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(54) **Apparatus and method for stacking.**

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PATENT ABSTRACTS OF JAPAN vol. 9, no. 231 (M-414)(1954) 18 September 1985; JP-A-60 087161 (TOSHIBA) 20 October 1983.

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Description

This invention relates to an apparatus and method for stacking and, more particularly, to relatively flexible products such as paper towels and the like.

In the production of converted paper products (and other products as well), it is frequently desirable to package the product in stacks. For example, C-folded paper towels are frequently sold in packs of 200 towels (stacked). This is a somewhat higher count than that utilized 25 years ago (see co-owned Patent 3,254,889) but the problems are the same. It is always a matter of developing square stacks of exact count at high speed.

The towels, for example, are formed continuously by slitting a wide web into five or six narrow strips of web and then longitudinally folding each strip by passing them over folding boards. These folded strips are then routed to travel combined into a ribbon of stacked strips. The ribbon is cut into towel lengths (about 10") and these substacks of towels are called clips. Apparatus showing this general arrangement can be seen in co-owned British Patent 2,028,774.

Final, salable stacks are formed then by stacking a fixed number of clips to yield the package quantity of towels. The final stacking operation is frequently the speed limiting part of the process and requires complicated mechanical assemblies to run at production speeds. The object of this invention is to simplify the final stacking operation while maintaining or increasing the potential speed of the production line. A further object is to provide ease of stack count changes and flexibility for culling off-specification products.

In the illustrated embodiment of the invention, slotted wheel means is employed in conjunction with endless chain conveyors in the general arrangement seen in our earlier, co-owned Patent 4,736,936. In the illustrated embodiment of the invention, the endless conveyors are equipped with diving fingers -- with the fingers on one conveyor being spaced orbitally from the fingers of the other conveyor so as to develop alternate stacks.

The invention is described in conjunction with the illustrative embodiment in the accompanying drawing, in which --

FIG. 1 is a fragmentary side elevational view of apparatus for practicing the invention;

FIG. 2 is a front elevational view of the apparatus of FIG. 1;

FIG. 3 is a graph relating the finger position to time, i.e., product count; and

FIGS. 4 and 5 are graphs relating finger assembly velocity to product count.

DETAILED DESCRIPTION:

In the illustration given and with reference first to FIG. 1, the numeral 10 designates the machine frame. In accordance with the usual practice in machines for converting paper product, the frame includes a pair of spaced apart side frames such as are clearly seen at the lower right hand portion of FIG. 2. The side frames are suitably connected to provide a rigid support for the various moving elements, the structure and function of which can be most readily understood by considering the general operation of the apparatus.

OPERATION GENERALLY:

Individual product clips 11 are carried by a belt conveyor 12 and inserted into individual slots in a slotted wheel 13 rotating in the direction of product travel but slowing the product velocity by a factor of from 1/3 to 1/5 of entrance velocity. Other means such as seen in Patent 4,736,936 may be used for advancing and introducing the product into the slotted wheel.

The slotted wheel 13 carries the products 11 around until they impact on stripper fingers 14 which are fixed relative to the frame 10. By this means, the product is stripped out of the slotted wheel 13 and stacked in a continuous manner on top of each other.

To accomplish separation of the continuously formed substacks or clips 11 into a completed stack 15 (a partial stack is designated 15A in the upper right hand portion of FIG. 1), sets of count finger assemblies 16, 17 and 18, 19 are mounted on multiple parallel continuous chain conveyors 20, 21 respectively. As can be appreciated from a consideration of the right hand portion of FIG. 2, the chains of conveyor 20 are the two outboard ones while the inboard chains constitute the chain conveyor 21.

These chains are mounted on upper and lower sprockets and travel in a generally vertical manner. Each chain set 20, 21 with its associated count fingers 16, 17 and 18, 19 is independently driven. For example, chain set 20 is driven at 22 (clearly seen in the upper central portion of FIG. 1) and idles at the lower position 23. On the other hand, set 21 is driven at 23 and idles at 22.

The upper sprocket is sized and located and the count finger shaped such that in combination, they form the insertion path 24 (see the upper right hand portion of FIG. 1) for the top of the count finger (shown in dashed line and designated 16′) to pass between adjacent product clips 11, thus separating the products into individual stacks 15, 15A, etc.

When separation is completed (fingers 16′ fully inserted), chain 20 is decelerated to a slower speed for stack building at the specific product bulk. On the other hand, chain 21 with the operative count finger 18 supporting a now completed stack accelerates down to a position in alignment with stack removal

means 25, drops off the stack 15 at the stack removal platform 26, decelerates and adjusts speed in preparation for insertion of count finger 19 between stacks. This process then repeats itself with subsequent insertion of finger assemblies 19, then 17, then 18 and back to 16.

As soon as each completed stack 15 reaches the platform 26, a conveyor paddle 27 provided as part of the means 25 removes that stack for packaging.

Detailed Description of Chain Conveyor

Chain conveyor 20 includes endless chains 28, 29 (see the upper central portion of FIG. 2). These chains are entrained over upper driven sprockets 30, 31 which rotate about the axis 22 and are also entrained over lower idler sprockets 32, 33 which rotate about the axis 23. Additionally, these chains are entrained about tensioning sprockets 34 -- see the central right hand portion of FIG. 1.

Mounted on the chains 28, 29 are finger assemblies 16, 17 via bars as at 35 seen relative to the fingers 16 in the upper central portion of FIG. 1. The chains 28, 29 are driven about the axis 22 by means of a programmable servo motor 36 operating through a right angled gear reducer 37 (shown schematically) or, alternatively, a cam box in the position of reducer 37.

The chain conveyor 21 is similiarly arranged and operated except that it is 180° out of phase to chain conveyor 20. This is because there are two chain conveyors employed. For ease of layout and construction, the chain conveyor 21 is driven about the axis 23 by a programmable servo motor or cam box 38 and right angle gear reducer 39 (see the lower portion of FIG. 1) -- and idled about the axis 22.

Detailed Description of Program of Operation

Referring to FIG. 3 there are four stepped lines designated 16, 18, 17, 19 which represent the positions of the finger assemblies 16-19 through five cycles of stacked development. For ease of presentation, the curves correspond to a 30 count stack.

Focusing on line 16, the point 40 at the extreme upper left hand portion of FIG. 3 represents the start of the diving function illustrated at 16′ in FIG. 1. This is also designated 40 in FIG. 4 which shows the speed of fingers 16 as a function of time. It will be appreciated that the finger assembly 16′ when traveling around the axis 22 moves at relatively high speed for the diving function. Additional details on this can be seen in co-owned Patent 4,285,621.

Still referring to FIG. 4, there is a rapid deceleration at 41 which is illustrated by the segment 41 in FIG. 3. The next mode of operation for finger 16 is the stacking function at which time the finger 16 is lowered gradually as illustrated by the segment 42 in FIG. 3. This occurs at a constant, lower speed also designated 42 in FIG. 4.

After a stack is completed, the finger 16, rapidly accelerates as indicated by the segment 43 in FIGS. 3 and 4 -- which is approximated by the point 43 in FIG. 3. When reaching the higher speed indicated at 44 in FIG. 4, the finger 16 continues downward as indicated also at 44 in FIG. 3.

During this downward movement, the finger assembly 16 passes through the platform 26 which results in shifting the stack 15 from the finger assembly 16 to the platform 26 for removal by one of the conveyor paddles 27. The conveyor paddles 27 are part of the stack removal means 25 which is powered by motor means 45 seen at the extreme lower left hand portion of FIG. 2. Many variations in the stack removal can be utilized inasmuch as the stack is now complete and free of control of the chain conveyor.

It will be appreciated that the velocity profile of finger assembly 17 -- as a function of time or product count is identical to that of finger assembly 16. On the other hand, finger assemblies 15 and 19 have a velocity profile as seen in FIG. 5 which is shifted relative to the showing in FIG. 4.

Returning to a consideration of finger assembly 16, when the stack is completed, this assembly moves upwardly in the non-stacking portion of its orbit -- as illustrated in the left hand portion of FIG. 1. There it travels about the tensioning sprockets 34. During this time the other finger assemblies 19, 17 and 18 follow the same sequence in developing stacks of product. In other words, each cycle of stack production represents one-half the orbit of a given conveyor chains. And the second conveyor chain is 180° out of phase with the first conveyor chain. Also, it will be appreciated from FIG. 4 that while the finger assembly 16 is not operating on product, it still follows the same deceleration-acceleration sequence because its supporting chain is governed by the driven sprockets 30, 31 which at this time is driving the finger assembly 17 through the stacking mode.

Summary of Operation

In the practice of the invention utilizing the embodiment of the apparatus illustrated in the drawing, spaced apart products 11 are advanced along a first path defined by a belt conveyor 12. Although the description given hereinbefore is directed to C-fold towel production, it is possible to utilize the inventive apparatus and method for a variety of products. With changes for example in the slotted wheel and chain geometrys combined with timing changes for the programmable servo drive (or cam drive) many other products can be stacked utilizing the invention.

As the products 11 are advanced, they encounter sequentially a slotted wheel 13 which is mounted on the frame 10 for rotation. Thus, the slotted wheel is

effectively in the first path and receives product adjacent to the zenith of the second generally arcuate path of travel developed by the slotted wheel. From a consideration of the upper portion of FIG. 1, it will be seen that the slotted wheel rotates clockwise and conveys the product sequentially along a path from about 1 o'clock to about 5 o'clock.

At the 5 o'clock position which is adjacent the nadir of the arcuate second path, the products sequentially encounter strippers 14 which remove the product sequentially for delivery into a third path defined by the vertical downward run of a pair of chain conveyors 20, 21.

The arrangement of the chain conveyors relative to each other can be appreciated best from the right hand portion of FIG. 2 where the numeral 20 refers to the two outboard chains while the numeral 21 refers to the two inboard chains.

Still referring to FIG. 2, it will be seen that the outboard chains are entrained about sprockets 30 and 31 at their upper reach and these are driven in the illustration given by means of a servo motor 36 and right angled gear box 37. The lower reach of the chains making up the conveyor 20 is defined by sprockets 32 and 33 which are idler or free running sprockets. For ease of construction, the chains making up the inboard conveyor 21 are driven at the bottom and idled at the top. It can be appreciated that the driving means 38, 39 is positioned in the lower right hand portion of FIG. 2.

Each chain of each conveyor is equipped with at least one outwardly projecting finger. In the illustrated embodiment the chains of conveyor 20 are equipped with the fingers 16 and 17 seen in the right central portion of FIG. 1. Each finger is part of a supporting bar 35 (referring to the fingers 16) which is rigidly attached to its associated chain.

The chains of conveyor 21 are also equipped with outwardly projecting fingers as at 18 and 19 and it will be seen from a consideration of FIG. 1 that these fingers are arranged in longitudinally interlaced relation to the fingers of the conveyor 20.

While one conveyor is accumulating product of a stack, the other conveyor is rapidly moving a previously completed stack out of the way of the developing stack for deposit on a platform 26. This is positioned adjacent the nadir of the generally obround third path. The platform 26 is slotted so that the four pairs of fingers can pass therethrough incident to return to stack defining position. From this, it will be seen that rapid stack buildup and removal is achieved by a pair of conveyors both having the same chain path. In effect, the fingers of one conveyor perform the diving, supporting and positioning for removal functions while the fingers of the other chain perform the same sequence of functions but are 180° out of phase.

An advantageous feature of the invention is the programming of movement and velocity of the fingers during a traverse around the obround third path. Each finger first serves as a diving finger -- see the dashed line showing designated 16′ in the upper right hand portion of FIG. 1 -- for defining the end of a previous stack and the commencement of a developing stack. This is illustrated graphically at the point 40 in FIGS. 3 and 4 relative to the finger 16. By virtue of the finger in the position 16′ passing around the upper sprocket the diving is achieved very rapidly in comparison with the finger movement in the straight runs in the third path. Once the finger 16 has reached the straight vertically downward run, it is decelerated rapidly as can be appreciated from the portions 41 in FIGS. 3 and 4. The finger thereupon enters its accumulating mode which is designated 42 in FIGS. 3 and 4 and from those views it will be seen that the velocity is constant and the finger moves downward slowly until a complete stack is achieved. For ease of presentation, the graphs of FIGS. 3-5 are in terms of a 30 count stack so as not to have unduly long abscissae.

Once the stack has been accumulated -- as represented by the point 43 in FIG. 3, the chain associated with the supporting finger in that mode is rapidly accelerated as can be appreciated from the portion 43 of the curve of FIG. 4. There upon, acceleration stops and a constant velocity of descent is provided in the conveying chains to provide the curve portion designated 44. It is during this constant speed descent that the stack encounters the platform 26 which is indicated in FIG. 3 as the stack drop point. Thereafter, the paddles 27 of the stack removal means 25 remove the stack from the platform 26 -- and it will be seen that the succeeding finger assembly 18 provided on the other conveyor 21 is in its stack accumulating mode so there is no interference with the removal operation.

Also, it will be seen from a consideration of FIG. 3 that the finger assembly 18 is inserted into the second and third paths substantially with the completion of the stack being supported by the finger 16, viz., at the point designated 43.

So we have provided a pair of chain conveyors working through the same chain path but operating in tandem and at varying speeds determined according to a preset program so that when one conveyor is developing a stack, the other conveyor is rapidly removing a previous stack from the vicinity and ultimately from the stack developing path.

As indicated previously, a variety of products can be stacked through the practice of the invention. For each product, it is advantageous to develop a diving velocity of the finger (in the position 16′) which is a function of the wheel geometry and the finger geometry. We have also found that the stacking velocity is a function of the product thickness and the rate of product advance -- as by the conveyor belts 12. Further, the lowering velocity is a function of the rate

of building the next stack and the time of removal of the first stack. These variables are advantageously controlled by a programmable servo motor so as to achieve the maximum speed without the possibility of one stack interfering with another.

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 in the details hereingiven may be made by those skilled in the art without departing from the scope of the invention.

Claims

1. Apparatus for accumulating products (11) into stacks (15) comprising: a frame (10), means (12) on said frame for advancing a series of longitudinally spaced products (11) along a first path, a slotted wheel (13) rotatably mounted in said first path for sequentially receiving said product for transmission along a second generally arcuate path, stripper means (14) on said frame in said second path, a pair of endless conveyors (20, 21) on said frame each equipped with at least one outwardly projecting finger (16-19) rigidly mounted thereon for finger movement through a third orbital path (24) intersecting said second path for receiving products (11) stripped from said slotted wheel (13), characterized in that the finger (16) of one conveyor (20) is positioned in said third path (24) in longitudinally spaced relation to the finger (18) of the other conveyor (21), and means (36, 37; 38, 39) operably associated with said conveyors (20, 21) are connected for varying the relative speeds thereof so that each finger first serves as a diving finger (16') for defining the end of a previous stack (15) and the commencement of a developing stack (15A) and thereafter serves as a descending platform for said developing stack while a finger from the other conveyor moves into the diving position, and when the developing stack is completed the first finger (16) thereafter rapidly descends to a stack removal position (26), said other conveyor finger (18) being inserted into said third path substantially simultaneously with the completion of said developing stack.

2. The apparatus of claim 1, characterized in that said speed varying means includes programmable servomotor means (36, 38).

3. The apparatus of claim 1, characterized in that said speed varying means includes cam box means (37, 39).

4. The apparatus of claim 1, characterized in that said third path (24) is generally obround.

5. The apparatus of claim 4, characterized in that said path includes chain tensioning means (34).

6. The apparatus of claim 1, characterized in that each conveyor (20, 21) includes a pair of spaced apart chains (28, 29) entrained about upper and lower sprockets (30, 31; 32, 33), the upper sprockets (30, 31) for one conveyor (20) being driven and the lower sprockets (32, 33) being driven for the other conveyor (21).

7. The apparatus of claim 1, characterized in that each conveyor (20, 21) includes spaced apart chains (28, 29), each conveyor being equipped with two pairs of fingers (16, 17; 18, 19) with the fingers in each pair being horizontally aligned, one on each chain, said speed varying means (36, 38) and the location of the fingers on each conveyor being arranged so that the fingers (16, 17) of one conveyor (20) are 180° out of phase relative to the fingers (18, 19) of the other conveyor (21).

8. The apparatus of claim 7, characterized in that said frame (10) is equipped with a platform (26) through which said fingers pass sequentially to deposit completed stacks (15) on said platform, said frame also being equipped with stack takeaway means (25) operably associated with said platform.

9. The apparatus of claim 1, characterized in that each conveyor (20, 21) is equipped with at least two orbitally spaced apart finger assemblies (16, 17; 18, 19) the finger assemblies of one conveyor being positioned in said third path (24) in longitudinally interlaced relation to the finger assemblies of the other path.

10. A method for accumulating products into stacks (15) comprising advancing a series of longitudinally spaced products (11) along a first path, transferring said products sequentially into a slotted wheel (13) rotatably mounted in said first path and arranged to transmit said products along a second generally arcuate path by moving fingers (16, 17; 18, 19) rigidly fixed to a pair of endless conveyor chains (20, 21) through said slotted wheel, stripping products sequentially from said slotted wheel (13) for delivery to a third generally vertically arranged third path (24), accumulating products in said third path on said pair of finger equipped endless chain conveyors (20, 21) characterized by programming the finger movement so that each finger (16, 17; 18, 19) on each chain conveyor first serves as a diving finger (16') for defining the end of a previous stack (15) and the commencement of a developing stack (15A) and thereafter serves as a descending platform for said developing stack while a finger from the other conveyor moves into diving position, and when the developing stack is completed said first finger (16) thereafter rapidly descends to a stack removal position (26), said other conveyor finger (18) being inserted into said second path substantially simultaneously with the completion of said developing stack.

11. The method of claim 10, characterized in that the velocity of the finger (16') during diving is a function of the wheel geometry and finger geometry, said paths being arranged so that said finger intersects said second path while traveling around a sprocket

(30, 31) in which the programming of said conveyors (20, 21) is arranged to develop a stacking velocity as a function of the product thickness and the rate of product advance in said first path in which said programming is arranged to provide a lower velocity as a function of the rate of building of a subsequent stack (15A) and the time of removal of a preceding stack (15).

Patentansprüche

1. Apparat zum Ansammeln von Produkten (11) zu Stapeln (15), mit einem Rahmen (10), mit Mitteln (12) auf dem Rahmen zum Vorwärtsbewegen einer Reihe von in Längsrichtung beabstandeten Produkten (11) längs einer ersten Bahn, mit einem geschlitzten Rad (13), welches in der ersten Bahn drehbar angeordnet ist zum aufeinanderfolgenden Aufnehmen des Produktes zur Übertragung längs einer zweiten, im allgemeinen gekrümmten Bahn, mit einem Abstreifmittel (14) auf dem Rahmen in der zweiten Bahn, mit einem Paar von Endlosförderern (20, 21) auf dem Rahmen, die jeweils mit wenigstens einem nach außen vorstehenden Finger (16-19) ausgestattet sind, der darauf starr angeordnet ist für eine Fingerbewegung auf einer dritten Umlaufbahn (24), die die zweite Bahn zum Aufnehmen der von dem geschlitzten Rad (13) abgestreiften Produkte (11) schneidet, dadurch gekennzeichnet, daß der Finger (16) eines Förderers (20) in der dritten Bahn (24) in in Längsrichtung beabstandeter Beziehung zu dem Finger (18) auf dem anderen Förderer (21) positioniert ist, daß den Förderern (20, 21) betriebsmäßig zugeordnete Mittel (36, 37; 38, 39) zum Verändern der relativen Geschwindigkeiten derselben angeschlossen sind, so daß jeder Finger erst als Tauchfinger (16′) zum Definieren des Endes eines vorhergehenden Stapels (15) und des Anfangs eines sich entwickelnden Stapels (15A) und danach als sich abwärts bewegende Plattform für den sich entwickelnden Stapel dient, während ein Finger von dem anderen Förderer sich in die Tauchposition bewegt, und daß, wenn der sich entwickelnde Stapel vervollständigt ist, der erste Finger (16) sich danach rasch auf eine Stapelabnahmeposition (26) hinabbewegt, wobei der Finger (18) des anderen Förderers in die dritte Bahn im wesentlichen gleichzeitig mit der Vervollständigung des sich entwickelnden Stapels eingeführt wird.

2. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß das Mittel zum Verändern der Geschwindigkeit ein programmierbares Servomotormittel (36, 38) einschließt.

3. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß das Mittel zum Verändern der Geschwindigkeit ein Nockengehäusemittel (37, 39) einschließt.

4. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß die dritte Bahn (24) im wesentlichen rundlich ist.

5. Apparat nach Anspruch 4, dadurch gekennzeichnet, daß die Bahn ein Kettenspannermittel (34) einschließt.

6. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß jeder Förderer (20, 21) ein Paar von zueinander auf Abstand stehenden Ketten (28, 29) einschließt, die um obere und untere Ritzel (30, 31; 32, 33) geführt sind, wobei die oberen Ritzel (30, 31) für einen Förderer (20) und die unteren Ritzel (32, 33) für den anderen Förderer (21) angetrieben sind.

7. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß jeder Förderer (20, 21) voneinander auf Abstand stehende Ketten (28, 29) einschließt, wobei jeder Förderer mit zwei Paaren von Fingern (16, 17; 18, 19) ausgerüstet ist, wobei die Finger in jedem Paar horizontal ausgerichtet sind, und zwar einer auf jeder Kette, wobei das Geschwindigkeitsveränderungsmittel (36, 38) und die Positionierung der Finger auf jedem Förderer so eingerichtet sind, daß die Finger (16, 17) des einen Förderers (20) relativ zu den Fingern (18, 19) des anderen Förderers (20, 21) um 180° phasenverschoben sind.

8. Apparat nach Anspruch 7, dadurch gekennzeichnet, daß der Rahmen (10) mit einer Plattform (26) ausgestattet ist, durch die die Finger nacheinander hindurchfahren, um fertige Stapel (15) auf der Plattform abzulegen, wobei der Rahmen auch mit einem Stapelabnahmemittel (25) ausgerüstet ist, welches der Plattform betriebsmäßig zugeordnet ist.

9. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß jeder Förderer (20, 21) mit wenigstens zwei orbital voneinander auf Abstand stehenden Fingeranordnungen (16, 17; 18, 19) ausgerüstet ist, wobei die Fingeranordnungen des einen Förderers in der dritten Bahn (24) in in Längsrichtung verwobener Beziehung zu den Fingeranordnungen der anderen Bahn angeordnet sind.

10. Verfahren zum Ansammeln von Produkten zu Stapeln (15), bei dem eine Reihe von in Längsrichtung beabstandeten Produkten (11) längs einer ersten Bahn vorwärts bewegt wird, bei dem die Produkte nacheinander in ein geschlitztes Rad (13) übertragen werden, welches in der ersten Bahn drehbar angeordnet und dazu vorgesehen ist, die Produkte längs einer zweiten, im allgemeinen gekrümmten Bahn zu übertragen durch Bewegen der Finger (16, 17; 18, 19), die starr an einem Paar von endlosen Förderketten (20, 21) befestigt sind, durch das geschlitzte Rad, bei dem die Produkte nacheinander von dem geschlitzten Rad (13) abgestreift werden zum Überführen an eine dritte, im wesentlichen vertikal angeordnete dritte Bahn (24), und bei dem die Produkte in der dritten Bahn auf dem Paar von mit Fingern ausgestatteten endlosen Kettenförderern (20, 21) angesammelt werden, gekennzeichnet durch Programmieren der Fingerbewegung derart, daß jeder Finger (16, 17; 18, 19) auf jedem Kettenförderer zuerst als Tauchfinger (16′) zum Definieren des Endes eines

vorhergehenden Stapels (15) und des Anfangs eines sich entwickelnden Stapels (15A) und danach als eine sich abwärts bewegende Plattform für den sich entwickelnden Stapel dient, während ein Finger von dem anderen Förderer in die Tauchposition einfährt, und wenn der sich entwickelnde Stapel fertiggestellt ist, bewegt sich der erste Finger (16) danach rasch abwärts in eine Stapelabnahmeposition (26), wobei der Finger (18) des anderen Förderers in den zweiten Pfad im wesentlichen gleichzeitig mit der Vervollständigung des sich entwickelnden Stapels eingeführt wird.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß die Geschwindigkeit des Fingers (16′) während des Eintauchens eine Funktion der Geometrie des Rades und des Fingers ist, wobei diese Bahnen so angeordnet sind, daß der Finger die zweite Bahn schneidet, während er um ein Ritzel (30, 31) herumläuft, wobei die Programmierung der Förderer (20, 21) eingerichtet ist, um eine Stapelgeschwindigkeit als Funktion der Produktdicke und der Produktvorschubgeschwindigkeit in der ersten Bahn zu entwickeln, wobei die Programmierung so eingerichtet ist, um eine untere Geschwindigkeit als Funktion der Geschwindigkeit des Aufbaus eines folgenden Stapels (15A) und der Zeit zum Abnehmen des vorhergehenden Stapels (15) vorzusehen.

Revendications

1. Dispositif pour accumuler des produits (11) en piles comportant un cadre (10), des moyens (12), montés sur ledit cadre, pour faire avancer une série de produits (11), longitudinalement espacés, le long d'un premier chemin, une roue à encoches (13), montée, avec liberté de rotation, sur ledit premier chemin pour recevoir séquentiellement ledit produit pour le transmettre le long d'un second chemin, formant de façon générale un arc, ainsi que des moyens éjecteurs (14) montés sur ledit cadre, sur ledit second chemin, ainsi qu'une paire de transporteurs sans fin (20, 21) montés sur ledit cadre et équipés chacun d'au moins un doigt (16-19) qui vient en saillie vers l'extérieur et qui y est rigidement monté pour permettre au doigt d'effectuer un mouvement sur un troisième chemin orbital (24) intersectant ledit second chemin pour recevoir les produits (11) éjectés hors de ladite roue à encoches (13), dispositif caractérisé par le fait que le doigt (16) d'un premier transporteur (20) est positionné, sur ledit troisième chemin (24), longitudinalement espacé du doigt (18) de l'autre transporteur (21), et par le fait que des moyens (36, 37; 38, 39), fonctionnellement associés auxdits transporteurs (20, 21), sont connectés de façon à faire varier leur vitesse relative de façon que chaque doigt serve d'abord de doigt d'insertion (16′) pour définir la fin d'une pile précédente (15) et le début d'une pile qui se créée (15A), puis serve de plateforme de descente pour ladite pile en cours de création, pendant qu'un doigt de l'autre transporteur se déplace pour venir dans la positon d'insertion, et, par le fait que, lorsque la pile en cours de création est achevée, le premier doigt (16) descend alors rapidement pour venir à une position (26) d'enlèvement de la pile, ledit doigt (18) de l'autre transporteur s'insérant dans ledit troisième chemin sensiblement simultanément avec l'achèvement de ladite pile en cours de création.

2. Dispositif de la revendication 1, caractérisé par le fait que lesdits moyens de variation de la vitesse comportent des moyens formant servomoteurs programmables (36, 38).

3. Dispositif de la revendication 1, caractérisé par le fait que lesdits moyens de variation de la vitesse comportent des moyens formant boîte à came (37, 39).

4. Dispositif de la revendication 1, caractérisé par le fait que ledit troisième chemin (24) est de façon générale constitué de portions circulaires et de portions rectilignes.

5. Dispositif de la revendication 4, caractérisé par le fait que ledit chemin comporte des moyens (34) de mise sous tension de la chaîne.

6. Dispositif de la revendication 1, caractérisé par le fait que chaque transporteur (20, 21) comporte une paire de chaînes (28, 29) espacées l'une de l'autre et entrainées autour de roues à chaîne supérieures et inférieures (30, 31; 32, 33), les roues à chaîne supérieures (30, 31) étant menantes pour l'un des transporteurs (20) et les roues à chaîne inférieures (32, 33) étant menantes pour l'autre transporteur (21).

7. Dispositif de la revendication 1, caractérisé par le fait que chaque transporteur (20, 21) comporte des chaînes (28, 29), espacées l'une de l'autre, chaque transporteur étant équipé de deux paires de doigts (16, 17; 18, 19), les doigts de chaque paire étant horizontalement alignés, un sur chaque chaîne, lesdits moyens (36, 38) de variation de la vitesse et la position des doigts sur chaque transporteur étant conçus de façon que les doigts (16, 17) de l'un des transporteurs (20) soient déphasés de 180° par rapport aux doigts (18, 19) de l'autre transporteur (21).

8. Dispositif de la revendication 7, caractérisé par le fait que ledit cadre (10) est équipé d'une plate-forme (26) à travers laquelle lesdits doigts passent séquentiellement pour déposer sur ladite plate-forme les piles achevées (15), ledit cadre étant également équipé de moyens (25) d'enlèvement de la pile, fonctionnellement associés à ladite plate-forme.

9. Dispositif de la revendicaiton 1, caractérisé par le fait que chaque transporteur (20, 21) est équipé d'au moins deux ensembles de doigts (16, 17; 18, 19), espacés orbitalement l'un de l'autre, les ensembles de doigts de l'un des transporteurs étant placés, sur ledit troisième chemin (24), en relation d'entrelacement longitudinal avec les ensembles de doigts de

l'autre transporteur.

10. Procédé pour empiler des produits en piles (15), comportant le fait de faire avancer une série de produits (11), espacés longitudinalement, le long d'un premier chemin, de transférer lesdits produits séquentiellement dans une roue à encoches (13) montée, avec liberté de rotation, sur ledit premier chemin et conçue pour transférer lesdits produits le long d'un second chemin de forme générale en arc en déplaçant des doigts (16, 17; 18, 19), rigidement fixés à une paire de chaînes (20, 21) de tranporteur sans fin, à travers ladite roue à encoches, le fait d'éjecter les produits séquentiellement hors de ladite roue à encoches (13) pour les mettre sur un troisième chemin (24) disposé de façon générale verticalement, le fait d'accumuler les produits sur ledit troisième chemin, sur ladite paire de transporteurs à chaîne sans fin (20, 21) équipés de doigts, procédé caractérisé par le fait que le mouvement des doigts est programmé de façon que chaque doigt (16, 17; 18, 19) de chaque transporteur à chaîne serve d'abord de doigt d'insertion (16′) pour définir la fin d'une pile précédente (15) et le début d'une pile qui se crée (15A), puis serve de plate-forme de descente pour ladite pile en cours de création pendant qu'un doigt de l'autre transporteur se déplace pour venir en position d'insertion, et par le fait que, lorsque la pile en cours de création est achevée, ledit premier doigt (16) descend alors rapidement pour venir à une position (26) d'enlèvement de la pile, ledit doigt (18) de l'autre transporteur s'insérant dans ledit second chemin sensiblement simultanément avec l'achèvement de ladite pile en cours de création.

11. Procédé de la revendication 10, caractérisé par le fait que la vitesse du doigt (16′) au cours de l'insertion est une fonction des caractéristiques géométriques de la roue et des caractéristiques géométriques du doigt, lesdits chemins étant conçus de façon que ledit doigt intersecte ledit second chemin en passant autour d'une roue à chaîne (30, 31), procédé dans lequel la programmation desdits transporteurs (20, 21) est conçue pour créer une vitesse d'empilage fonction de l'épaisseur de produit et de la vitesse d'avance du produit sur ledit premier chemin et procédé dans lequel ladite programmation est conçue pour donner une vitesse moindre, fonction de la vitesse d'établissement de la pile suivante (15A) et du temps d'enlèvement d'une pile précédente (15).

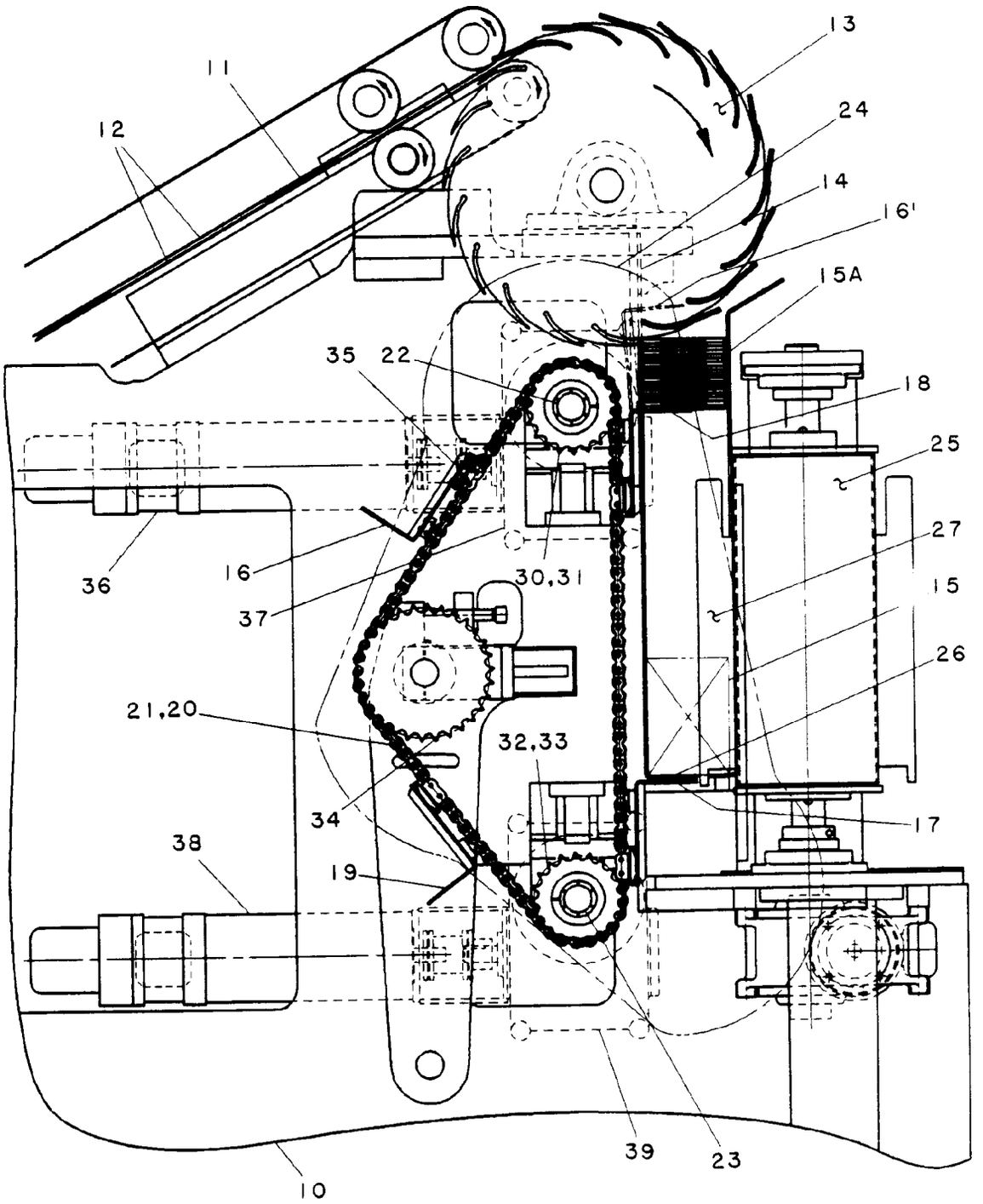

13
11
12
24
14
16'
15A
35
22
18
25
27
16
30,31
37
36
15
26
21,20
32,33
34
17
38
19
39
23
10

FIG. 1

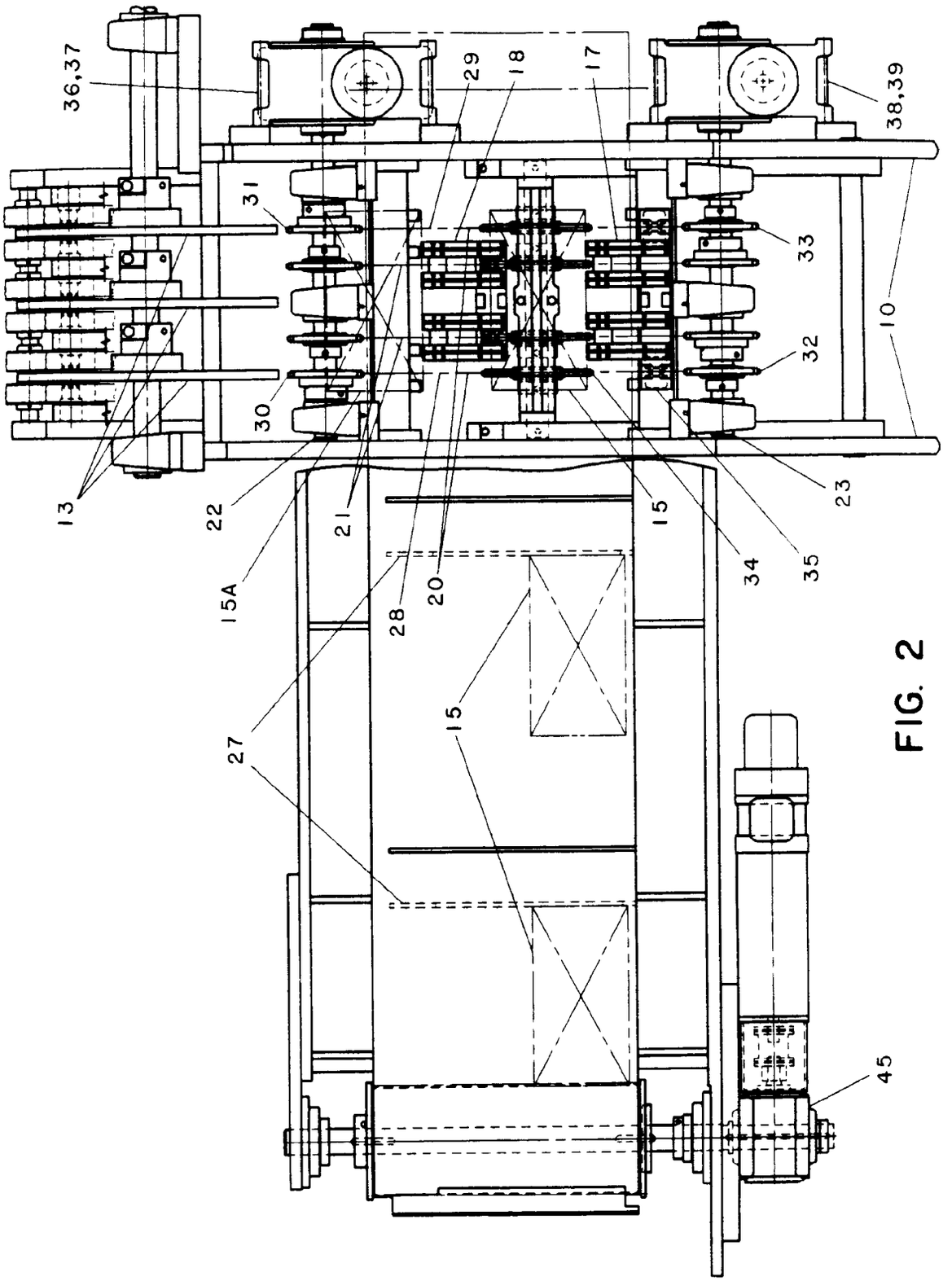

36,37
29
18
17
38,39
31
33
10
32
30
13
22
21
15
23
15A
28
20
34
35
27
15
45

FIG. 2

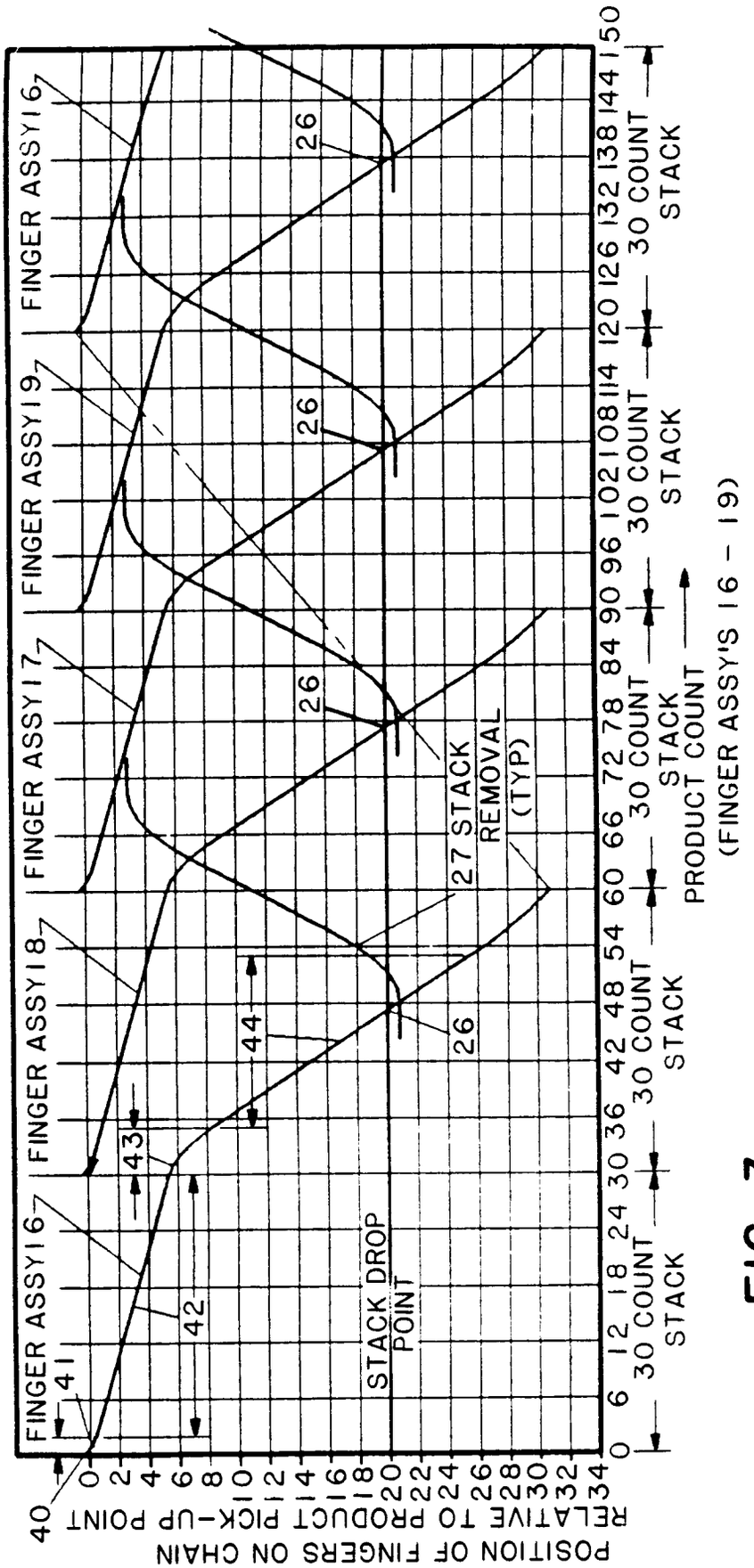

POSITION OF FINGERS ON CHAIN
RELATIVE TO PRODUCT PICK-UP POINT
40
41
42
43
44
26
27 STACK REMOVAL (TYP)
STACK DROP POINT
FINGER ASSY 16
FINGER ASSY 17
FINGER ASSY 18
FINGER ASSY 19
30 COUNT STACK
PRODUCT COUNT
(FINGER ASSY'S 16 - 19)

FIG. 3

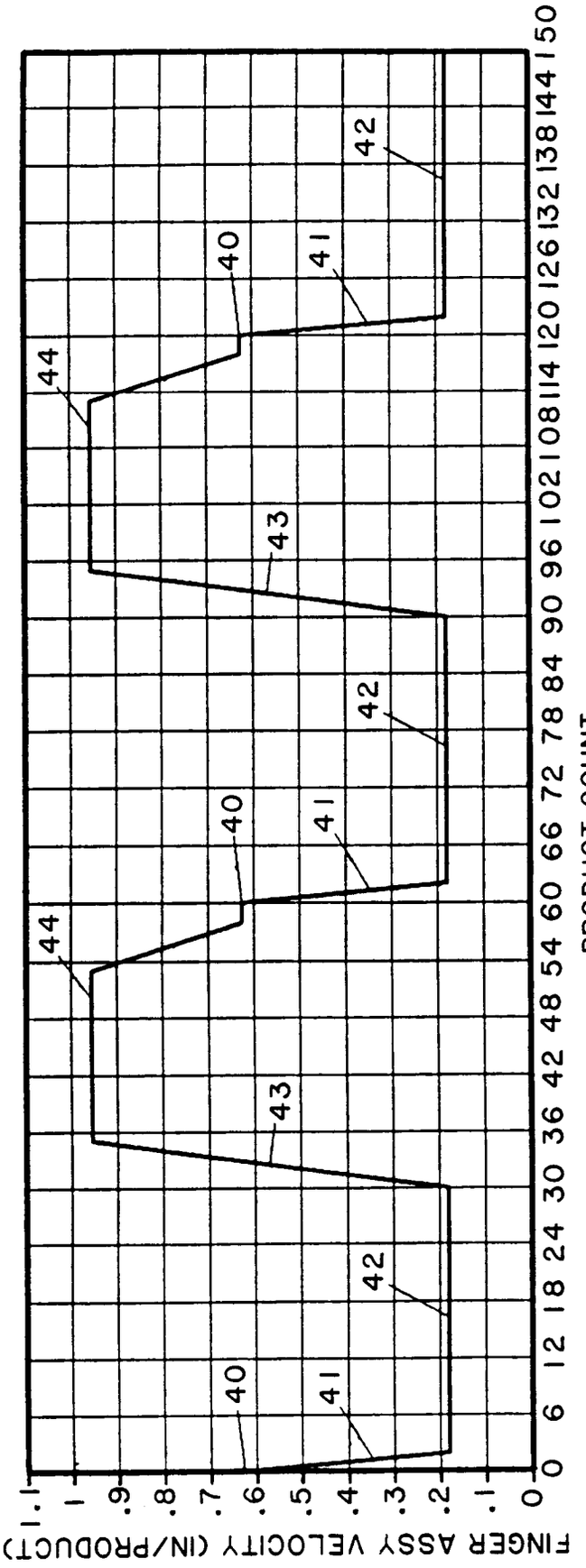

FINGER ASSY VELOCITY (IN/PRODUCT)
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
1.1
0 6 12 18 24 30 36 42 48 54 60 66 72 78 84 90 96 102 108 114 120 126 132 138 144 150
PRODUCT COUNT
(FINGER ASSY'S 16 & 17)
40
41
42
43
44

FIG. 4

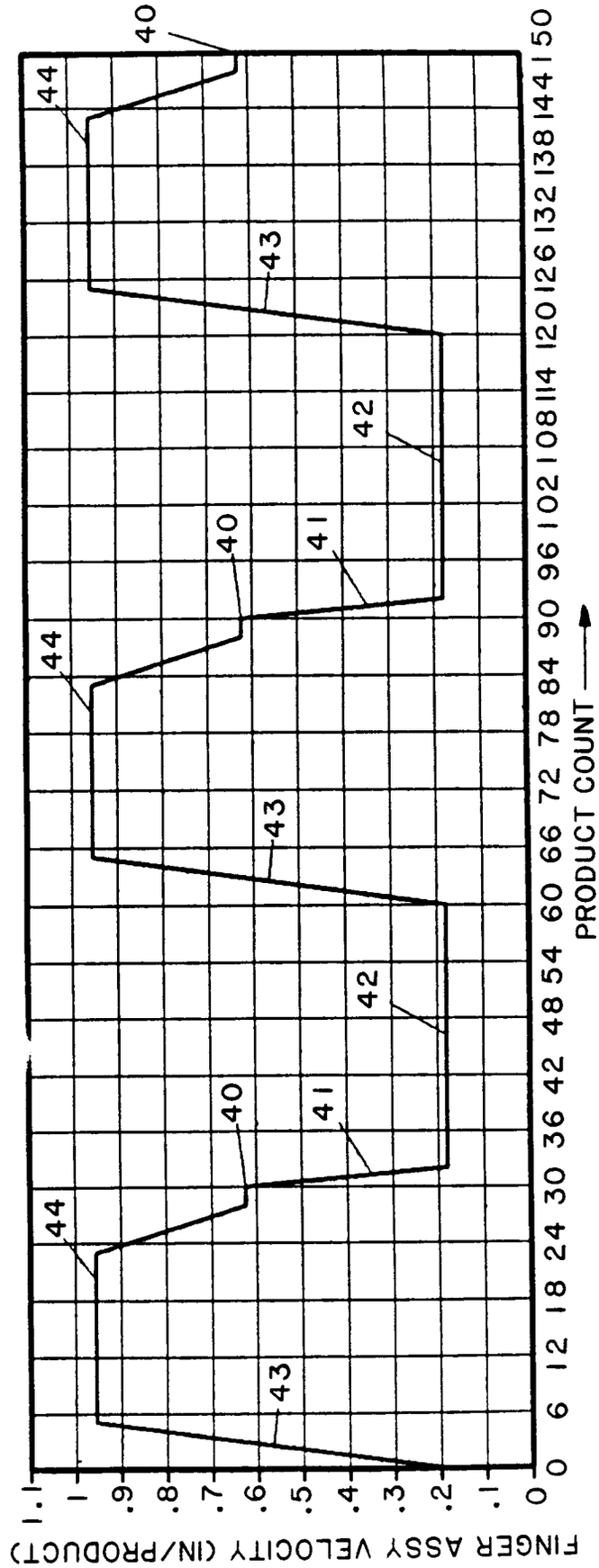


FIG. 5

CURVES ILLUSTRATED ARE BASED ON 30 PRODUCTS PER STACK