

March 3, 1970

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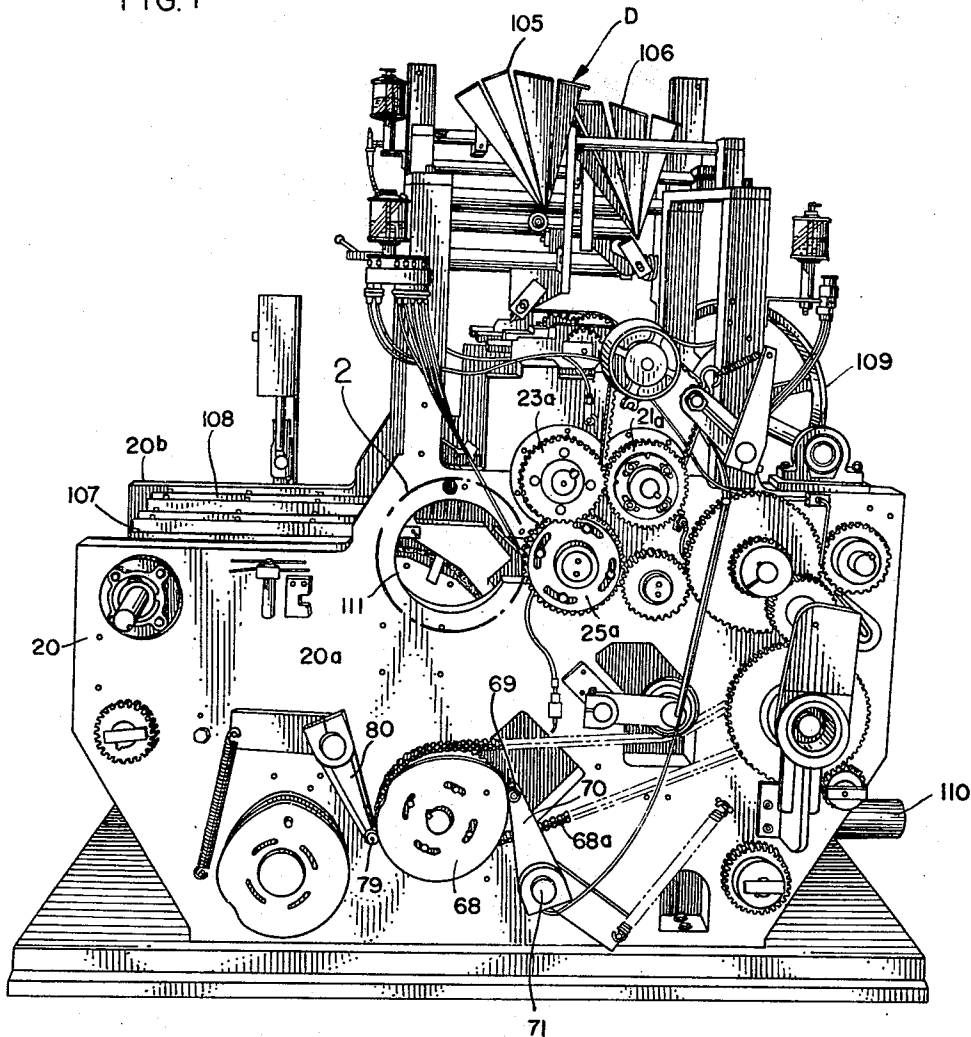
3,498,600

DELIVERY APPARATUS FOR WEB SEGMENTS TO BE STACKED

Filed Dec. 20, 1967

6 Sheets-Sheet 1

FIG. 1



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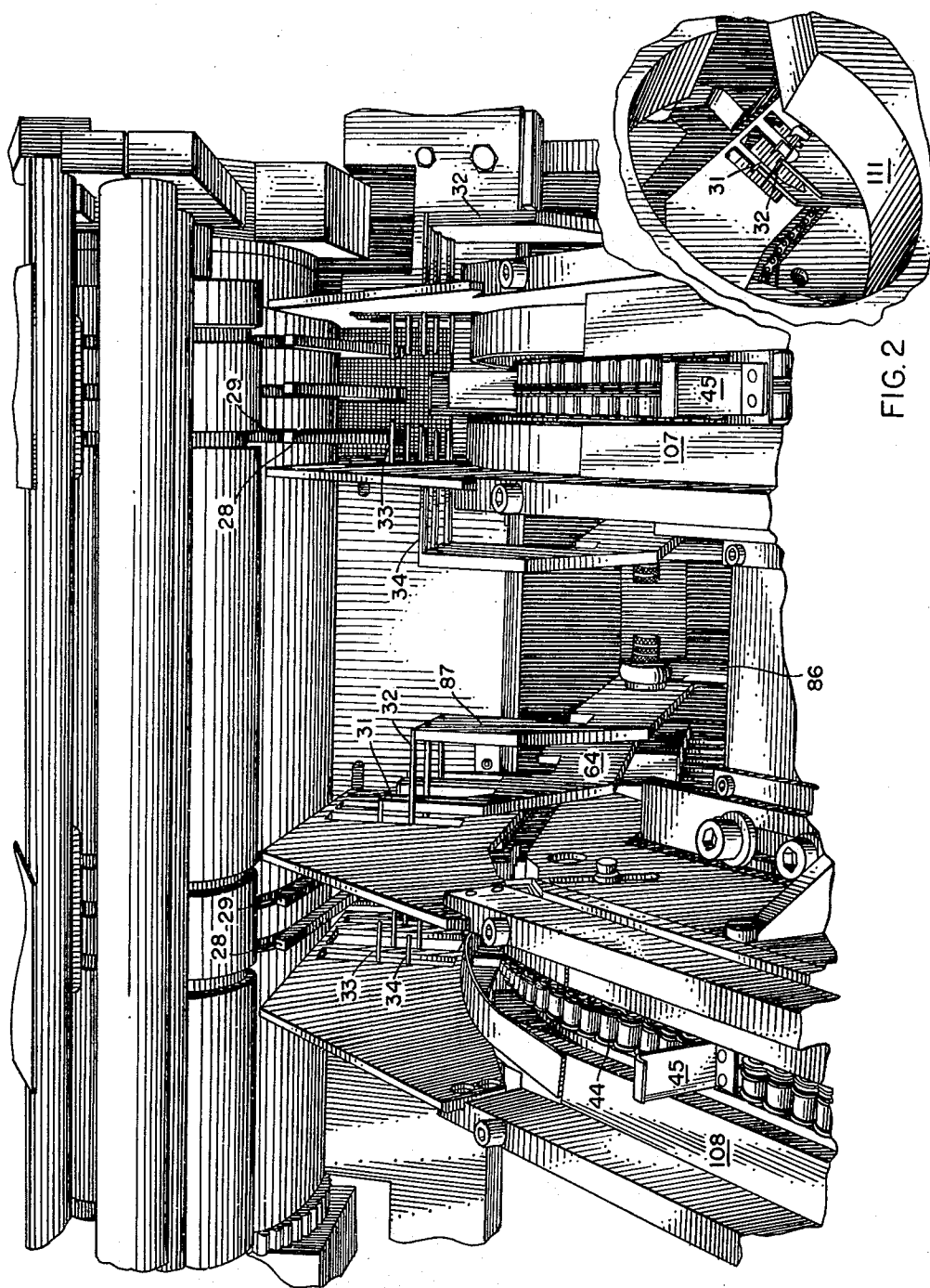


FIG. 3

FIG. 2

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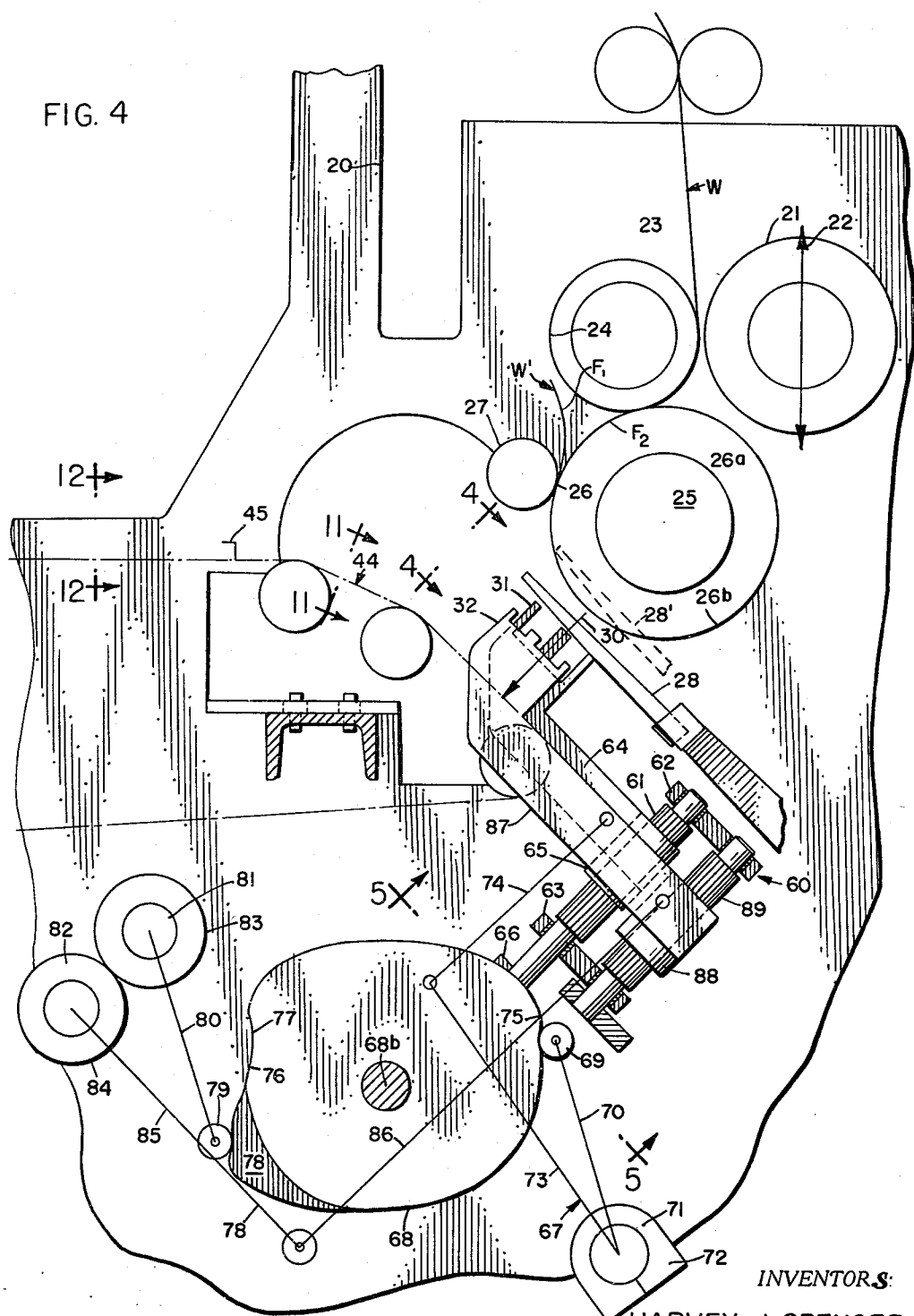
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DELIVERY APPARATUS FOR WEB SEGMENTS TO BE STACKED

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FIG. 4



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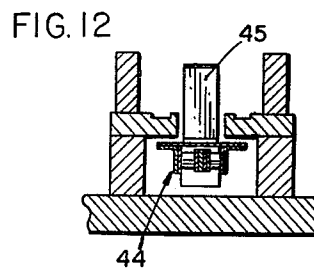
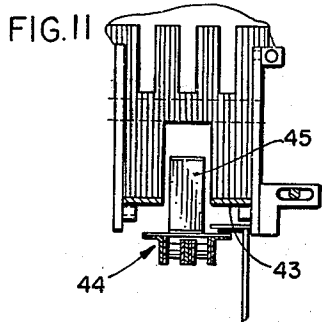
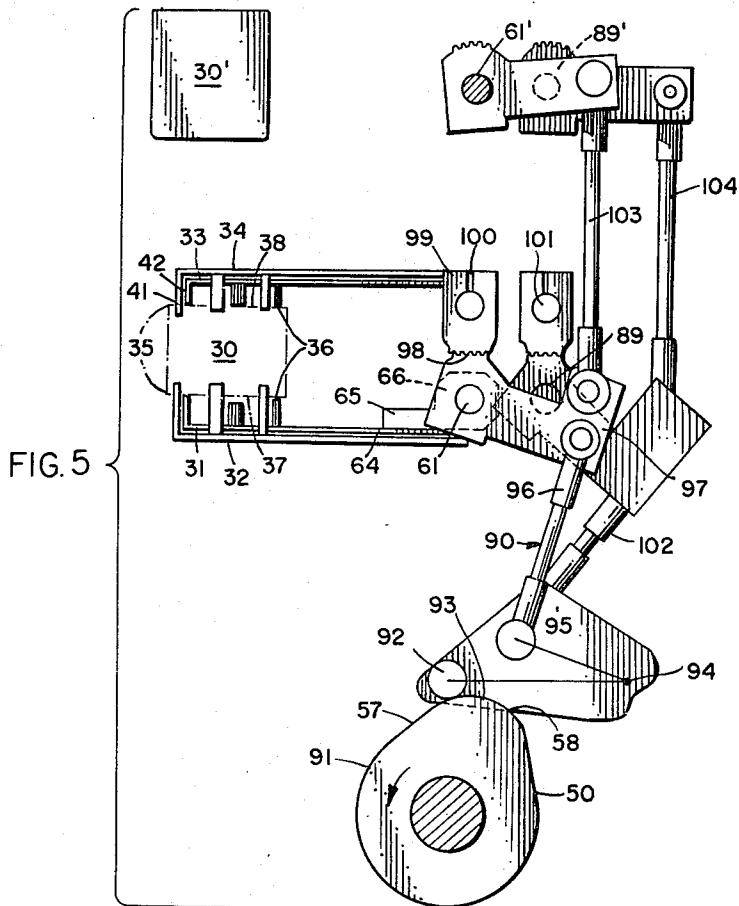
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FIG. 6

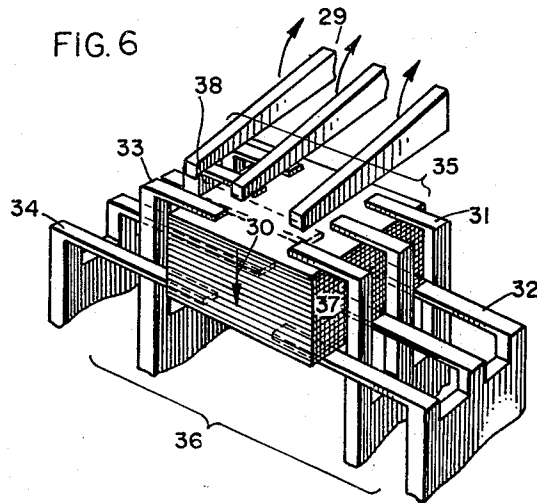


FIG. 7

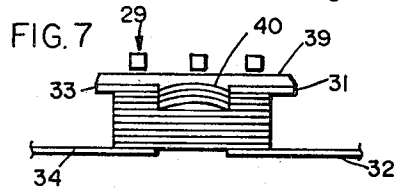


FIG. 8

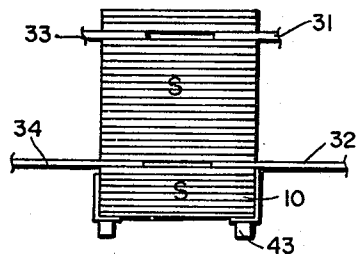


FIG. 9

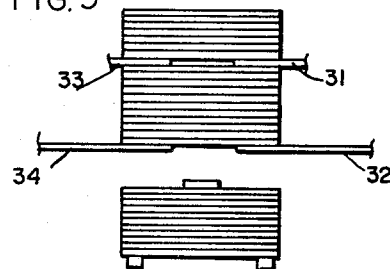
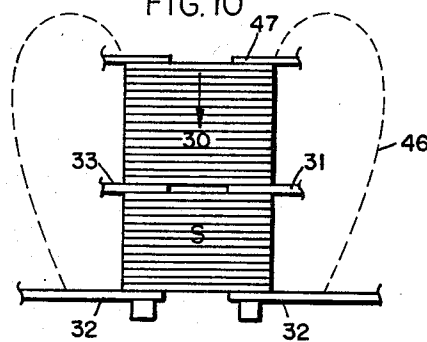


FIG. 10



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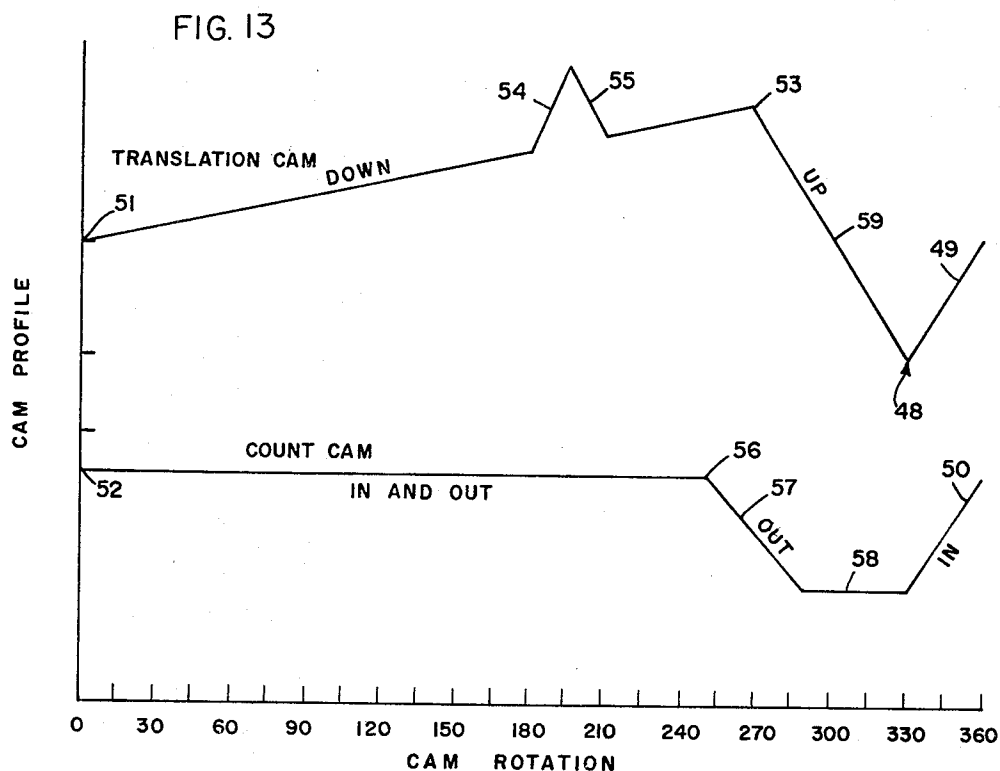
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DELIVERY APPARATUS FOR WEB SEGMENTS TO BE STACKED

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3,498,600

DELIVERY APPARATUS FOR WEB SEGMENTS TO BE STACKED

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Int. Cl. B65h 31/30, 31/34

U.S. Cl. 271—69

6 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for delivering stacks of web segments such as towels, tissues, paper handkerchiefs and the like wherein orbiting fingers provided in pairs beside a delivery pad operate to stabilize a stack of previously delivered web segments so as to present a receiving surface capable of high speed (greater than 500 feet per minute) operation.

SUMMARY OF INVENTION

This invention constitutes an improvement over that disclosed in Nystrand Patent No. 3,254,889. In that patent, orbiting fingers were used in conjunction with reciprocating fingers to receive individual web segments such as towels to stack the same and deliver the stacks for packaging. The orbiting fingers performed a counting function, i.e., separating the aligned webs into discrete stacks of pre-determined number. Prior to the machine of the aforementioned patent, this "counting" in the paper converting industry was done by hand-divider strips being inserted every so often in the flow of web material. The machine of the above mentioned patent was a definite improvement over the prior practice but has been found inadequate to separate webs into stacks at the high speeds required by the paper napkin and paper "hankie" producers.

A concurrent problem that existed in attempting to utilize the machine of the aforementioned patent in high-speed operations was that of developing uneven edges on the stacks. At least the initial layers of the stack tended to move laterally so that a nice, square (or rectangular) stack was unobtainable.

These drawbacks are avoided by the use of the machine of the instant invention and the provision of such a machine constitutes an important objective of this invention.

The invention is described in conjunction with the accompanying drawing in which—

FIG. 1 is a side elevational view of the inventive machine;

FIG. 2 is an enlargement of the encircled portion of FIG. 1;

FIG. 3 is a fragmentary perspective view of the inventive machine taken essentially from the left side of FIG. 1;

FIG. 4 is an elevational view of the machine viewed from just inside of one of the side frames so as to disclose the essential working parts;

FIG. 5 is a sectional view such as would be seen along the sight line 5—5 as applied to FIG. 4;

FIG. 6 is a fragmentary perspective view of the stacking portion of the machine and corresponds to a view taken along the lines 6—6 of FIG. 4;

FIGS. 7—10 are schematic views showing the operation of the various finger assemblies on stacks of web segments;

FIGS. 11 and 12 are sectional views taken along the sight lines 9—9 and 10—10 applied to FIG. 4 in the vicinity of the stack remover; and

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FIG. 13 is a graph plotting cam contour as a function of cam rotation—cams being employed to control the movement of the aforementioned finger assemblies in developing stacks.

In the illustration given and with particular reference to FIG. 1, the numeral 20 designates the frame of the machine which, in accordance with conventional practice, includes two relatively heavy side members as at 20a and 20b in FIG. 1. Usually provided as part of the machine frame is the apparatus for delivering the webbed segments into the stacking station or area. The forming and delivery mechanism need not be that illustrated here and may take a variety of forms. In certain aspects it is described in greater detail in the aforementioned Patent No. 3,254,889. The superstructure designated D in FIG. 1 shows this generally.

WEB DELIVERY MECHANISM

The web in FIG. 4 is designated by the symbol W and is seen to pass between a cutoff roll 21 equipped with knives 22 and operating against an anvil roll 23. Both of these rolls are advantageously rotatably supported on the frame 20 and driven by gears 21a and 23a, respectively (see FIG. 1). The cutoff roll 21 illustrated here is a "two-time" roll and operates to transversely sever the web W at discrete intervals. In addition to providing an anvil surface, the roll 23 also has a web-adhering function through the use of internal vacuum. Thus, the leading edge of the web W is caused to follow the surface of the roll 23 to the point designated 24 in FIG. 4.

In the configuration of elements given in FIG. 4, the web W has followed the periphery of roll 23 only part way to the point 24. A previous web segment W' has been removed from the roll 23 under the influence of a folding roll 25. The folding roll 25 has vacuum ports at the points designated 26, 26a, 26b and operates to remove a middle portion (i.e., half-way along its length) of a web segment from the roll 23. This develops folds F₁ and F₂ in the segment W'. The web W advantageously may be longitudinally folded (as by the mechanism D) so as to provide a stack of "double folded" hankies, napkins, etc.

The segment W' then passes between the surface of the roll 25 and that of an ironing roll 27 so that a transversely folded web segment is delivered by orbiting packer fingers 28 to the stack defining station. As can be best seen in FIG. 3, the packer fingers 28 operate to strip segments from the roll 25 by moving into annular grooves 29 thereof—before the segments W' reach that portion of the roll 25. This stripping position is seen in dotted line in FIG. 4 and is designated 28'.

Web segments (folded or otherwise depending upon the type of delivery means) follow a path generally designated 30 and which also is seen in FIGS. 3 and 5. In FIG. 5, a second path is designated 30' and will be appreciated that as many side by side paths can be utilized as is convenient in an installation. For example, the path 30 would be that associated with the righthand set of fingers and grooves 28 and 29 in FIG. 2 while the path 30' with the lefthand set. The stack defining means provided herein are essentially the same in each path.

The path 30, as seen in FIG. 4, is arranged at about 45° from the vertical. However, for the sake of ease of description, it will be described as being a generally downward path, but those skilled in the art can appreciate that the path may have many other directions than that shown and described.

FINGER ASSEMBLIES

In the illustration given, we employ four finger assemblies 31, 32, 33 and 34 to effect the definition of each stack of web segments. These assemblies are seen in frag-

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mentary perspective form in FIG. 6 and it will be seen that assemblies 31 and 33 form one set 35 while the other assemblies 32 and 34 form a second set 36. The assemblies 31 and 33 (also designated in FIG. 5) are commonly actuated and are generally aligned in a direction transverse of the length of the path 30. The same applies to the other set 36 consisting of the assemblies 32 and 34. The assemblies are arranged in pairs on opposite sides of the path 30, assemblies 31 and 32 being on the side 37 while the assemblies 33 and 34 are on the side 38. The finger assembly arrangement also can be readily appreciated from a consideration of FIGS. 2 and 3.

By providing the finger assemblies as shown, an especially advantageous operation such as is depicted in FIG. 7 can be achieved. The showing in FIG. 7 is schematic and occurs a short time after the configuration of elements seen in FIG. 6. In FIG. 6, the packer finger mechanism is seen to be moving upwardly after the assemblies 31 and 33 have begun to clamp a completed stack against the assemblies 32 and 34. A short time later the packer mechanism is delivering a subsequent segment 39 (see FIG. 7) against the upper segment 40 of the just completed stack. By virtue of the geometry of these finger assemblies that extend only partially inwardly over a minor portion of the stack in the path 30, there is provided a substantial central portion which is uncompressed or uncompacted and which tends to bulge upwardly. This provides an excellent frictional engagement surface for the receipt of the subsequent segment 39 and anchors the same notwithstanding the wiping action of the packer mechanism 29 in withdrawing for another deposit. As can be seen from FIGS. 3-5, the actual fingers of the two sets of assemblies are offset or interleaved (as at 41 and 42 in FIG. 5) so as to permit the fingers to move more vertically past each other.

As more and more segments are deposited on the aligned finger assemblies 31 and 33, we reach the configuration of stacks illustrated in FIG. 8. There, a preceding stack S' is seen to be resting on rails 43 (see also FIG. 11). Shortly thereafter, the bottom-most stack S' will be engaged by the stack remover generally designated 44 and which includes an upstanding L-shaped clip 45 (see also the central lefthand portion of FIG. 4). Before this engagement occurs, we prefer to have the lower-most stack S' compacted in the fashion seen in FIG. 8. Comparison of FIGS. 7 and 8 shows that the stack of say ten hankies confined between the upper set of finger assemblies 31 and 33 and the lower set of finger assemblies 32 and 34 is compacted in FIG. 7 but is not so compacted in FIG. 8. Rather, in FIG. 8, the lower finger assemblies operate against the outlet guide rails 43 to compress the stack S'. Thereafter, the elements move into the configuration seen in FIG. 9 where the stack S' is now being removed from the path 30 by means of the clip 45, the lower set of finger assemblies 32 and 34 having been moved upwardly so as to again compress the following stack S. Thus, there is a short retrograde movement of each set of finger assemblies as they approach the bottom of the path. Following the retrograde movement indicated in FIG. 9 and the removal of the stack S', the lower set of finger assemblies 32 and 34 move downwardly and then outwardly and upwardly in a generally orbital movement such as is designated 46 in FIG. 10, finally re-entering the path 30 as at 47 after the requisite number of segments has been introduced—in the illustration given, ten.

The orbital movement of the finger assemblies can also be appreciated from a consideration of FIG. 13. In FIG. 13, the upper curve represents a projected profile of the cam employed to develop the movement of the finger assemblies in the direction of the path. As mentioned previously, for the sake of convenience, this can be considered "up" and "down." The "down" movement can be considered in the direction of the path of web segment movement while the "up" movement can be considered against the flow of web segments. The lower curve

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in FIG. 13 represents the contour of a second cam which is responsible for the movement of the assemblies transverse to the direction of the path 30. In other words, after the finger assemblies reach the bottom of that portion of their orbit which is in the path 30, they must move laterally outwardly from the path before moving upwardly to enter the path in the movement indicated schematically at 47 in FIG. 10.

An orbit or cycle can be considered to start at the point generally designated 48 in FIG. 13 where a given set of finger assemblies is at the very top of its orbit. From that point there is a movement downward designated 49 and a corresponding inward movement (so labeled) and indicated by the numeral 50 applied to the lower curve. At this juncture, the given finger assembly set is ready to receive subsequent web segments and support the same for the formation of a stack. The initial web segment is deposited at a time corresponding to the extreme lefthand portion of FIG. 13 and designated 51 relative to the upper curve and 52 relative to the lower curve.

From a consideration of the upper curve, it will be noted that three-quarters of the time of an orbit or "cycle" is utilized in the "downward" movement, the reversal occurring at a point 53 which corresponds to 270° of cam rotation. Prior to that time, however, there is the accelerated downward movement of the finger assemblies of the character depicted in FIG. 8. This is illustrated in FIG. 13 at 54 with the subsequent return of the finger assemblies to again support the stack S (see FIG. 9) being indicated at 55 in FIG. 13. Thereafter, the finger assemblies 32 and 34 (as shown in FIG. 10) continue downwardly but at a point corresponding to about 250° of cam rotation, the fingers are withdrawn from the path as indicated by the lower curve commencing at the point designated 56. Thus, by the time the upward movement is commenced (see point 53), the finger assemblies are out of the path, being at a point corresponding to that designated 57 in FIG. 13. At these points (53 and 57) the stack removal operation has been completed, as by the clip 45 having moved the stack S' completely out of the path 30. From the portions designated 58 and 59, it will be seen that the return or upward movement of the finger assemblies occupies only a minor portion of the cycle.

ORBITING MEANS

The means for orbiting the finger assemblies is generally designated 60 and includes the mechanism shown essentially in the lower portion of FIG. 4, particularly the splined shaft 61 at the righthand central portion of FIG. 4—this being selected as exemplary for ease of description. The splined shaft 61 provides the means for guiding the orbital movement of the finger assembly 31. It will be understood that in the illustration given, a splined shaft will be provided for each of the four finger assemblies 31-34. However, in connection with the shaft 31, it will be noted that it is rotatably supported on the frame 20 by means of bearings 62 and 63. The splined shaft 61 is inclined at 45° to the vertical, thus paralleling the direction of the path 30. The finger assembly 31 is provided as part of an arm 64 (see also FIG. 3) extending at right angles to the length of the splined shaft 61 and is slidably mounted on the shaft 61 by means of a block 65 (see the central portion of FIG. 5). Still referring to FIG. 5, it is seen that the shaft 61 is provided with a gear segment 66 which is fixed or pinned thereto. This is responsible for the horizontal component of the orbital motion and the actuating mechanism therefore will be described in detail hereinafter.

Returning now to the means for achieving the vertical component of the orbiting of the finger assemblies, the numeral 67 (seen only in the lower righthand portion of FIG. 4) designates generally a linkage system for this vertical component. It includes a cam 68, the contour of which is seen in projected form in the upper curve in FIG. 13. It will be appreciated that the cam 68 is rotatably

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mounted on the frame and is powered by belt 68a (FIG. 1). Usually in machines of this nature, a single, high-powered motor is used with interconnecting gears, gear reducers, etc. and many of these have been omitted as being conventional expedients. Riding against the periphery of the cam 68 is a cam follower 69 mounted on an arm 70. The cam follower arm 70 is shown in FIG. 4 only as a line, i.e., in schematic form so it is not to obscure with unnecessary detail the remaining portion of the drawing. The cam follower arm 70 is fixed to a transverse pivot or rocker shaft 71 mounted in suitable pillow blocks 72 provided as part of the frame 20. Also fixed or pinned to the pivot shaft 71 is a pivot or rocker arm 73 (shown schematically in FIG. 4). Pivotedly interconnected between the arm 64 and the end of the rocker arm 73 is a linkage 74 (still referring to FIG. 4). Thus, as the cam follower 69 follows the contour of the cam 68, the rocker shaft oscillates and conveys the same motion to the finger assembly arm 64. This oscillation includes, for example, the portion of the upper curve in FIG. 13 designated 49 where the finger assembly is moving downwardly and inwardly to the position designated 47 in FIG. 10. The particular portion of the cam contour which serves as an actuator or velocity control for this phase of the operation is designated 75. Reference has also been made to the fact that the finger assembly moves rapidly downwardly to compress a stack about to be taken out of the path 30 (as at S' in FIG. 8) and thereafter the finger assembly moves back into supportive relationship with the succeeding stack S. This is reflected in the upper curve on FIG. 13 at 54 and 55. The corresponding cam contour for this purpose is designated 76 and 77 in FIG. 4.

A second cam 78 for the other set 36 of finger assemblies is designated 78 in FIG. 4. It will be appreciated that the cam 68 through the cam follower 69 and rocker shaft 71 is responsible for the up and down movement of both of the finger assemblies 31 and 33 constituting the first set 35. A linkage assembly including arms like those designated 73 and 74 is provided for the finger assembly 33. The means for moving the other set 36 of finger assemblies 32 and 34 includes a cam follower 79 (still referring to the bottom of FIG. 4) cam follower arm 80 and first rocker shaft 81, suitably journaled in the frame 20. In the illustration given, a second rocker shaft is provided at 82 and is responsive to the oscillation of rocker shaft 81 by virtue of interconnecting gears 83 and 84—this being provided to reverse the movement of the cam follower 79 inasmuch as the same is provided on the opposite side of the cam shaft 68b from the cam follower 69, it being appreciated that all of the finger assemblies follow the same orbit. This output of the rocker shaft 82 is transmitted through a rocker arm 85 and linkage 86 to the arm 87 (see also FIG. 3) associated with the finger assembly 32. As before, the arm 87 is fixed to a block 88 which is slideably mounted on a splined shaft 89.

What we have thus far described is the means for moving the fingers 31 and 32 up and down. An identical mechanism is used for moving the fingers 33 and 34 up and down—the splined shafts for this latter portion being designated 100 and 101 in FIG. 5. These will be described in connection with means for developing horizontal movement of the fingers.

MEANS FOR ACHIEVING HORIZONTAL COMPONENT OF ORBITAL MOTION

To achieve the "in and out" movement of the finger assemblies, we employ a cam and linkage system generally designated 90 in FIG. 5. The control for this movement is provided in the form of a cam 91. A cam follower 92 is positioned for movement in accordance with the contour of the cam 91 and is rotatably mounted on a cam follower arm 93 (again schematically represented). The cam follower arm 93 is fixed to a rocker or cross-shaft 94 as is a rocker arm 95. The other end of the rocker arm 95 is pivotedly connected to a link 96 which in turn is pivot-

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edly connected to a block 97. The block 97 has at one end a gear segment 98 and is fixed to the splined shaft 61. Thus, as the rocker shaft 94 oscillates or rotates, so also does the splined shaft 61. The gear segment 98 is employed to deliver the same movement to a second gear segment 99 mounted on the splined shaft 100. The splined shaft 100 is associated with the finger assembly 33 constituting the mate of the finger assembly 31 in making up the set 35. Thus, as the finger assembly 31 moves out, so also does the finger assembly 33. Both of these finger assemblies 31 and 33 operate from the cam 91. A second cam (not shown) is mounted coaxially with the cam 91 and is employed for imparting the in and out movement to the finger assemblies 32 and 34 by virtue of a suitable connection with the splined shaft 89 and 101. We also provide extensions from these two linkage systems (90 for the set 35 and 102 for the set 36) in the form of linkages 103 and 104. These operate to pivot additional splined shafts as at 61' and 89' associated with a parallel path 30'. Thus, it will be seen that any number of stacking paths can be provided, depending upon the width limitations of the machine.

OPERATION

The machine illustrated in the drawing is intended for delivering two streams of stacked paper handkerchiefs. For this purpose, two separate folding devices are provided at the very top portion of the showing in FIG. 1 as at 105 and 106 for the paths 30 and 30', respectively. As webs (not shown) pass over the folding devices 105 and 106, the webs are longitudinally folded for ultimate delivery through troughs 107 and 108, respectively at the left center portion of FIG. 1. These troughs or ways are also identified in FIG. 3.

The webs W are folded transversely in the fashion indicated in FIG. 4 in the central portion thereof where the fold portions are designated by the symbols F₁ and F₂. This is achieved through the cooperation of the folding roll 25 and the ironing roll 27. The folding roll 25 is equipped with a gear 25a (see FIG. 1) which, like the other gears pictured, derives rotational power through a series of gears, ultimately, in the illustration given, from a drive pulley 109 on the rear side of the machine and pictured in the upper righthand portion of FIG. 1. The folding roll 25 is equipped with the previously referred to vacuum grooves 29 (see particularly FIG. 3) which are coupled to a vacuum pump by means of a manifold 110 (see the lower righthand side of FIG. 1). The frames 20a and 20b are cut out as at 111 (see the central portion of FIG. 1) for the ready removal of the folding roll 25. This cut out 111 provides the basis for the showing of the interior workings in FIG. 2. It will be appreciated that the finger assemblies 31 and 32 alternate in moving downwardly so as to define stacks. As the finger assembly 32 reaches the nadir of its orbit, it is moved laterally outwardly from engagement with the stack, i.e., out of the paper and then upwardly to a position above the finger assembly 31. When the fingers 31 and 32 are arranged as illustrated, we offset or interleave them as shown for readily passing one another.

The fingers 32 in the operation depicted in FIG. 2 are withdrawn from supporting relation with a given stack of webs only after the clip 45 attached to the stack remover chain 44 has removed a completed stack.

While in the foregoing specification a detailed description of an embodiment of the invention has been set down for the purpose of illustration, many variations of the details hereingiven may be made by those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. In delivery apparatus for web segments to be stacked which include a frame (20), a packer mechanism (29) on said frame for delivering said segments sequentially into one end of a predetermined path (36), a stack re-

mover (44) on said frame for removing stacks of said segments from the other end of said path in the direction generally perpendicular to said path, an improved stack defining mechanism characterized by the fact that it includes:

four finger assemblies (31, 32, 33, and 34) on said frame disposed in a pair (31-32 and 33-34) on each of two opposite sides (37, 38) of said path, each assembly of a given pair being aligned with one assembly of the other pair to provide two sets (35, 36) of finger assemblies,

said finger assemblies being sized to extend over a minor edge portion of a given segment (39) in said path so as to present a substantial central portion of said given segment for frictional engagement with a subsequent segment (40) moving into said path, and

means (60) operably associated with said finger assemblies sets for sequentially orbiting said sets with a portion of each orbit being in said path, and including a retrograde movement said means being arranged and constructed to limit the movement of said finger assemblies toward each other so as to necessarily present said substantial central portion.

2. In delivery apparatus for web segments to be stacked which includes a frame (20), a packer mechanism (29) on said frame for delivering said segments sequentially into one end of a predetermined path (30), a stack remover (44) on said frame for removing stacks of said segments from the other end of said path in the direction generally perpendicular to said path, an improved stack defining mechanism characterized by the fact that it includes:

four finger assemblies (31, 32, 33 and 34) on said frame disposed in a pair (31-32 and 33-34) on each of two opposite sides (37, 38) of said path, each assembly of a given pair being aligned with one assembly of the other pair to provide two sets (35, 36) of finger assemblies,

said finger assemblies being sized to extend over a minor edge portion of a given segment (39) in said path so as to present a substantial central portion of said given segment for frictional engagement with a subsequent segment (40) moving into said path, and

means (60) operably associated with said finger as-

semblies sets for sequentially orbiting said sets with a portion of each orbit being in said path, said means including an actuator (75) to position a set commencing said orbit portion in compacting relation with a stack supported on the other set whereby said central portion is caused to upstand relative to said commencing set finger assemblies during at least the initial build up of a succeeding stack.

3. The apparatus of claim 2 in which said means includes a second actuator (76) for accelerating the movement of each set shortly prior to the end of its movement in said orbit portion to compact a preceding stack just prior to engagement of said preceding stack with said stack remover.

4. The apparatus of claim 3 in which said means includes a third actuator (77) for reversing the movement of each set for a predetermined time immediately following the compaction of said preceding stack whereby the stack following said preceding stack is supported free of engagement of said stack remover, said stack remover being arranged and constructed to engage said preceding stack only after the beginning of the reverse movement.

5. The apparatus of claim 1 in which each finger assembly includes a plurality of finger parts projecting into said path, the finger parts of one assembly of a given pair being offset (41, 42) from the finger parts of the other assembly of said given pair whereby said parts are adapted to pass each other during sequential orbiting thereof.

6. The structure of claim 1 in which said means includes four splined shafts (61, 89, 100, 101) rotatably mounted on said frame, finger-assembly carrying arms (64, 87) movably mounted on said shafts (61, 89) means interconnecting pairs of said shafts for cooperative action in rotating the same, and gear means coupled to said arms and cooperative rotating means for orbiting said finger assemblies.

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RICHARD E. AEGERTER, Primary Examiner

U.S. Cl. X.R.

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