generally denoted 332. The rollers 325 may be spring loaded, as shown, or otherwise resiliently biased toward engagement with the drive roller 293 so as to cause the band web 75 to be gripped therebetween; and such rollers 325 are driven by the shaft 326 via a gear connection thereof (not shown) with the shaft 324.

The rod 309 adjacent its upper end passes through the bifurcated nut 307 which receives a collar 333 between the spaced legs thereof that is freely pivotal with respect to both the nut and rod. The collar 333, as shown most clearly in FIG. 16, is fixedly secured to the support 296 which is therefore carried by the two rods 308 and 309 via the respectively associated collars 320 and 333. The support 296 provides a mounting for the knife structure 77 and, in this respect, is equipped with leg structure 334 having spaced-apart legs that pivotally receives therebetween an outwardly extending arm 335 mounted upon a pivot axis 336. Secured to the arm 335 by a plurality of screw-type fasteners is an elongated movable knife 337 having a cutting edge or blade 338 therealong. The knife 337 is movable relative to a fixed knife blade 339 bolted, as shown at 340, to the plate 296. A knife stripper 329′ carried by the support 329 cooperates with the movable knife 337, as best suggested in FIG. 17.

Cooperative with the rear guides 331 in confining the web length 74 after it is severed by the knife structure 77 from the web 75 are a plurality of transversely spaced guides 341 (FIGS. 15 and 17) forming a part of the aforementioned guide structure 332. Such severence of the web 75 to provide a band length 74 is effected by the shearing action of the blades 338 and 339 brought about by displacement of the movable knife 337 which, through the arm 335 and leg structure 334 is connected to a pin 342 fixed to a crank arm 343 that at one end is pivotally connected to the reciprocable piston-equipped rod of a motor means **345** in the form of a pneumatic piston-cylinder structure, the cylinder of which is pivotally connected to a mount **346** bolted or otherwise secured to the plate **296**. Accordingly, whenever the motor means **345** is energized the rod **344** is displaced outwardly whereupon the knife **337** through the described intervening structure is displaced toward its closed position against the stationary knife **339** to sever the web positioned therebetween.

The roller **293** is driven by the shaft **324** through the bevel gears **322** and **323** and, as shown in FIG. **15**, the gear **322** is drivingly connected to a shaft **347** equipped therealong with a spline or rib **348** that defines the driving connection of the shaft with the gear **322**. Such interrelationship of the gear **322** and shaft **347** permits the gear to be displaced axially relative to the shaft upon adjustment of the vertical position of the knife structure **77** and drive roll assembly **292** by manual manipulation of the knob **319**.

At its lower end the shaft **347** is rotatably supported by bearing structure **349** carried by a support **350** bolted to a frame element **351**. Also mounted upon the frame element **351** is an electric motor **352** drivingly connected through a gear reducer **353** and chain-and-sprocket assembly **354** to a drive shaft **355**. Adjacent one end, the shaft **355** is equipped with a bevel gear **356** that drivingly engages a bevel gear **357** mounted upon the shaft **347**. Evidently, then, whenever the motor **352** is energized the shaft **355** is driven as are the shafts **347** and **324** that are connected thereto, the latter of which drives the roller **293** of the feed roller assembly **292**.

Adjacent its other end, the shaft **355** is equipped with an overriding clutch **358** enabling a shaft **359** positively driven in one angular direction (by the shaft **355** through the clutch **358**) to be rotated in such direction independently of the shaft **355**, thereby enabling the severed length **74** of banding material to be yieldingly withdrawn from the grip of a control roller assembly **360** when a compressed bundle of bags is displaced from the bundle-forming conveyor mechanism **55** into alignment with the first flap-folder mechanism **73**. The shaft **359** is journaled for rotation adjacent the opposite ends thereof in the aforementioned bracket **318** and in a bracket **361** both of which are secured to frame structure of the apparatus. The control roller assembly **360** is provided with a plurality of transversely spaced rollers **362** mounted upon the shaft **359** so as to rotate therewith; and it further includes a plurality of rollers **363** (FIG. **13**) mounted upon a shaft **364** supported at its opposite ends in brackets **365** that depend from and are pivotally related to a support shaft **366**. The shaft **366** is carried by frame structure of the apparatus, and the brackets **365** and shaft **364** are resiliently biased by a helical spring **367** in a clockwise direction, as viewed in FIG. **13**, so as to urge the rollers **363** toward engagement with the rollers **362**, thereby grippingly confining the band length **74** therebetween. The shaft **364** is driven by the shaft **359** via a gear train **367'** indicated in FIG. **15**.

Disposed below the control roller assembly **360** in general alignment with the guide structure **332** associated therewith is movable web guide structure **368** comprising a forward guide component **369** and a rear guide component **370** that define a space therebetween through which the severed band length **74** is movable. As is most evident in FIG. **14**, each of the guide components **369** and **370** comprises a plurality of transversely spaced fingers which, with respect to the component **369** are denoted with the numeral **371**. The assembly **368** is vertically reciprocable between the lower position thereof illustrated in FIG. **13** in which the upper termini of such components **369** and **370** are below the plane along which the compressed bag bundles **63** move in being transported from the bundle conveyor **55** to the banding apparatus **52**, and an upper position in which such upper termini are adjacent the lower extremities of the guide assembly **332**. The function of the movable guide assembly **368** is to provide continuous control over the web of banding material as it is advanced downwardly, as viewed in FIG. **13**, by the feed roller assembly **292** and control roller assembly **360** and, therefore, the guide assembly **368** must be displaced upwardly to adjacency with the assembly **332** as the web is moved downwardly into a position traversing the bundle conveyor **55** in preparation for the next successive compressed-bag bundle **63** being advanced into the banding apparatus **52**.

The guide structure **368** is mounted upon a pair of upwardly extending drive links **372** secured to the components **369** and **370** through a transverse support **373**, and at their lower ends the links **372** are pivotally connected by a pin and collar **376** to a crank arm **377**. Referring to FIG. **32** in addition to FIG. **14**, it will be seen that the arm **377** at its opposite end is mounted upon an elongated shaft **378** journaled in the frame structure of the apparatus for pivotal displacements and secured to an arm **379** having a cam follower **380** that ridingly engages a cam **381** driven by the aforementioned motor **291**. Whenever the motor **291** is energized the cam **381** is rotated and the guide structure **368** cycles through a reciprocable displacement between the lower and upper positions thereof.

Located generally adjacent the guide structure **368**, as shown in FIG. **13** and **14**, is a depending edge guide **374** for the band web **75** which is formed of two flat bars spaced from each other by a bracket **375**. The band edge passes downwardly through the member **374**. A band-sensing arrangement operative to sense the presence of a band web and to de-energize the motor **352** in response to the presence of such band is adjacent and generally associated with the edge guide. The particular sensing arrangement employed is a photo-sensitive detector means that includes a photocell and associated light source located on one side of the guide structure **368** and a reflector **383** located on the opposite side thereof. Evidently, when a band web **74** is interposed between the photocell **382** and reflector **383**, the photo-sensitive cathode of the cell will not be energized, and through suitable circuitry (not shown) associated therewith, the motor **352** is de-energized.

The photocell **382** and reflector **383** are vertically adjustable so that the length of the web section **74** can be varied in accordance with the requirements of the bag bundles being processed by the apparatus at any particular time. In this respect, the photocell **382** and reflector **383** are carried by an essentially L-shaped bell crank **384** pivotally supported intermediate its ends at **384'** and equipped at its upper end with an offset support bracket **385** defining a space with the crank in which a nut **386** is pivotally supported and which threadedly engages a control shaft or rod **387**. The shaft at its opposite end is journaled in a bearing assembly **388** mounted upon a frame component **389** of the apparatus, and the rod is equipped with a knob **390** permitting manual adjustment thereof. Upon rotation of the rod **387**, the nut **386** is displaced axially therealong and as a consequence thereof, the bell crank swings about the axis **384'** to cause the photocell **382** and reflector **383** to be adjustably positioned (raised or lowered, as the case may be) to decrease or increase the length of the web length **74**. The guide member **374** is notched at **374'** to provide an optical path for the photocell **382** in its uppermost position.

Returning to FIG. **13** and considering FIG. **9** in conjunction therewith it will be observed that a U-shaped track structure **392** is located generally adjacent the stop assembly **72**, and at its base end the track structure is equipped with an ear to which is pivotally secured a depending support arm **393** that at its lower end is pivotally supported by a pin **394** journaled in the frame structure of the apparatus. Extending forwardly from the support **393** is a lever arm **395** which at its outer free end overlies the support **373** of the reciprocable guide structure **368** so as to be selectively engaged thereby. The track structure is movable in longitudinal directions and is carried therefor on roller means **392'**. A helical tension spring **396**, attached at one end to the arm **395** and at its other end to the frame structure of the apparatus, resiliently biases the assembly **392** forwardly in a counterclockwise direction as viewed in FIG. **13**.

Whenever the guide structure **368** is displaced upwardly, the support **373** thereof engages the arm **395** and moves it upwardly into the dotted-line position shown in FIG. **13** whereupon the track **392** is displaced toward the right so as to accommodate such upward movement of the guide structure. When the guide structure is returned to its lower retracted position, the spring **396** causes the track to move forwardly and thereby extend between the bundle conveyor **55** and banding apparatus **52** so as to provide support for a compressed bag bundle **63** being advanced thereacross by the compression-transfer mechanism **51**.

The banding apparatus **52** just forwardly of the bundle conveyor **55**, as shown in FIGS. **13** and **14**, provides rail structure **397** defining essentially a continuation of such bundle conveyor and along which a compressed bag bundle **63** is supported in being displaced into the banding apparatus. The fingers **369** of the reciprocable guide structure **368** respectively pass through openings provided therefor in such rail structure **397** which thereby contains the guide structure for such vertical reciprocations thereof. Along such track structure **397** is a band-friction assembly **398** that includes transversely spaced, longitudinally disposed friction plates **399** (formed of Teflon or other low frictional coefficient material) each held by stop structure within a recess **400** defined along the associated element of the track **397** and biased upwardly by a plurality of compression springs **401**. Each friction plate **399** is operative to press upwardly against the band length **74** disposed between it and a compressed bag bundle **63** being displaced into the banding apparatus **52** by the compression-transfer apparatus **51**; and the frictional inhibition imparted to the band length **74** by the plates **399** primarily keeps the bottom of the wrap from dropping into the bundle-transfer mechanism **78** before the first fold involving the flap **74A** is made, and secondarily, in cooperation with the resistance afforded by the control roller assembly **360** maintains the band length **74** in a substantially even distribution with respect to the compressed bag bundle about which it is to be wrapped.

Considering a cycle of operation of the band delivery system, the web **75** is withdrawn from the parent roll **76** upon demand and in accordance with actuation of the feed roller assembly **292** and control roller assembly **360** as a consequence of the drive motor **352** therefor being energized. Assuming as a starting condition the configuration illustrated in FIG. **1** in which the band web extends downwardly intermediate the stop assembly **72** and a bundle **63** of bags being advanced theretoward, as the compression plate **69** displaces such bundle toward the stop assembly **72**, the band length **74** is pressed thereagainst. Further assuming that the knife structure **77** has severed the band web **75** to provide a length **74** thereof gripped by the control roller assembly **360**, as the compression-transfer apparatus **51** advances the compressed bag handle **63** into a banding apparatus **52** and into alignment with the first flap-folder mechanism **73** therein, the severed band length **74** will be displaced with such bag bundle and the length of banding thereabove will be yieldingly withdrawn from the control roller assembly **360** because of the function of the overriding clutch **358**. At this time, it will be noted that the motor **352** is de-energized so that the rollers **362** and **363** of the control roller assembly **360** will be motionless except for the angular displacement imparted thereto in such withdrawal of the band length **74** therebetween.

As the roller assembly **360** controls the extent or portion of the band length **34** disposed above the compressed bag bundle **63**, an analogous control is imposed upon the portion extending downwardly from the bag bundle by the friction assembly **398** and, particularly, by the friction plates **399** thereof. More especially, as the compression-transfer apparatus **51** displaces the compressed bag bundle toward alignment with the first flap-folder **73**, the cut band length **74** is tightly confined between such bundle and the stop assembly **72**; and the magnitude of the constraint defined by the assembly **72** and bag bundle urged thereagainst is sufficient to withdraw the band length **74** from the grip of the control roller assembly **360** and through the friction assembly **398**. Accordingly, such band length **74** is continuously controlled as the bag bundle is displaced into the banding apparatus, wherefore the band length is properly distributed along the top and bottom surfaces of such bundle to provide band flaps **74*a*** and **74*b*** of substantially equal lengths.

The compression transfer apparatus **51** is returned to its starting position after it has effected such transfer of a bag bundle and after such bundle has been placed therefrom by the first flap-folder mechanism **73**, and as soon as the stop assembly **72** of the apparatus **51** has been returned to its initial position, as shown by full lines in FIG. **13**, the motor **291** through the cam **381** and cam follower **380** causes the reciprocable guide structure **368** to be displaced upwardly into substantial adjacency with the stationary guide assembly **332**. During these procedures and starting shortly after the band length **74** has been withdrawn from the band feed system, the motor **352** is energized and the drive roller assembly **292** as a consequence thereof withdraws another length of banding from the parent roll **76** and displaces such length downwardly through the knife structure **77** and into the nip of the control roller assembly **360** which together with the assembly **292** continues to advance the web downwardly until the leading end thereof is sensed by the photoelectric cell **382** which is operative to de-energize the motor **352**.

During such downward displacement of the band web **75**, it is continuously controlled by the reciprocable guide structure **368** which guides the band length along the rearwardly facing edge of the stop assembly **72** so that the band is in proper position for cooperation therewith when the next successive bag bundle **63** is transferred into the banding apparatus **52** by the compression-transfer apparatus **51**. Just after the motor **352** has been de-energized, the pneumatic motor means **345** of the knife assembly is actuated by appropriate supply of compressed air thereto with the result that the movable blade **337** of the knife structure **77** is displaced to sever the band web **75** and thereby provide a determinate length **74** which is held by the control roller assembly **360**. As soon as the band web has been fed downwardly into the control of the reciprocable guide structure **368**, such guide structure is displaced downwardly into its retracted position by the linkage connected therewith including the arm **377** and cam **381** driven by the motor **291**. The band feed mechanism has then completed a cycle of operation, and the entire apparatus is thereby conditioned for displacement of another compressed bag bundle **63** into the banding apparatus **52**.

FIRST FLAP-FOLDER MECHANISM

In describing the first flap-folder mechanism reference will be made in particular to FIGS. **1**, and **18** through **22**.

The mechanism **73** is operative to engage a compressed bag bundle tightly held between the compression plate **69** and stop assembly **72** and displace it downwardly into the bundle-transfer mechanism **78**. The mechanism **73** includes a presser plate **402** having a plurality of longitudinally extending recesses or channels **403** formed therein at transversely spaced locations and defining fingers **404** therebetween. Disposed along the forward edge of the plate **402** in overlying relation with the ends of the fingers **404** is a carrier strip **405** secured to the plate by a plurality of cap screws **406**. Affixed to the strip **405** in transversely spaced orientation are a plurality of auxiliary fingers **407** respectively aligned with the recesses **403** and projecting thereinto. Thus, the auxiliary fingers **407** effectively constitute a part of the presser plate **402**.

The aforementioned teeth **251** forming a part of the stop assembly **72** are respectively aligned with the fingers **404** of the plate **402** and are therefore interposed between the auxiliary fingers **407** and, as seen in FIG. **20**, lie forwardly of the strip **405**. Accordingly, when the plate **402** is displaced downwardly and into engagement with a compressed bag bundle **63**, the auxiliary fingers **407** pass between the teeth **251** and therefore move through the stop assembly **72**. It will be observed in FIGS. **18** and **20** that the strip **405** is secured to the plate **402** through intermediate connector plates **408** oriented at right angles with respect to the strip and respectively disposed along the longitudinal edges of the plate **402**. The connectors **408** enable the strip and auxiliary fingers **407** carried thereby to be adjustably connected to the plate **402** by selecting the particular disposition of the connectors **408** relative to the plate **402** and then securing the two one to another by a plurality of cap screws **409**.

The plate **402** is equipped with upwardly extending ears **410** and **411** that are spaced apart and receive a connector **412** therebetween to which they are rigidly affixed. The connector **412** is mounted upon the lower end of a shaft **413** supported for reciprocable displacements in spaced-apart bearings **414** and **415** welded or otherwise rigidly attached to a strap **416** that is mounted upon a frame component **417** of the apparatus. As shown in FIG. **19**, the shaft **413** has a coupling **418** mounted thereon which is equipped with a roller **419** that rides within a track or channel **420** defined along a rigid frame or support member **421**. The coupling **418** has a channel **422** therein receiving a drive pin **423** which is connected to one end of a crank arm **424** that at its opposite end is clamped by a connector **425** to a shaft **426** journaled for rotation in supports **427**. A depending crank arm **428** clamped to the shaft **426** by a connector **429** is operative upon angular displacement thereof to rotate the shaft **426** in opposite directions and thereby reciprocate the shaft **413** and presser plate **402** connected therewith between the upper position shown in FIG. **18** and a lower position adjacent the bundle transfer mechanism **78** in which it has displaced a compressed bag bundle **63** from the grip of the compression plate **69** and stop assembly **72** and into such bundle-transfer mechanism **78**.

Considering FIG. **32** in association with FIG. **19**, it will be observed that the crank arm **428** is connected at its lower end to a link **430** pivotally supported on the shaft **284** through an elongated arm **431** equipped intermediate its ends with a cam follower **432** cooperative with a cam **433** mounted upon and driven by the aforementioned shaft **287**. Evidently, if the cam **433** is rotatably driven upon energization of the motor **291**, the described linkage causes the folder mechanism **73** to reciprocate in vertical directions to displace each successive bag bundle **63** downwardly from the grip of the compression-transfer mechanism **51**.

The extent of the vertical displacement required by the mechanism **73** and plate **402** thereof to displace bag bundles into the bundle-transfer mechanism **78** would be related to the size of the bags being processed by the apparatus and particularly to the width of such bags in the absence of contrary provisions in the apparatus. That is to say, if a bag bundle **63** has a somewhat shorter vertical dimension (i.e., bag width) than the bundle shown in FIG. **18**, the presser plate **402** would have to be displaced downwardly through a greater distance before it engaged such a bag bundle, and also would have to continue to be displaced downwardly to a greater extent to effect proper transfer of such bundle into the mechanism **78**. Such differences in displacement that would then be required of the mechanism **73** could be accommodated by manual adjustment of the point at which the link **420** is connected to the crank arm **428**, thereby varying the angular throw of the crank arm about the axis of the shaft **426**. In FIG. **19**, a plurality of apertures **434**, **435** and **436** are provided along the crank arm **428** so as to permit ready change in the point of location of the connection of the link **430** thereto. Evidently, the throw or angular displacement of the crank arm **428** will be greater when the link **430** is connected at the aperture **436** than when the link is connected to the aperture **434**. However, the requirement for such adjustment can be obviated and a uniform displacement of the mechanism **73** preserved by inserting spacers or fillers **436'** (FIG. **18**) into the bundle-transfer mechanism **78** to accommodate variation in bag width from a selected standard.

In a cycle of operation of the first flap-folder mechanism **73**, the presser plate **402** thereof is elevated into its uppermost position, shown in FIG. **18**, at the initiation of any such cycle. In this location of the pressure plate **402**, the compression-transfer apparatus **51** is fee to displace a compressed bag bundle **63** into a position of alignment with the plate **402**, as shown in FIG. **18**. The mechanism **73** functions in mechanically enforced synchronism with the compression-transfer apparatus **51** since they are both driven by the motor **291** via the aforementioned cams mounted upon the shaft **287**. Accordingly, immediately after a compressed bag bundle **63** has been displaced beneath the plate **402** by the compression-transfer apparatus **51**, the plate **402** is displaced downwardly into engagement with such bag bundle and forces it downwardly from its position between the compression plate **69** and stop assembly **72**. After the bundle **63** has been firmly seated within the bundle-transfer mechanism **78**, the folder mechanism **73** and plate **402** thereof are returned to the upper position shown, and the mechanism is then in condition for a subsequent cycle of operation.

BUNDLE-TRANSFER MECHANISM

In describing the bundle-transfer mechanism **78** reference will be made in particular to FIGS. **1**, **18**, and **21** through **25**.

The bundle-transfer mechanism **78** is operative to accept the compressed bag bundle **63** displaced thereinto by the first flap-folder mechanism **73** and to advance such bundle bodily into vertical alignment with the second flap-folder mechanism **81**. It will be observed, especially in FIG. **18**, that downward movement of the bag bundle **63** into the bundle-transfer mechanism **78** is effective to fold the lower flap **74*a*** of the band length **74** upwardly into juxtaposition with the last or trailing bag in the bundle **63**. In this respect, the transfer mechanism **78** is equipped with an L-shaped guide **437** located at the upper trailing corner thereof, and the horizontal leg of such guide supports the trailing band flap **74*a*** in horizontal orientation prior to the bundle being moved downwardly. Upon such downward movement of the bag bundle, the flap is drawn downwardly with the bundle and is folded thereagainst by the vertical leg of the band guide.

The bundle-transfer mechanism **78** includes a carriage **438** that is reciprocable along a track defined by spaced apart rails **439** between positions of alignment with the first flap-folder mechanism **73** and second flap-folder mechanism **81**. The rails **439**, as shown most clearly in FIG. **22**, are generally I-shaped and define channels along the inner and outer faces of the web thereof in which ride a plurality of outer rollers **440** and inner rollers **441** each of which is mounted upon the carriage **438**. More particularly, the outer rollers **440** are mounted upon a carriage frame **442** that is horizontally disposed and has such rollers located adjacent its ends. The carriage frame **442** includes components which are disposed along each end of the carriage, and a plate **443** extends between the members **442** and is secured to the rear ends thereof in bridging relation with the track defined by the rails **439**. The plate **443** is generally L-shaped (FIG. **18**), and the upwardly extending frame **444** thereof has a plate **445** fixedly secured thereto which defines the inner wall or surface of a rear constraining assembly, generally denoted by the numeral **446**, along which each bundle **63** slides in being displaced into the bundle-transfer mechanism **78**.

Bolted or otherwise attached to the frame member **442** is a support bracket **447** providing a point of attachment for the crank assembly and by means of which the carriage **438** is reciprocated along the rails **439**. In this reference, the bracket **447** has an opening **448** formed therein that is dimensioned to pivotally receive an enlarged end **449** of a crank arm **450** and which end thereof is pivotally secured to the bracket **447** by means of a pin **451** extending downwardly therethrough. The crank arm **450** projects across the track in underlying relationship therewith, and at its opposite end it is constrained by a connector **452** upon a shaft **453** supported in generally vertical orientation for pivotal displacements by spaced bearings **454** and **455** carried by a frame component **456** of the apparatus. At its upper end of the shaft **453** is secured by a coupling **457** to a link **458**, and referring to FIG. **32**, it will be observed that the link **458** is attached to a bell crank **459** having along a leg **460** thereof a cam follower **461** that engages a cam **462** mounted upon the aforementioned shaft **287** so as to be driven by the motor **291**. During each cycle of operation of the motor, the bundle-transfer mechanism **78** and, in particularly, the carriage **438** thereof are reciprocated along the rails **439** between the extreme positions respectively constituting locations of alignment with the first and second flap-folders **73** and **81**.

The carriage **438** also includes a front or forward constraining assembly generally denoted **463** that comprises a plurality of transversely spaced and upwardly extending stop fingers **464** respectively attached to longitudinally disposed carriers **465** defining a cantilever support for the fingers. The carriers extend rearwardly in underlying relation with the aforementioned plate **443** and are bolted or otherwise secured to a transversely oriented mounting block **466**. The block **466** at each end thereof has a nut **467** mounted thereon, and threadedly extending through the opening of such nut is a screw shaft **468**. The shaft **468** is rotatably carried by an L-shaped lug **469** attached by a plurality of cap screws **470** to the aforementioned plate **443** so as to be rigidly related thereto. The shaft **468** is equipped with a bevel gear **471** driven by bevel gear **472** mounted upon a transversely extending adjustment shaft **473** journaled for rotation in ears **474** secured to the aforementioned members **469**.

The rod **443** at its outer end is equipped with a manually manipulable knob **475**, and it will be apparent that rotation of such knob and the rod **473** attached thereto will rotate each screw shaft **468** whereupon the nut **467** mounted thereon will be displaced relative to the screw shaft, thereby carrying the supports **465** and fingers **464** thereof forwardly or rearwardly, as the case may be, relative to the rear constraining structure **446**. Both FIGS. **21** and **22** show that a screw shaft is provided at each end of the carriage **438** and that the adjustment rod **473** has a pair of gears **472** in respective engagement with the bevel gears **471** of such screw shafts. Consequently, the forward constraining structure **463** will be displaced uniformly relative to the rear constraining structure **446** upon adjustment of the rod **473**. The inner rollers **441** are mounted upon the outermost carriers **465**, and therefore contribute to the stability of the carriage and also support the forward end portion of the constraining structure **463**, thereby facilitating adjustable displacements thereof relative to the constraining structure **446**.

The rails **439** are supported by the previously denoted frame structure **389** (FIG. **18**) which is equipped with strips **476** that depend therefrom and at their lower ends are welded or otherwise attached to the lower flange of the respectively associated I-shaped rails **439**. The upper flange and web of each rail terminates a spaced distance from the strap **476**, as is evident in FIG. **18**, and when the carriage **438** is in its rearmost position the carriers **465** are in close proximity to the straps **476** although the exact position of the carriers will depend upon the particular adjustment of the forward constraining structure **463**. The frame member **389**, it can be observed in FIG. **18**, also supports the rails **215** as explained hereinbefore with particular reference to FIG. **14**.

A glue assembly **477** is provided which is operative at particular intervals to apply glue or adhesive to a portion of the upper flap **74*b*** of the band length **74** preparatory to the flaps thereof being secured to each other. The glue assembly **477** may be largely conventional and referring to FIGS. **23** and **24**, it is seen to be mounted upon the plate **443** of the carriage **438**. Extending upwardly from the plate **443** are a pair of spaced-apart standards **478** to which are pivotally secured, respectively, ears **479** that depend from an adhesive reservoir or container **480** (the container might serve as an overflow receiver in the case of the adhesive applicator being an extrusion device). The reservoir **480** is elongated in a transverse sense and is angularly displacable about the pivotal connection of the ears **479** with the standards **478** between a lower retracted position shown in FIG. **18** and an upper glue-applying position shown in FIGS. **23** and **25**.

The reservoir **480** provides journals at its ends for a shaft **481** extending therethrough that is equipped at spaced-apart locations within the reservoir with a plurality of glue wheels **482** that in the upper orientation of the reservoir **480** are adapted to engage the flap **74*b*** of the band length **74** and apply lines of adhesive to the under surface thereof. At an outer end, the shaft **481** is equipped with a pinion gear **483** that is driven by a spur gear **484** mounted upon the output shaft of an electric motor **485**. The motor runs and rotates the wheels **482** continuously but they apply adhesive to a band flap **74*b*** only during those intervals in which the reservoir **480** is swung upwardly into the position shown in FIGS. **23** and **25**.

Movement of the reservoir **480** into such active glue-applying position thereof is effected by a fluid motor **486** in the form of pnuematic piston-cylinder structure the cylinder of which is fixedly secured to the plate **443** via a mounting bracket **487** attached thereto, and the rod-equipped piston of which bears against push clips **488** attached to the reservoir **480** through a mounting plate **498** extending downwardly therefrom. The weight distribution of the assembly **477** is such that the reservoir **480** is gravity biased in a clockwise direction as viewed in FIGS. **18**, **23** and **25** so that it remains retracted except for those intervals during which the motor means **486** is energized to displace the rod thereof outwardly against the clip **488** and thereby swing the reservoir **480** in a counterclockwise direction into its active glue-applying position. A doctor blade structure **490** is associated with the wheels **482** to prevent build up of excess glue thereon.

In a cycle of operation of the bundle-transfer mechanism **78**, the initial position thereof is one in which the carriage **438** is aligned with the first flap-folder mechanism **73** so that downward displacement of the presser plate **402** thereof will force a bag bundle **63** from the frictional grip of the compression-transfer mechanism **51** and into the space provided for receipt of such bundle between the rear constraining structure **446** and forward constraining structure **463**. As shown in FIG. **22**, the fingers **464** of the forward constraining structure **463** respectively align with the teeth **251** of the constraining structure **72** so that the presser plate **402** is movable downwardly into the bundle-receiving space of the transfer mechanism **78**, should this be required, to positively seat the bag bundle therewithin.

Following such bundle displacement into the frictional grip of the rear and front constraining structures **446** and **463**, the carriage **438** is moved forwardly through the connection thereof with the drive link **450**, and such forward movement of the carriage is effected in timed relation with the movements of the compression-transfer apparatus **51** and first flap folder **73** because all three of these assemblages are mechanically driven from the same prime mover, namely the motor **291**. The bundle-transfer mechanism **78** terminates its forward movement in substantial alignment with the second flap-folder mechanism **81**, and following displacement of a bag bundle therefrom into the compression drier and ejector mechanism **82**, the bundle-transfer mechanism **78** is returned to its starting position preparatory for a subsequent cycle of operation.

SECOND FLAP-FOLDER MECHANISM

In describing the second flap-folder mechanism **81** reference will be made in particular to FIGS. **1**, **25** and **26**.

The second flap-folder mechanism **81** is operative to displace a compressed bag bundle **63** upwardly from the frictional grip of the bundle-transfer mechanism **78** into the compression-drier mechanism **82**, as diagrammatically shown in FIG. **1**. In the performance of this function, the mechanism **81** includes components that are vertically reciprocable through the openings defined between the spaced-apart finger structures **464** of the bundle-transfer mechanism **78**. It may be noted that those components of the folder mechanism **81** that are so vertically reciprocable are configured such that the bundle-transfer mechanism **78** may be moved rearwardly toward alignment with the first flap-folder mechanism **73** when the second flap-folder mechanism **81** is in its upper position adjacent the compression-drier mechanism **82**.

In more particular terms, the second flap-folder mechanism **81** comprises a plurality of transversely spaced columns or fingers **491** that are disposed in transverse alignment and at the lower ends thereof are bolted or otherwise rigidly secured to a mounting plate **492**. The plate **492** intermediate the ends thereof has a vertically extending rack gear **493** fastened thereto that is engaged by a sector gear **494** mounted upon a shaft **495** to which it is keyed so as to be angularly displaced thereby. The shaft **495** is journaled for rotation by bearings **496** and **497** secured to the end support by frame components **498** and **499**. The shaft **495** at its opposite end is equipped with a pinion gear **500** (FIG. **32**) engaged by a sector-type drive gear **501** pivotally mounted upon the aforementioned shaft **284** and angularly displaced through a link and cam follower **502** controlled by a cam **503** mounted upon the shaft **287** and driven thereby from the aforementioned motor **291**.

The rack gear **493** is constrained for reciprocable displacements in vertical directions by guide structure **504** secured to and carried by the frame component **499**. The column and plate assembly **491**, **492** is further constrained for such vertical displacements by an elongated guide track **505** carried by a frame member **506** and providing an elongated channel or recess **507** therealong within which a roller **508** is confined. The roller **508** is mounted upon one end of a bar **509** which at its opposite end is bolted or otherwise attached to the plate **492**. The guide structure **504** is located within the rack gear **493** which has a generally U-shaped configuration so as to partially enclose such guide structure. Generally adjacent the sector gear **494** is a supplementary guide **510** located so as to maintain the meshing engagement of the gears **493** and **494** by confining each in a transverse sense.

In a cycle of operation of the second flap-folder mechanism **81**, the columns **491** thereof are initially in the lower position shown in FIGS. **25** and **26** by full lines, and following translational displacement of the bundle-transfer mechanism **78** into a position of alignment therewith, as illustrated in FIG. **25**, the cam **503** is rotated by the shaft **287** and drive motor **291** into a position in which the cam follower **502** actuates the gears **501** and **500** which, through the shaft **495** and gears **494** and **493**, cause the columns **491** to be displaced upwardly into the broken-line positions thereof shown in FIG. **26**. Such upward movement of the columns **491** carries with it a compressed bag bundle **63** located thereabove so as to push the same into the compression-drier mechanism **82** after which the columns are returned to their lower position by reverse displacement of the sector gear **494** which is enforced thereon by displacement in the opposite direction of the gear **501** under the influence of the cam follower **502** and cam **503**.

As explained heretofore, the bundle-transfer mechanism **78** may commence its return movement in a rearward direction toward alignment with the first flap-folder **73** before the second flap-folder **81** is retracted because the relative orientation of the columns **491** (which are supported only at their lower ends by the plate **492**) and stop fingers **464** of the transfer mechanism **78** permits such movement of the columns with respect to the fingers, as is most evident in FIG. **26**. It will be appreciated that the transfer mechanism **78** makes one complete cycle of operation for each bag bundle **63** being processed by the apparatus and, therefore, the second flap-folder mechanism **81** cycles through an upward displacement and then returns to its starting position for each bundle being processed by the apparatus.

COMPRESSION-DRIER AND EJECTOR MECHANISM

In describing the compression-drier and ejector mechanism **82** reference will be made in particular to FIGS. **1** and **25** through **27**.

The mechanism **82** is intended to receive each successive bag bundle displayed upwardly thereinto by the second flap-folder mechanism **81** and to confine each bundle under longitudinal constraint until the adhesive sets to anchor one to the other the superposed flaps **74*a*** and **74*b*** of the band length **74**. The mechanism **82** is operative to receive and confine a plurality of bag bundles and may have any height necessary or desirable to assure complete curing of the flap-securing adhesive before each bundle reaches the upper level within the mechanism and is ejected therefrom. In the particular apparatus being considered, the mechanism **82** has a height sufficient to accommodate four bag bundles, and in the case in which the apparatus processes four bundles per minute it will be evident that the retention time of each bundle within the mechanism **82** approximates one minute when the apparatus is in continuous operation.

Adhesive is applied by the glue assembly **83** to the upper flap **74*b*** of the band length **74** as the bundle **63** is displaced upwardly into the compression-drier mechanism **82** by the second flap-folder **81**. In this respect, the flap **74*b*** initially has the disposition shown in FIG. **25** in which it extends along the L-shaped guide **437** of the compression-transfer mechanism **78**. Disposed generally thereabove but of greater length than the guide **437** is a backing plate or mandrel **511** against the under surface of which the upper band flap **74*b*** is pressed by the various wheels **482** of the glue assembly **83** whenever such assembly is elevated to cause the wheels thereof to deposit adhesive along the bottom surface of the flap. The mandrel **511** is supported by an L-shaped channel **512** which is carried by fixed frame components of the apparatus.

Comparing FIGS. **25** and **26**, the compression-drier mechanism **82** is seen to be provided at transversely spaced locations generally adjacent its opposite ends with biasing assemblies **513** each of which includes a fixed pin equipped with a circumjacent compression spring bearing against an ear **514** that extends outwardly from an associated latch finger **515** supported for pivotal movement at its upper end by pin structure **516**. At their lower ends each of the latches **515** is equipped with an inwardly turned projection **517** adapted to underlie the adjacent bottom edge of the lowermost bag bundle within the mechanism **82** so as to retain such bundle (and those above) therewithin. A similar bundle-retention arrangement is provided along the opposite side of the mechanism **82**, as shown in both FIGS. **25** and **26**, and it includes a latch **518** equipped with an ear **519** against which the spring of a biasing assembly **520** bears to urge the latch inwardly about the pivot support **521** therefore so as to cause an inward projection **522** provided at the lower end of the latch to engage the bottom edge portion of such lowermost bag bundle **63**.

The latches **518** are carried at the lower end portions of the outer two of a plurality of transversely spaced and upwardly extending guides **523** each of which is secured by cap screws to a transversely disposed support plate **524**. As is evident in FIG. **26** the outermost guides **523** are reduced in width, as shown in **525**, so as to accommodate the latches **518**. A generally similar arrangement of guides **526** (the outer two of which carry the latches **515**) is provided along the opposite side of the mechanism **82** in generally facing disposition with the guides **523** and they are attached to a support plate **527** secured to frame components of the apparatus such as the frame plate **528** shown. The guides **526** are all stationary but the guide fingers **523** are adjustable so as to change the spacing defined between the guides **523** and **526** and into which space each compressed bag bundle **63** is displaced.

Adjustability of the guides **523** is effected through the arrangement shown most clearly in FIG. **27**, and as shown in this figure, the aforementioned support plate **524** extends beyond the outer guide **523** toward adjacency with the frame plate **528** and it is equipped thereat with a rearwardly turned bracket **529**. The bracket **529** is provided with a roller **530** extending outwardly therefrom for receipt within a channel **531** provided by the frame plate **528**. Intermediate the outer guide **523** and the bracket **529** the plate **524** has an opening through which a threaded shaft **532** passes, and which shaft at its inner end is rotatably supported by a bearing 533 mounted within a frame element 534 which is generally disposed in transverse alignment with the guides 526.

Secured to the plate 524 by a plurality of cap screws is an elongated nut 535 threadedly receiving the shaft 523 therein, and which shaft projects outwardly from the plate 524 and passes through a mounting bracket 536 bolted or otherwise rigidly related to a flange 537 secured to and forming a part of the frame plate 528. The bracket 536 is equipped at its outer end with a bearing 538 through which the shaft 532 passes and is rotatably supported thereby. The shaft is constrained against translational displacements relative to the bracket 536 by flanges 539 and 540 that are fixed to the shaft and are respectively disposed on opposite sides of the bracket 536. At its outer end, a knob or hand wheel 541 facilitates manual rotation of the shaft.

The assemblage described enables the guides 523 which are all carried by the plate 524 to be displaced either toward or away from the guides 526 upon rotation in the appropriate direction of the wheel 541 and shaft 532 secured thereto. Referring especially to FIGS. 25 and 27, it will be observed that rotation of the shaft 532 in one direction causes the elongated nut 535 to move along the shaft, thereby carrying with it the plate 524 and guides 523. Rotation of the shaft 532 in the opposite direction will also cause the elongated nut 535 to move therealong in a reverse direction again carrying with it the plate 524 and guides 523. Such adjustment of the guides 523 can be effected while the apparatus is in operation.

As heretofore explained the ejector assembly 84 is operative to displace bodily each bag bundle 63 issuing upwardly from the mechanism 82 through the space defined between the guides 523 and 526. Referring to FIG. 29, it will be seen that a discharge conveyor 542 is located adjacent the upper end of the guides 523 and 526 and may include a conventional arrangement in which a continuously moving belt is entrained about a pulley 543. The ejector 84 includes an upwardly extending bar or shaft 544 pivotally supported at its lower end and angularly movable between the full-line and broken-line positions shown in FIG. 29. At its upper end the bar 544 has a pair of spaced-apart plates 545 welded thereto and between which is sandwiched a pusher 546 that may be fixedly connected to the plates by one or more fasteners 547. The pusher 546 extends outwardly from the plates 545 at a substantially normal orientation relative to the axis of the bar 544, and the pusher is adapted to engage each bundle 63 after it has been ejected from the guides 523, 526 and push such bundle onto the conveyor 542.

At its lower end, the bar 544 is supported for pivotal movement upon a stub shaft assembly 548 that extends outwardly from a mounting plate 549 fixed to at least certain of the guides 526. A link or crank arm 550 is attached to the bar 544 adjacent the pivotal support thereof and forms a type of bell crank assembly therewith. A link 550 is pivotally secured by a clevis 551 to the rod-equipped piston of a pneumatic piston-cylinder motor means 552, the cylinder of which at its upper end is pivotally connected, as shown at 553, to an ear 554 extending outwardly from one of the guides 526. Whenever the motor means 552 is energized, the link 550 and bar 544 are displaced angularly in a counterclockwise direction as viewed in FIG. 26, whereupon the pusher 546 engages a bag bundle 63 enected from the guides 523 and 526 so as to displace such bundle onto the conveyor 542.

The compression drier mechanism 82 is for the most part a static structure and simply functions to receive each bag bundle displaced upwardly thereinto through the lower end thereof and to permit each such bundle to be ejected therefrom following a sufficiently long period of adhesive-curing retention. During such upward displacement of a bag bundle thereinto, adhesive is applied to the trailing flap 74*b* of a band length 74 surrounding the bundle, and the adhesive-equipped upper flap 74*b* is pressed against the lower flap 74*a* by the guides 526 as the bundle is displaced upwardly into the mechanism 82. As the bundle moves upwardly, the latches 515 and 518 are forced outwardly against the bias imparted thereto by the springs of the biasing assemblies 513 and 520, and as soon as the bundle passes beyond the projections 517 and 522 at the lower ends of such latches, the latches swing inwardly and thereby prevent such bundle, and the bundles thereabove, from falling downwardly from the mechanism 82.

As each bundle 63 is displaced upwardly step by step through the mechanism 82, the guides 526 maintain the upper flap 74*b* in tight contiguous engagement with the underlying flap 74*a* of the band length 74, thereby affording sufficient opportunity for the adhesive to unite such flaps with the result that the band length 74 is thereafter able to maintain the bundle in a compressed condition following its being ejected from the mechanism 82. As each bundle is so ejected therefrom, the bar 544 and pusher 546 carried thereby are energized to displace the bundle onto the discharge conveyor 542.

OPERATION

In the foregoing description, each of the sections 50, 51 and 52 and the mechanisms thereof has been explained in terms of an operational sequence and, accordingly, a description of an overall operational cycle is unnecessary. As respects such overall cycle and the timed interrelationships of the various mechanisms and certain components thereof, FIG. 34 graphically depicts the same and, therefore, a review of this figure may be advantageous. Along the left-hand side of the graph of FIG. 34 are designated by parts number the various mechanisms comprising the bundle-forming apparatus 50, the compression-transfer apparatus 51, and the banding apparatus 52. Along the top of the graph, one complete operational cycle is subdivided into time increments defined in terms of the angular degrees comprising one 360° cycle of the control cams and related elements. Therefore, at any particular instant of time, and which instant has a particular angular degree value, the conditions of the various mechanisms can be determined by noting the character of the time-displacement curves at such instant or angular position defining the same.

As noted in FIG. 34 and as explained hereinbefore, the hand-transfer mechanism 59 and bundle-locator mechanism 66 are continuously driven by a drive train connected to the collator apparatus 53 and, therefore, the mechanical motions of these two mechanisms are effected repetitively in mechanically enforced synchronism. Similarly, the various mechanisms comprising the banding apparatus 52 are for the most part mechanically energized by cams driven by the motor 291 via the shaft 287, as shown in FIG. 32. The particular exception to such mechanical energization concerns the pneumatic displacement of the compression plate 69 in a transverse direction in response to energization of the motor means 70 and pneumatic displacement in a longitudinal direction in response to energization of the motor means 71.

The motor means 70 is energized through a switch 555 (whenever the photocell 277 is sensing the presence of a bag bundle, as previously explained) actuated by the bundle-locator mechanism 66 so as to displace the compression plate 69 into its extreme transverse position, shown by broken lines in FIG. 9, thereby causing a switch 555′ (FIG. 9) associated with such displacement of the plate to be actuated which completes the circuit for the drive motor 291 wherefore all of the mechanical drive functions performed by the compression-transfer apparatus 51 and banding apparatus 52 then will be effected. The motor 291 drives a cycle timer comprising a plurality of cam-controlled switches (FIGS. 33 and 34) one of which energizes the motor means 71. As the shaft 287 is rotated by the motor 291, the carriage 217 of the compression-transfer apparatus 51, the first flap-folder mechanism 73, bundle-transfer mechanism 72, second flap-folder mechanism 81, and reciprocable band guide 368 are all energized through a complete cycle of operation by the cam drives respectively associated therewith, all as heretofore explained.

It might be observed that the bundle-transfer mechanism 78 is in its forward or advanced position of alignment with the second flap-folder mechanism **81** at the start of the cycle of operation and very quickly thereafter (20° later), the second flap-folder **81** commences its upward movement to displace a bag bundle **63** from the transfer mechanism **81**. Such displacement of the mechanism **81** is completed at the 80° position in the cycle at which time the bundle-transfer mechanism **78** is moving rearwardly, and which movement continues until the mechanism **78** attains its most rearward position in alignment with the first flap-folder mechanism **73** at about the 165° position. At that time, the first flap-folder mechanism **73** starts downwardly to displace the next successive bag bundle **63** from the compression-transfer apparatus **51** and into the bundle-transfer mechanism **78** located therebelow. Evidently, this time relationship describes the condition in which two successive bag bundles **63** are being processed essentially concurrently by the banding apparatus **52** during each cycle of operation.

As shown in FIG. **33**, a plurality of switches are respectively associated with a plurality of cams driven by the aforementioned shaft **287** so that whenever the motor **291** is energized, the cam controlled switches are actuated in a predetermined sequence at fixed time intervals. In this respect, a switch **556** actuated by a cam **557** controls the supply of compressed air to the motor means **71** and thereby controls the forward displacement of the dolly **223** and compression plate **69**. As soon as the cam **557** has rotated through such determinate angular distance (20° for example), the switch **556** is de-energized whereupon the motor means **71** continues to maintain the dolly and compression plate in their forward positions.

At about the 250° position, a switch **558** controlled by a cam **559** associated with the shaft **287** is actuated and causes the motor means **71** to displace the dolly **223** (and compression plate) in the opposite direction, which displacement thereof is completed at about the 280° position whereupon the dolly is then maintained thereat until the next cycle of operation. Concerning termination of such cycle, a switch **560** under the control of a cam **561** is actuated thereby once during each 360° cycle of operation and, in association with the control circuitry for the motor **291**, is operative to de-energize it, thereby terminating such cycle.

The glue assembly **83** is pneumatically actuated once each cycle to cause the upper flap **74***b* of the band length **74** to have adhesive applied thereto, and the glue cycle is initiated at the 20° position by a switch **561** activated by a cam **562** rotated by the shaft **287**. Upon such initiation, the assembly is displaced upwardly and immediately retracted to terminate its cycle at about the 60° position. The motor **352** controlling delivery of the band **75** is energized in response to actuation of a switch **563** controlled by a cam **564** driven by the afore-mentioned shaft **287**. Evidently, then, at a predetermined time in the operational cycle the band **75** is advanced and continues to be until the motor **352** is de-energized by operation of the afore-mentioned photoelectric senser **382**. Analogously, the knife structure **77** is actuated by operation of a switch **565** controlled by a cam **566** driven by the shaft **287**, and the ejector assembly **84** is reciprocated once during each cycle of operation in response to actuation of a switch **567** that is controlled by a cam **568** also driven by the shaft **287**.

The various adjustments provided throughout the machine to enable it to accommodate bag products of different sizes and thicknesses can be made while the machine is in operation. This feature has a corollary advantage of permitting slight alterations to be made in one or more of the adjustments if and whenever necessary to compensate for any minor changes in such adjustment caused by operation of the machine, and also to compensate for slight differences in the basis weight of bag runs derived from different stock ostensibly having the same dimensions and thickness. For convenience, the machine is illustrated in the drawings with all of its adjustable components in their positions of minimum adjustment.

The machine is capable of processing bags at relatively high rates of speeds and, as indicated hereinbefore, speeds in which 2,000 bags per minute are processed are readily accommodated. Actually, the mechanical characteristics of the machine enable the various components and mechanisms thereof to move at relatively slow rates even though the number of bags being handled by the machine is quite high. Relevant to this feature is the fact, as will be apparent in FIG. **34**, that the compression-transfer apparatus **51** and banding apparatus **52** have a dwell period during each complete cycle of operation of the machine.

The compression-transfer apparatus **51** utilizes two separate mechanical motions to effect compression of each bag bundle and transfer thereof into the banding apparatus **52**. More particularly, compression of each bag bundle results from forward displacement of the compression plate **69** by the motor means **71**, and displacement of the compressed bag bundle into the banding apparatus results from the longitudinal movement in a forward direction of the carriage **217** which has both the motor means **71** and compression plate **69** mounted thereon. In addition to the increase in speed attributable to the general concurrency of such compressional and translational movements, the permissible mass of the motor means **71** is much less than would be required were the total of such compressional and translational movements imparted to each bag bundle obtained solely from the motor means.

Relatively high compressional force is imparted to each bag bundle by the compression plate **69** in cooperation with the stop assembly **72**, and as a result, the bag-to-bag friction within a compressed bundle is sufficiently great to resist relative vertical movements between contiguous bags within such a bundle. This factor enables simplification of the mechanisms required to displace the bag bundle first, from the compression-transfer apparatus **51** and second, from the bundle-transfer mechanism **78**.

More especially in this reference, it may be noted in FIG. **18** that the pressure plate **402** is somewhat smaller in longitudinal extent than the space occupied by an underlying bag bundle **63** so that such plate does not engage each bag in the bundle during displacement thereof into the bundle-transfer mechanism **78**. It will be appreciated that very exacting tolerences would be required as between the presser plate **402** of the first flap-folder mechanism and the compression plate **69** and stop assembly **72** of the compression-transfer apparatus should there be a requirement that the plate **402** engage each such bag. The consequences thereof would materially complicate the machinery and increase the cost thereof and could also reduce the operating speed because precise alignment of relatively moving components would be necessary in order for the compression-transfer apparatus **51** to permit the presser plate **402** to pass downwardly therethrough.

Although the particular embodiment of the apparatus hereof is illustrated and described for the banding of grocery bags as they are discharged from a bag collector, such apparatus and the method hereof are applicable to the banding of any type of article, particularly flat sheet articles such as newspapers, wherein it is advantageous to band them into bundles under compression. In this connection, flat articles after banding with sheet banding material, such as paper, can be subsequently cut through the band into units of smaller size.

What is claimed is:

1. Compression-transfer apparatus for compressing a bundle of bag articles or the like and for transferring the same into banding apparatus, comprising an elongated track equipped with a carriage longitudinally reciprocable therealong, drive structure connected with said carriage for effecting such reciprocable displacements thereof, a dolly mounted upon said carriage and being longitudinally reciprocable with respect thereto, first drive means connected with said dolly and being operative to effect such reciprocable displacements thereof relative to said carriage, a compression plate supported by said dolly for movement therewith and being transversely displacable with respect thereto, second drive means connected with said compression plate and being operative to

displace the same selectively between an extended operative position and a retracted inoperative position, and constraining structure supported by said carriage for movement therewith and being adapted to have such bundle compressed thereagainst by said compression plate in the extended operative position thereof upon displacement of said dolly relative to said carriage in a direction toward said banding apparatus, said carriage being operative upon displacement thereof to transfer such compressed bundle into the aforementioned banding apparatus.

2. The compression-transfer apparatus of claim 1 in which said first and second drive means each comprise fluid motor means.

3. The compression-transfer apparatus of claim 2 in which said first motor means comprises piston-cylinder structure operatively connected between said carriage and dolly for reciprocating the latter relative to said carriage, and in which said second motor means comprises piston-cylinder structure operatively connected between said dolly and compression plate to displace the latter between the extended operative and retracted inoperative positions thereof.

4. The compression-transfer apparatus of claim 1 and further comprising stop structure mounted upon said carriage and being cooperative with said dolly to define the maximum extent of the compressional displacement enforcable on said compression plate by said dolly.

5. The compression-transfer apparatus of claim 1 and further comprising adjustment means connecting said constraining structure with said carriage for selectively determining the relative positions thereof and thereby establish the minimum permissible distance between said constraining structure and compression plate upon compressional displacement of the latter as enforced thereon by said dolly.

6. The compression-transfer apparatus of claim 5 and further comprising stop structure mounted upon said carriage and being cooperative with said dolly to define the maximum extent of the compressional displacement enforcable on said compression plate by said dolly.

7. The compression-transfer apparatus of claim 6 in which said first drive means comprises fluid motor means in the form of piston-cylinder structure operatively connected between said carriage and dolly for reciprocating the latter relative to the former, and in which said second drive means comprises fluid motor means in the form of piston-cylinder structure operatively connected between said dolly and compression plate to displace the latter between the extended operative and retracted inoperative positions thereof.

8. In banding apparatus in which bundles of bag articles or the like, compressed at a station generally adjacent the entrance to such apparatus, have bands wrapped and secured thereabout to maintain each bundle in a compressed state for shipment and storage, band delivery mechanism comprising feed roller structure repetitively operative to withdraw continuous strips of band webbing from a supply roll thereof and advance the webbing through such station for engagement by each such bundle compressed thereat, knife structure for severing such webbing into predetermined lengths each adequate to be secured about a bundle for constraining the same in its compressed state, and a control roller assembly intermediate said knife structure and compression station for controlling each severed length of band webbing as it extends through such station for engagement by a bundle thereat, said control roller assembly being characterized by enabling such severed length of band webbing controlled thereby to be displaced with such bundle from said compression station and into said banding apparatus; said band-delivery mechanism further including a reciprocable band guide assembly movable through such compression station between an upper position of adjacency with said control roller assembly to receive the band webbing advancing therethrough and guide the same through such compression station and a lower position remote from such station so as to offer no interference to movement thereinto and compression of a bundle thereat, and drive structure for displacing said band guide assembly between such upper and lower positions thereof.

9. The band delivery mechanism of claim 8 in which said control roller assembly is operative to grip such band webbing and yieldingly resist withdrawal therefrom of a severed length of such webbing.

10. The band delivery mechanism of claim 9 in which said control roller assembly includes a driven roller and an idler roller cooperative therewith, said driven roller being equipped with an overrunning clutch to enable such severed band length to be yieldingly withdrawn from the grip of said driven and idler rollers.

11. In banding apparatus in which bundles of bag articles or the like, compressed at a station generally adjacent the entrance to such apparatus, have bands wrapped and secured thereabout to maintain each bundle in a compressed state for shipment and storage, band delivery mechanism comprising feed roller structure repetitively operative to withdraw continuous strips of band webbing from a supply roll thereof and advance the webbing through such station for engagement by each such bundle compressed thereat, knife structure for severing such webbing into predetermined lengths each adequate to be secured about a bag bundle for constraining the same in its compressed state, and a control roller assembly intermediate said knife structure and compression station for controlling each severed length of band webbing as it extends through such station for engagement by a bag bundle thereat, said control roller assembly being characterized by enabling such severed length of band webbing controlled thereby to be displaced with such bundle from said compression station and into said banding apparatus; said band delivery mechanism further including friction structure engageable with a severed band length along a section thereof generally located on the side of such compression station opposite that of said control roller assembly and cooperative with such band section to control the same during displacement of such bundle from the compression station and into said banding apparatus.

12. The band delivery mechanism of claim 11 in which said friction structure is slidably engageable with such severed band length to yieldingly inhibit translational displacement thereof with such compressed bundle into said banding apparatus.

13. The band delivery mechanism of claim 12 in which said friction structure includes a friction plate formed of a material having a low coefficient of friction.

14. In banding apparatus in which bundles of bag articles or the like, compressed at a station generally adjacent the entrance to such apparatus, have bands wrapped and secured thereabout to maintain each bundle in a compressed state for shipment and storage, band-delivery mechanism comprising feed roller structure repetively operative to withdraw continuous strips of band webbing from a supply roll thereof and advance the webbing through such station for engagement by each such bundle compressed thereat, knife structure for severing such webbing into predetermined lengths each adequate to be secured about a bag bundle for constraining the same in its compressed state, and a control roller assembly intermediate said knife structure and compression station for controlling each severed length of band webbing as it extends through such station for engagement by a bag bundle thereat, said control roller assembly being characterized by enabling such severed length of band webbing controlled thereby to be displaced with such bundle from said compression station and into said banding apparatus; said band delivery mechanism further including a reciprocable band guide assembly movable through such compression station between an upper position of adjacency with said control roller assembly to receive the band webbing advancing therethrough and guide the same through such compression station and a lower position remote from such station so as to offer no interference to movement thereinto and compression of a bag bundle thereat, drive structure for displacing said band guide assembly between such upper and lower positions thereof, and friction structure

engageable with a severed band length along a section thereof generally located on the side of such compression station opposite that of said control roller assembly and cooperative with such band section to control the same during displacement of such bundle from the compression station and into said banding apparatus.

15. The band delivery mechanism of claim 14 in which said control roller assembly is operative to grip such band webbing and yieldingly resist withdrawal therefrom of a severed length of such webbing, and in which said control roller assembly includes a driven roller equipped with an overrunning clutch to enable such severed band length to be yieldingly withdrawn from the grip of said driven and idler rollers.

16. The band delivery mechanism of claim 15 in which said friction structure is slidably engageable with such severed band length to yieldingly inhibit translational displacement thereof with such compressed bundle into said banding apparatus, and in which said friction structure includes a friction plate formed of a material having a low coefficient of friction.

17. The band delivery mechanism of claim 16 and further including an adjustment assembly supporting said feed roller and knife structures for adjustable displacements thereof along the path of movement of such band webbing toward said control roller assembly so as to enable the extent of such predetermined web lengths to be changed.

18. The band delivery mechanism of claim 17 and further including sensor means operatively connected with said feed roller structure to terminate operation thereof whenever a strip of band webbing withdrawn thereby from such supply roll reaches a predetermined location, said sensor means being adjustable so as to permit change of such predetermined location.

19. In banding apparatus adapted to wrap and secure a band about a bundle of compressed bag articles or the like to maintain the same in the compressed state for shipment and storage, a first flap-folder mechanism and a bundle-transfer mechanism spaced therefrom and together defining a first flap-folding station, said transfer mechanism comprising spaced-apart constraining members and being reciprocable between a bundle-receiving position in alignment with said first flap-folder mechanism and a bundle removal station remote therefrom, said first flap-folder mechanism being equipped with a reciprocable presser plate engageable with a compressed bundle located intermediate said folder and transfer mechanisms to displace such bundle into said transfer mechanism, drive structure connected with said presser plate for cyclically reciprocating the same to displace successive bundles into said transfer mechanism, drive means for reciprocably displacing said transfer mechanism between the aforesaid bundle-receiving and bundle removal positions, and second flap-folder mechanism at said bundle removal position.

20. The banding apparatus of claim 19 in which said bundle-transfer mechanism includes longitudinally spaced front and rear bundle-constraining assemblies adapted to receive such compressed bundle therebetween, and further comprising means for adjusting one of said constraining assemblies with respect to the other so as to change selectively the bundle-receiving space therebetween.

21. The banding apparatus of claim 20 in which the longitudinal extent of said presser plate actually engageable with such compressed bag bundle is somewhat less than the longitudinal spacing between said front and rear bundle-constraining assemblies, whereby the internal friction between contiguous articles in a compressed bundle thereof cooperates with said presser plate in the displacement of such bundle into said transfer mechanism.

22. The banding apparatus of claim 20 in which said front constraining assembly is equipped with adjustment means connecting the same with said bundle-transfer mechanism to adjustably position said front constraining assembly relative to said rear constraining assembly.

23. The banding apparatus of claim 22 in which said presser plate is provided with a plurality of transversely spaced longitudinal projections along the forward edge thereof and said front constraining assembly is provided with transversely spaced components adapted to pass said projections therethrough, and in which the rear edge of said presser plate lies forwardly of said rear constraining assembly so that the longitudinal extent of said presser plate actually engageable with such bag bundle is somewhat less than the longitudinal spacing between said front and rear bundle-constraining assemblies, whereby the internal friction between contiguous articles in a compressed bundle thereof cooperates with said presser plate in the displacement of such bundle into said transfer mechanism.

24. The banding apparatus of claim 19 and further comprising a glue assembly carried by said bundle-transfer mechanism and operative to deposit adhesive onto one of the flaps of a bundle-wrapping band during the reciprocable displacement of said bundle-transfer mechanism.

25. In bundle-forming apparatus having a conveyor equipped with longitudinally spaced flights and along which bundles of articles are advanced in longitudinally separated relation by the interposition of said flights therebetween, bundle-locator mechanism comprising a carriage reciprocable longitudinally along a section of said conveyor, finger structure supported by said carriage for reciprocable displacement relative thereto between a lower retracted position beneath such bundles being advanced along said conveyor and an upper extended position in the path of travel of such bundles, and drive mechanism for reciprocating said carriage and for displacing said finger structure in timed relation with said conveyor so as to insert said finger structure into the space defined between successive bundles by the presence of a flight thereat, said drive mechanism being operative to accelerate said carriage to a velocity exceeding the normal velocity of such bundles so as to compress the bundle forwardly of said finger structure and thereby increase the spacing defined between such forward bundle and adjacent flight so as to accommodate a compression plate; said longitudinally spaced flights being operative to advance such bundles along said conveyor, and said drive mechanism including drive structure connected with said carriage for reciprocating the same longitudinally along said conveyor section and further including separate drive structure connected with said finger structure for displacing the same between such lower retracted and upper extended positions thereof.

26. In banding apparatus in which bundles of bag articles or the like, compressed at a station generally adjacent the entrance to such apparatus, have bands wrapped and secured thereabout to maintain each bundle in a compressed state for shipment and storage, band-delivery mechanism comprising feed roller structure repetively operative to withdraw continuous strips of band webbing from a supply roll thereof and advance the webbing through such station for engagement by each such bundle compressed thereat, knife structure for severing such webbing into predetermined lengths each adequate to be secured about a bag bundle for constraining the same in its compressed state, and a control roller assembly intermediate said knife structure and compression station for controlling each severed length of band webbing as it extends through such station for engagement by a bag bundle thereat, said control roller assembly being characterized by enabling such severed length of band webbing controlled thereby to be displaced with such bundle from said compression station and into said banding apparatus; said band-delivery mechanism further including an adjustment assembly supporting said feed roller and knife structures for adjustable displacements thereof along the path of movement of such band webbing toward said control roller assembly so as to enable the extent of such predetermined web lengths to be changed, and further including sensor means operatively connected with said feed roller structure to terminate operation thereof whenever a strip of band webbing withdrawn thereby from such supply

roll reaches a predetermined location, said sensor means being adjustable so as to permit change of such predetermined location.

7. In banding apparatus adapted to wrap and secure a band about a bundle of compressed bag articles or the like to maintain the same in the compressed state for shipment and storage, a first flap-folder mechanism and a bundle-transfer mechanism spaced therefrom and together defining a first flap-folding station, said transfer mechanism being reciprocable between a bundle-receiving position in alignment with said first flap-folder mechanism and a bundle removal station remote therefrom, said first flap-folder mechanism being equipped with a reciprocable presser plate engageable with a compressed bundle located intermediate said folder and transfer mechanisms to displace such bundle into said transfer mechanism, drive structure connected with said presser plate for cyclically reciprocating the same to displace successive bundles into said transfer mechanism, drive means for reciprocably displacing said transfer mechanism between the aforesaid bundle-receiving and bundle removal positions, a glue assembly carried by said bundle-transfer mechanism and operative to deposit adhesive onto one of the flaps of a bundle-wrapping band during the reciprocable displacement of said transfer mechanism; said glue assembly being selectively movable between an inactive retracted position and an active extended position to deposit adhesive onto such band flap, and further comprising motor means connected with said glue assembly for displacing the same between such positions thereof in timed relation with the reciprocable displacement of said bundle-transfer mechanism between the bundle-receiving and bundle removal positions thereof.

28. In apparatus of the character described having a conveyor by which bundles of bag articles or the like are advanced in longitudinally separated relation toward banding apparatus, bundle removal mechanism for bodily carrying successive bundles from said conveyor into said banding apparatus including spaced-apart constraining members between which the bundle is positioned, means for feeding a banding web ahead of said bundle removal mechanism from a supply thereof, means for moving said bundle removal mechanism with a bundle held therein against a side of said web to cause said web to overlie the bottom, top and the leading end of the bundle, means for severing said web into predetermined lengths each providing a pair of flaps for overlying the trailing end of the bundle, a first flap-folder mechanism positioned at the opposite side of said web, a bundle-transfer mechanism spaced therefrom, said first flap-folder mechanism being operative to move the bundle into said transfer mechanism and fold one of said flaps over the trailing end of said bundle, a second flap-folder mechanism spaced from said first flap-folder mechanism, and means for moving the transfer mechanism from said first flap-folder mechanism to the second flap-folder mechanism, said second flap-folder mechanism being operative to fold the other of said flaps over the trailing end of said bundle.

29. The bundle forming apparatus of claim 28 in which mechanism is provided to accelerate movement of the trailing constraining member of said bundle removal mechanism to compress the bundle against the leading constraining member and thus compress the bundle.

30. The bundle-transfer mechanism of claim 28 further comprising a glue assembly carried by said bundle-transfer mechanism and operative to deposit adhesive onto one of said flaps.

31. In banding apparatus adapted to wrap and secure a band about a bundle of bag articles or the like, means for feeding a banding web from a supply roll thereof, bundle carrying mechanism for bodily moving a bundle in one general direction against a side of said web to cause said web to overlie the bottom, top and the leading end of the bundle, means for severing said web into predetermined lengths each providing a pair of flaps for overlying the trailing end of bundle, a first flap-folder mechanism positioned at the opposite side of said web and a bundle-transfer mechanism spaced therefrom and together defining a first flap-folding station at the opposite side of the web, said transfer mechanism being reciprocable between a bundle-receiving position in alignment with said first flap-folder mechanism and a bundle removal position spaced therefrom, said first flap-folder mechanism including a reciprocable presser plate engageable with a bundle to displace such bundle from said bundle carrying mechanism into said transfer mechanism for folding one of said flaps over said bundle end, drive structure connected with said presser plate for cyclically reciprocating the same to displace successive bundles into said transfer mechanism, drive means for reciprocably displacing said transfer mechanism between said bundle-receiving and bundle removal positions, and second flap-folder mechanism at said bundle removal position operative to fold the other of said flaps over the trailing end of the bundle.

32. The banding apparatus of claim 31 including a feed roller structure repetitively operative to advance said web, and a roller assembly between the web severing means and said bundle carrying mechanism for controlling the feeding of each severed length of web.

33. In bundle forming apparatus having a conveyor equipped with longitudinally spaced flights and by which bundles of articles are advanced in longitudinally separated relation by the interposition of said flights therebetween; compression-transfer mechanism operative to transfer bodily successive bundles from said conveyor into a banding apparatus and for compressing the same comprising a leading constraining structure and a trailing compression plate for receiving a bundle therebetween, drive mechanism operative to displace said compression plate toward said constraining structure to compress the bundle therebetween, drive mechanism for advancing the compressed bundle against a side of a banding web in said banding apparatus to cause said web to overlie the bottom, top and leading end of the bundle, and flap-folder mechanism at the opposite side of said web including a presser plate for displacing the compressed bundle with severed length of the web from between said constraining structure and said compression plate into a bundle transfer device.

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