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E. GUGGISBERG

3,394,930

APPARATUS FOR THE INDIVIDUAL SEPARATION OF FOLDED
PAPER ARTICLES FROM A STACK OF SUCH ARTICLES

Filed May 6, 1966

4 Sheets-Sheet 1

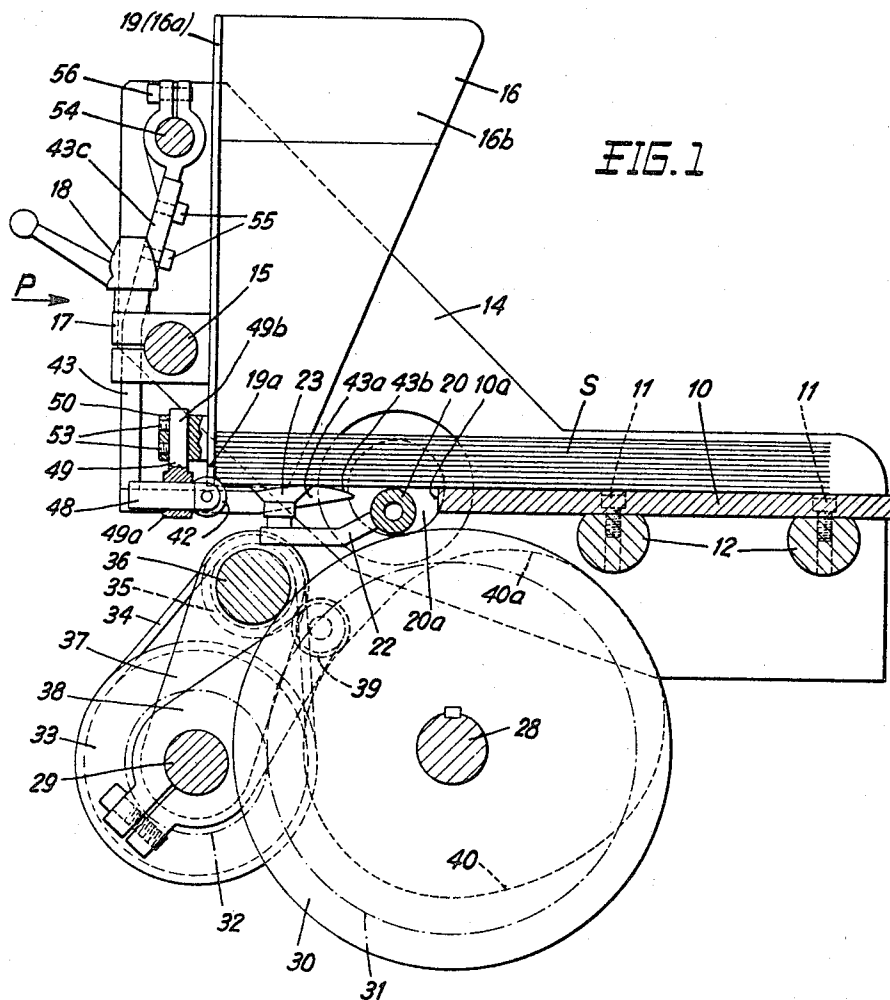


FIG. 1

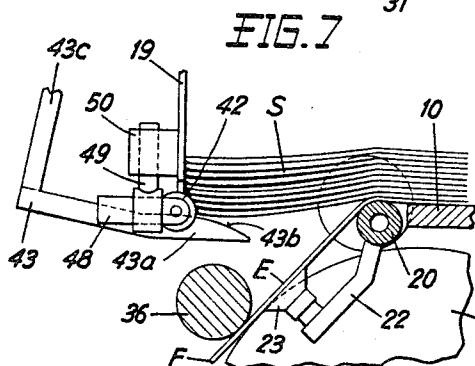


FIG. 7

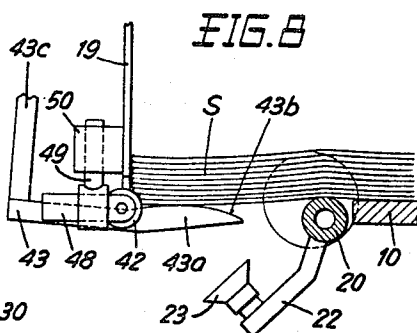


FIG. 8

INVENTOR:

ERNST GUGGISBERG

By *Dennis O. Klemm*
His Attorney

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ERNST GUGGISBERG

By Arnold D. Kleiman
His Attorney

July 30, 1968

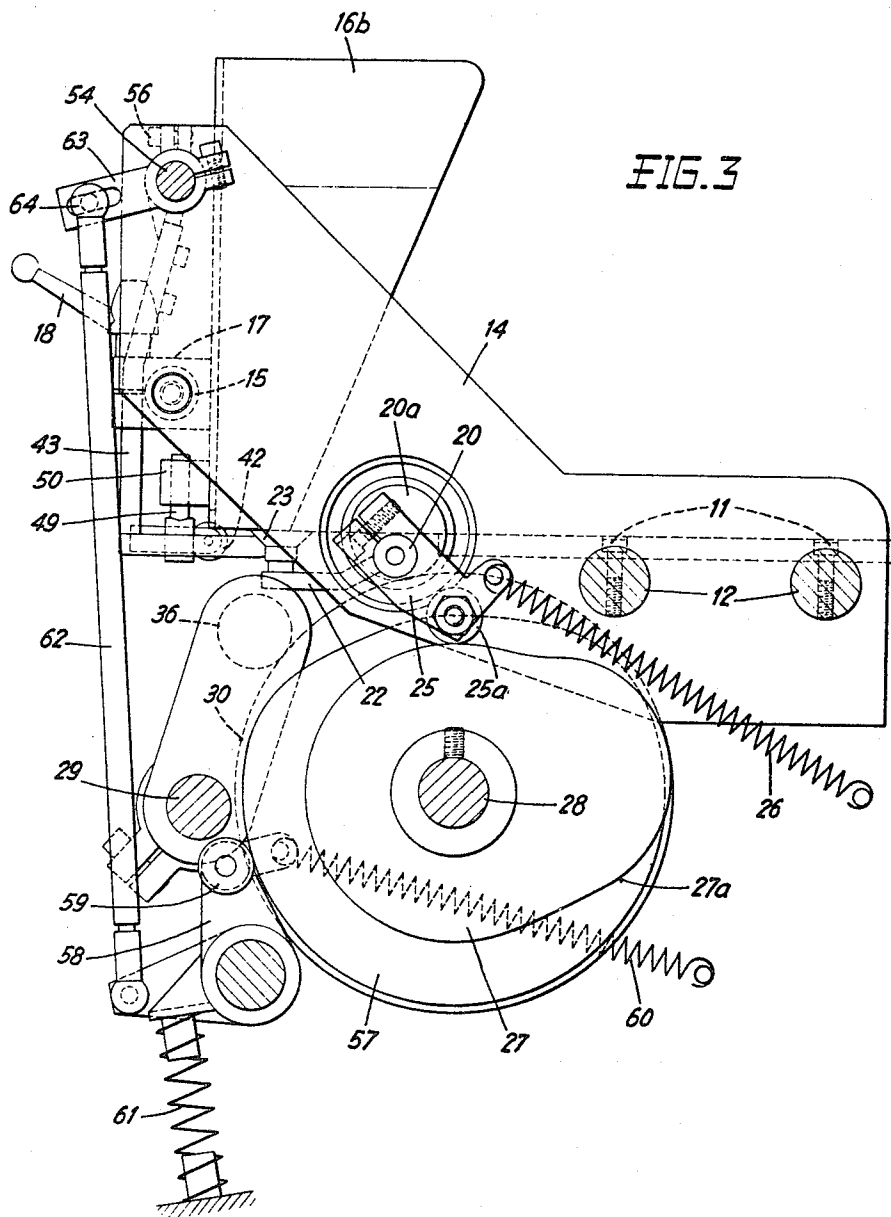
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4 Sheets-Sheet 3



INVENTOR:
Ernst Guggisberg
By *Werner D. Kleiman*
His Attorney

July 30, 1968

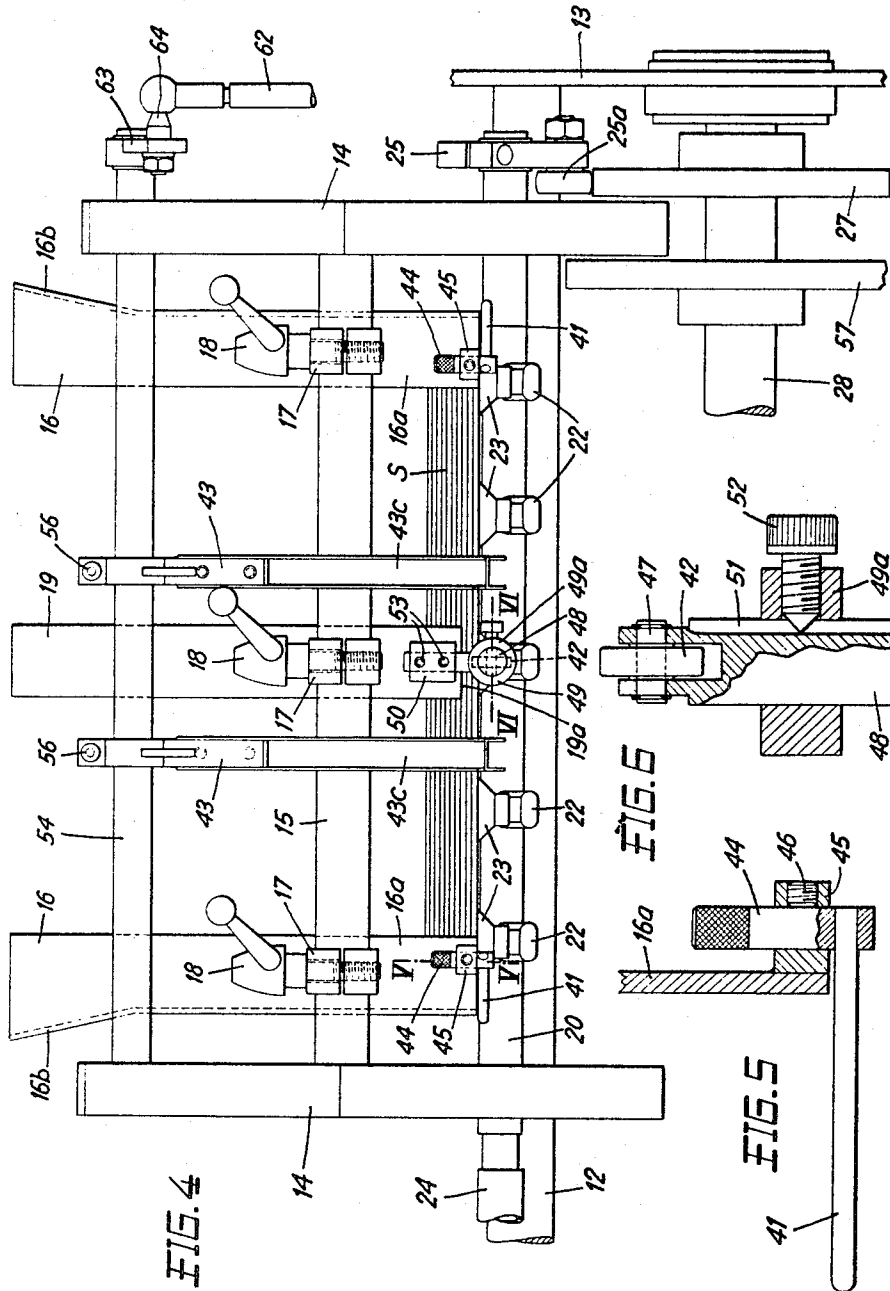
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INVENTOR:
ERNST GUGGISBERG
By *Dennis W. Kleaman*
His Attorney

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APPARATUS FOR THE INDIVIDUAL SEPARATION OF FOLDED PAPER ARTICLES FROM A STACK OF SUCH ARTICLES

Ernst Guggisberg, Fluh, near Oberbalm, Switzerland, assignor to Graphicart Internationale Ausrüstungsgesellschaft für graphische Kunst AG., Berne, Switzerland, a corporation of Switzerland

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8 Claims. (Cl. 271—11)

ABSTRACT OF THE DISCLOSURE

An improved apparatus for separation of one article after another from a stack of such articles. The apparatus is particularly applicable for high-speed separation of a stack of paper products such as magazines, newspaper sections, supplements, signatures, periodicals, and so forth. The apparatus comprises a preferably flat stationary support having a forward edge and which supports the lowermost article of the stack at the portion thereof remote from the fold edge of such article. Two stack guide elements are laterally arranged in spaced relation from such forward edge of this flat stationary support and against which the articles of the stack bear with their fold edge. The stack guide elements and the flat stationary support cooperate with one another so as to define the compartment for the article stack. Suction means incorporating a number of suckers are mounted for conjoint pivotal movement about an axis located in the neighborhood of the forward edge of the flat stationary support, and suitable conveying means transport away the individual paper article which has been separated from the stack. Drive means bring about rocking movement of the suction means from an article-withdrawal position from which the suckers bear against the underface of the lowermost article of the stack into a delivery position in which the lowermost article is flexed into a position where it can be seized by the aforesaid conveying means.

The present invention broadly has reference to an improved apparatus for the reliable separation of one article after another from a stack of such articles. The stack separator of the present invention has particular applicability for high-speed separation of a stack of paper products, such as magazines, newspaper sections, supplements, signatures, periodicals, and so forth. More precisely, the invention can be used to advantage in conjunction with a high-speed stuffing machine for stuffing newspapers with supplements or inserts, for instance a newspaper stuffing machine of the type set forth in my co-pending United States application, Ser. No. 498,600, filed Oct. 20, 1965 and entitled "Method of and Apparatus for Stuffing Printed Matter with Inserts, Particularly for Stuffing Newspapers and the Like." It is significant to note, however, that the use of the inventive stack separator with such a stuffing machine is merely one illustrative example of its versatility, and it is to be clearly understood that its sphere of use is not limited to just newspaper stuffing machines, rather can be employed to advantage whenever it is desired to separate a stack of paper articles one article after the other.

Generally speaking, the inventive apparatus comprises a preferably flat stationary support having a forward edge

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and which supports the lower-most article of the stack at the portion thereof remote from the fold edge of such article. Two stack guide elements are laterally arranged in spaced relation from such forward edge of this flat stationary support and against which the articles of the stack bear with their aforesaid fold edge. The stack guide elements and the flat stationary support cooperate with one another so as to define the compartment for the article stack. Additionally, suction means incorporating a number of suckers are mounted for conjoint pivotal movement about an axis located in the neighborhood of the forward edge of the flat stationary support, and suitable conveying means transport away the individual paper article which has been separated from the stack. Moreover, drive means bring about rocking movement of the suction means from an article-withdrawal position from which the suckers bear against the underface of the lower-most article of the stack into a delivery position in which the lowermost article is flexed into a position where it can be seized by the aforesaid conveying means.

Apparatuses of this and similar broad generic type are already well known to the art: see for instance United States Patent 1,817,701, granted Aug. 4, 1931 to W. E. Molins; United States Patent 2,262,798, granted Nov. 18, 1941 to H. P. Elliott; United States Patent 2,979,329, granted Apr. 11, 1961 to J. M. Cunningham; German Patent 679,675 and Swiss Patent 396,048.

However, most of the stuffing apparatuses of the paper industry, particularly those for inserting folded paper articles for further handling in machines, do not operate satisfactorily. This is apparently attributable to the difficulty of reliably achieving individual separation of the articles from the stack. In the prior art constructions it often-times occurs, depending upon the thickness and the paper quality of the article, that either no or two or more articles instead of one are removed at one time. It should be apparent that such apparatuses, if they have high-speed machines arranged before and/or after them, must work in the same tempo or rhythm, and then reliably.

Accordingly, it is a primary object of the present invention to provide an improved apparatus for removing one article after the other reliably and at high speed from a stack of such articles.

Another important object of this invention is to provide an improved stack separator incorporating new and improved support means for effectively supporting a stack of articles and ensuring for stack separation through one article after the other.

Still a further important object of this invention has reference to an improved apparatus for individually separating paper articles from a stack of such articles one after the other, such apparatus being extremely reliable in operation, sturdy in construction, requiring very little maintenance and servicing, easy to adjust to handle various size articles and stack height, and extremely economical to manufacture.

Characteristic of the inventive apparatus of the aforementioned type is the provision of article-corner support elements arranged diagonally directly beneath the aforesaid stack guide elements, and a small diameter support roll freely rotatable about an axis substantially parallel to the forward edge of the flat stationary support and disposed substantially centrally in front of such forward edge in a position that only a small portion of the support roll extends into the aforesaid stack compartment.

According to a preferred embodiment of the invention, there are also provided pivotable support rockers laterally to each side of said support roll assisting in supporting the stacked articles by bearing against the lowermost article and operating in timed relation with the movement of the suckers.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description and drawings in which:

FIGURE 1 is a vertical sectional view of a preferred embodiment of inventive apparatus, taken along the line I—I of FIGURE 2;

FIGURE 2 is a fragmentary, top plane view of the apparatus depicted in FIGURE 1, partly in section;

FIGURE 3 is a vertical sectional view taken along the lines III—III of FIGURE 2;

FIGURE 4 is a front view of the preferred embodiment of apparatus of FIGURE 1, as viewed in the direction of the arrow IV of FIGURE 2;

FIGURE 5 is an enlarged, sectional view showing a detail of the inventive apparatus, taken along the line V—V of FIGURE 4;

FIGURE 6 is an enlarged, sectional view showing a further detail of such apparatus, taken along the line VI—VI of FIGURE 4;

FIGURE 7 is a schematic, fragmentary, partly vertical sectional view, on an enlarged scale, showing a portion of the apparatus of FIGURE 1, with certain of the movable elements in a predetermined operational position; and

FIGURE 8 is a view similar to FIGURE 7 showing the same elements or components in a different operational position.

Turning attention now to the drawings, the preferred exemplary embodiment of inventive apparatus for separating folded paper articles or the like one after the other from a stack S of such articles embodies a support element or member 10 for carrying the stack S of such folded paper articles, for instance printed material such as newspapers, pamphlets, catalogs, magazines, books, periodicals, or the like. This support member 10 is here shown in the form of a plate connected by screws 11 or any equivalent fastening expedients to the flattened or beveled portions of two spaced support rods 12. These support rods 12 are affixed at their one respective end to a stationary side plate 13, as best shown in FIGURE 2. Also at their other non-illustrated end they are connected with a similar side plate, which for the purpose of simplifying the drawing has been omitted. Further, such support rods 12 carry two stiff frame members 14 laterally disposed at each side of the support element 10. At the front end of the apparatus these stiff frame members 14 are rigidly interconnected by means of a carrier or support rod 15.

Moreover, at the front of the inventive apparatus there are also located two stack guide members 16 which, when viewed from the top, are substantially angle-shaped. At their forwardmost side or leg 16a, as best seen in FIGURES 1 and 4, they have affixed thereto a respective clamping collar 17, each of which, through actuation of an associated hand-lever screw 18, can be detachably affixed to the carrier rod 15. This manipulation first takes place after these angle-shaped stack guide elements 16, through displacement of the clamping collars 17 along the carrier rod 15, are so adjusted that their rearwardly extending legs 16b are capable of laterally guiding the stack S without a great deal of play. As best seen by inspecting FIGURES 2 and 4, the upper end of these rearwardly extending legs 16b of the stack guide elements 16 are outwardly inclined in order to facilitate the dropping-in of an additional supply of articles to the stack S.

An additional stack guide element 19 consisting of a flat plate which is flushly aligned with the forward disposed legs 16a of the previously considered stack guide elements 16, is likewise fixedly but adjustably retained by a similar clamping collar 17 and hand-lever screw 18 upon the carrier rod 15.

A hollow shaft 20, near but in front of the forwardmost edge 10a of the stack support element 10, extends substantially parallel to such edge and over the full length thereof. This hollow shaft 20 is provided at each end with eccentric portions 20a which are rotatably and non-displaceably mounted by means of ball bearings 21 at the two stiff frame portions or members 14. Forwardly extending hollow arms 22 are secured to this hollow shaft 20 and which at their forwardmost or free end each carry a sucker or suction cup 23 formed of rubber or any other suitable material. All of these suckers 23 are connected during a part of each work cycle of the apparatus to a suitable suction source, for instance to a suction ventilator, by means of their associated hollow arm 22, the hollow shaft 20, a flexible conduit 24 connected to such shaft, and a non-illustrated valve or similar air through-passage control element actuated at the proper time in relation to the operation of the apparatus.

Mechanism of known construction is also provided in order to oscillate or rotate the hollow shaft 20 back and forth together with the hollow arms 22 and the suckers 23 in properly timed relation during the operating cycle of the machine. This mechanism incorporates a cam feeler arm 25 fixedly clamped upon the hollow shaft 20. As best seen by inspecting FIGURE 3, this cam feeler arm 25 is subjected to the action of a tension spring 26 suspended at one end at the aforesaid arm and, by means of a roller 25a mounted at such cam feeler arm 25, scans the profile or contour 27a of a cam disk 27. Cam disk 27 is fixedly seated upon a shaft 28 which is rotatably and non-displaceably mounted in the illustrated side plate 13 as well as the other previously mentioned, yet non-illustrated, companion side plate at the opposite end of the machine. A shaft 29 which is disposed somewhat more forwardly and in substantial parallelism with the just-considered shaft 28 is also mounted rotatably and non-displaceably in such side plates 13.

Upon the shaft 28 there are fixedly seated in spaced relation from one another a number of article-removal or conveying disks 30 as well as a gear 31. The latter meshes with a gear 32 which, like a pulley disk 33 which is fixedly connected for rotation with the gear 32, is freely rotatably mounted upon the shaft 29. For the sake of preserving clarity in illustration shaft 29 has been conveniently omitted in FIGURE 2. A pulley belt 34 interconnects this belt pulley 33 with a belt pulley 35 fixedly seated upon a drop roll 36. This drop roll 36 extends across the full width of the apparatus and at its ends is rotatably mounted upon carrier arms 37 which like a cam feeler arm 38 are fixedly seated upon the shaft 29. The last-mentioned cam feeler arm 38 carries a freely rotatably mounted roller 39 thereon by means of which it scans the contour 40a of a cam disk 40 (FIGURE 1) which is fixedly seated upon the non-illustrated end portion of the shaft 28.

With regard to the known portion of the operation of the apparatus it can already be mentioned that in a first phase of each work cycle of the apparatus or each rotation of the shaft 28, the suckers 23 with their free marginal edges are aligned at the upper surface of the stack support element 10, in other words, bear at the underface of the lowermost folded paper article E of the stack S. It is further to be mentioned that the fold edge F of each of the paper articles which form the stack S are located forwardly in bearing contact with the transversely extending legs 16a of the stack guide elements 16 and with the additional stack guide element 19. During their downward rocking movement from the position of FIGURE 1 into position shown in FIGURE 7, these suckers 23 are connected to the negative pressure or suction source and, therefore, downwardly flex the lowermost paper article E of the stack S about the upper peripheral region of the shaft 20, as shown in FIGURE 7 for instance. It is of importance to here also remark that preferably this upper region of the shaft 20 is flushly

aligned with the upper surface of the support element 10 and, in so doing, this shaft 20 carries out an eccentric movement about the center of its support bearings 21 because it is mounted with its eccentric portions 20a in these bearings 21. As a result there is achieved that upon downwardly bending or flexing the lowermost paper article E the stack S must not be pulled out, rather, so to speak, is rolled upon the upper surface of the shaft 20. As soon as the paper article E has been downwardly flexed to such an extent that it comes to bear with its marginal region or portion which is disposed in the region of the fold line or edge F upon the circumference of the conveying or withdrawal rollers 30, then already the drop roll 36 is subjected to the action of non-illustrated springs and in accordance with the control brought about by the cam surface or profile 40a of the cam disk 40 presses this marginal region against the conveyor rollers 30 (FIGURE 7), at which time the connection between the suckers 23 and the suction source is interrupted. Due to the coaction of the conveyor rollers 30 and the drop roll 36 the lowermost paper article E of the stack S is pulled away from such stack and guided or conveyed away past the shaft 29. In this respect, there can also be employed band drives as an additional aid which, in the usual manner, possess small transport bands which pass over the withdrawal rollers 30 and other rollers.

It can be easily imagined that if no special measures are undertaken, then when downwardly pivoting the hollow arms 22 with the suction cups or suckers 23 not only the lowermost paper article E of the stack would be downwardly flexed, rather other superimposed articles of the stack under their own weight would more or less also be downwardly flexed. This has already been recognized by others who, however, have not recognized and undertaken those special measures proposed by the invention which ensure for a reliable single separation of one article after the other from the stack with a quick rhythm or tempo, and indeed even when working with different thicknesses and paper qualities of the articles E also guarantee for reliable separation of one article after the other from the stack.

According to the present invention, to such special measures there belong two article-corner support elements 41 diagonally arranged directly beneath the stack guide elements 16 across the corners and a freely rotatable, small diameter support roll 42 which is freely rotatable about an axis disposed substantially parallel to the forward edge 10a of the support element 10. This small diameter support roll 42 is arranged intermediate the stack guide elements 16 in front of the middle of this forward edge 10a in such a position that it only extends into the stack compartment with a small portion of its peripheral surface. Such stack area or compartment is defined by the plate-like support element 10 and the stack guide elements 16, 19, and between which there is formed the article-discharge opening.

Preferably, these special measures also encompass support rockers or rocker arms 43 arranged laterally at both sides of the support roll 42 and which possess an angle-shaped configuration and have a lower arm 43a. These support rockers 43 are pivotable or rockable about an axis which is disposed substantially parallel to the forward edge 10a of the support element 10 and in front of the outer face of the upper portion of the stack guide elements 16, 19, as best shown in FIGURES 1 and 3. These support rockers 43 can move conjointly from a position in which their lower respective arm 43a contacts by means of its curved upper edge 43b the bottom of the stack compartment (FIGURE 8), into a position in which they do not hinder the downward flexing of the lowermost article E of the stack S by the suckers 23. Moreover, a drive mechanism is provided for these support rockers 43—to be considered shortly—which is operatively connected with the drive arrangement 25, 26,

27 which brings about rocking of the suckers 23, so as to move these support rockers 43 in the same rhythm or timed relation as the suckers 23.

As best seen by inspecting FIGURES 4 and 5, the corner supports 41 each consist of a thin circular rod or bar rounded at its one free end and with its other end is pressed into the bore of a carrier or support bolt 44, the latter being arranged at right angles to the associated rod 41. This support or carrier bolt 44 is elevationally displaceable and rotatable in a vertical bore of a bearing block 45 fixed at the lowermost region of the front face or side 16a of each stack guide element 16. Fixation of the carrier bolt 44 in desired position is achieved by means of a threaded pin or set screw 46 for instance.

As clearly shown in FIGURE 6, the support roll 42 is mounted upon an axle bolt 47 so as to be freely rotatable about an axis which is parallel to the front edge 10a of the support element 10 for the article stack S. This axle bolt or pin 47 is fixed in suitable bores provided at both legs of the bifurcated end of a carrier or support bolt 48. This support bolt 48 extends perpendicular to the forward edge 10a of the support element 10 in a horizontal bore provided at the lower terminal portion 49a of a journal or carrier piece 49, the cylindrical part 49b of which extends upwardly through the vertical bore of a bearing member or journal piece 50 which is affixed to the forward face of the additional stack guide element 19 (FIGURE 4).

Carrier bolt 48 has a lengthwise extending V-notch 51 into which engages the pointed end of a retaining or set screw 52 provided at the terminal or end part 49a. This carrier piece or journal element 49 is fixedly retained via its upward extending part 49b by two set screws 53 at the bearing block 50.

Upon loosening the knurled retaining screw 52 it is possible to adjust the position of the support roll 42 in horizontal direction with respect to its spacing from the forward edge 10a of the support member 10. Moreover, upon loosening the retaining screws 53 it is possible to elevationally adjust such support roller 42 to a small degree with respect to its elevational position. It is still to be mentioned that the additional stack guide element 19 does not extend with its lower edge 19a completely down to the lower limit of the stack compartment, so that a space is provided for the support roll 42.

The geometric axis about which the support rockers 43 are rotatable, is the geometric axis of a shaft 54 which is mounted rotatably and non-displaceably at the upper portion of the frame elements 14. The downwardly depending arms 43c of the substantially angle-shaped support rockers 43 are divided along their length and upon loosening the fixing screws 55 can be displaced towards one another in order to render it possible to adjust the elevational position of the horizontal arms 43a; the upper portion of each of the arms 43c, as shown, embraces the shaft 54 and is fixed upon the latter by means of a respective screw 56. The upper edge 43b of each of the horizontal arms 43a is curved in lengthwise direction, particularly well shown in FIGURES 1, 7 and 8. In the tucked-in or upwardly rotated position of the support rockers 43 of FIGURE 1, the highest point of such upper surface or face 43b is situated at the extension of the upper face of the support element 10.

As will be recalled, actuation of these support rockers 43 takes place in the same rhythm as the operation of the suckers 23, the arms 22 and the shaft 20, and this is achieved by a suitable mechanism. Such mechanism incorporates a cam disk 57 fixedly seated upon the shaft 28, a flexed cam feeler arm or lever 58 having a feeler roller 59, a tension spring 60, a pressure spring 61, a connecting rod 62 which at its lower end is articulated to an arm of the feeler arm or lever 58, and an arm 63 fixedly clamped upon the shaft 54 and provided with an articulation portion 64 adjustably arranged at the arm 63

and with which the upper end of the connecting rod 62 is articulated.

Each time when, as previously considered, the suckers 23 downwardly flex the lowermost article E, as depicted in FIGURE 7, the corner regions of such article E during the first phase of the downward flexing thereof are pulled past the rod-like corner supports 41. Immediately thereafter the latter as well as the support roll 42 support the thereover lying articles of the stack S, whereby the fold edge F of such articles are in rolling contact with the support roll 42. As has been found by observing the entire operation with stroboscopic illumination or light the marginal article portions situated at the region of the fold edges F of those articles which are still located in the stack S first move slightly downwards and then again slightly upwards which apparently considerably contributes to the fact that there is not erroneously downwardly flexed—in addition to the lowermost paper article E which is directly engaged by the suckers 23—still further such paper articles. The portion of the stack S overlying the removal opening and which does not bear upon the support element 10, as shown in FIGURE 7, and also if observed in the direction of the arrow P of FIGURE 1, is indeed slightly flexed downwards from the corner supports 41 towards the center, but it is still sufficiently supported or braced by the support roll 42.

If the stack S is quite high the support roll 42 is not able to carry out its support function in every instance. It is for this reason that the support rockers 43 are provided which, as clearly shown in FIGURE 8, come into play as soon as the lowermost paper article E is moved away. When the support rockers pivot into the position shown in FIGURE 8, they slightly lift the downward flexed portion of the stack S by means of their arms 43a, whereby the fold edges F bearing against the support roll 42 of the lower group of paper articles of the stack S slightly rotate the support roll 42 back and thereby slightly move upwards. Supporting of the folded edges F by the support roll 42 is then again completely ensured for carrying out the next operating or work cycle.

While there is shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. Apparatus for the individual separation of folded paper articles from a stack of such articles, comprising, in combination, a flat stationary support having a forward edge and supporting the lowermost article of the article stack at the portion thereof remote from the fold edge, two stack guide elements laterally arranged in spaced relation from said forward edge of said flat stationary support against which the articles of the stack bear with their fold edge, said stack guide elements cooperating with said flat stationary support for defining a stack compartment, suction means incorporating a number of suckers mounted for conjoint pivotable movement about an axis located in the neighborhood of said forward edge of said flat stationary support, conveying means for conducting away the individual paper articles separated from the stack, drive means for rocking the suction means from an article-withdrawal position in which the suckers bear against the underface of the lowermost article of the stack into a delivery position in which the lowermost article is flexed into a position where it is seized by said conveying means, article-corner support elements arranged diagonally directly beneath said stack guide elements, a small diameter support roll freely rotatable about an axis substantially parallel to said forward edge of said flat stationary support and disposed substantially centrally in front of said forward edge in such a position that only a small portion of said support roll extends into said stack compartment.

2. Apparatus for the individual separation of folded

paper articles from a stack of such articles as defined in claim 1, further including support rockers located to each side of said support roll, said support rockers having an angle-shaped configuration and each possessing a lower arm, said support rockers being conjointly mounted for pivotable movement about an axis substantially parallel to said forward edge of said flat stationary support and located externally of the upper portion of said stack guide elements, said support rockers being rockable about said support rocker axis from a position in which each of their lower arms contacts with its upper surface the bottom of the stack compartment into a position which does not obstruct the downward flexing of the lowermost article of the stack by said suction means, rocker drive means cooperating with said suction drive means for displacing said support rockers in the same rhythm as said suction means.

3. Apparatus for the individual separation of folded paper articles from a stack of such articles as defined in claim 1, wherein each of said article-corner support elements comprises a rod member, a carrier bolt disposed at substantially right angles to said rod member for supporting one end of said rod member, stationary bearing means provided with a vertical bore, said carrier bolt being elevationally displaceable and rotatably mounted within said vertical bore of said bearing means.

4. Apparatus for the individual separation of folded paper articles from a stack of such articles as defined in claim 3, wherein each of said stack guide elements is angle-shaped and has a pair of leg portions, one of said leg portions being substantially parallel to said forward edge of said flat stationary support, said bearing means being mounted to said one leg portion of each stack guide element.

5. Apparatus for the individual separation of folded paper articles from a stack of such articles as defined in claim 4, further including a stationary carrier rod mounted substantially parallel to said forward edge and in front of said stack guide elements and above said bearing means, clamping means mounted to each of said stack guide elements and engageable with said carrier rod for laterally adjustably positioning said stack guide elements.

6. Apparatus for the individual separation of folded paper articles from a stack of such articles as defined in claim 5, further including an additional stack guide element, clamping means carried by said additional stack guide element engageable with said carrier rod for flushly aligning said additional stack guide element with said one leg portion of each of said angle-shaped stack guide elements.

7. Apparatus for the individual separation of folded paper articles from a stack of such articles as defined in claim 6, further including a journal bearing having a vertical bore arranged at the lower region of said additional stack guide element, a journal element possessing a horizontal bore and a bolt projection, said bolt projection being retained in said vertical bore to selectively vertically position said journal element possessing said horizontal bore, and a support bolt carrying said support roll and being adjustably retained in said horizontal bore of said journal element with respect to its spacing from said flat stationary support.

8. Apparatus for the individual separation of one article after the other from a stack of such articles, comprising means for retaining a stack of articles and having an opening at one lower end thereof for removal of one article after the other from the stack, pivotable sucker means for downwardly flexing the lowermost article of said stack in a direction out of and away from said article-removal opening, means located in the region of said article-removal opening for supporting said stack of articles, said stack-supporting means comprising an article-corner support element located at each outermost extremity of said article-removal opening and beneath opposite corners of the lowermost article of said

stack, an adjustably positionable support roll located intermediate said article-corner support elements at the region of said article-removal opening for supporting the edges of the lowermost articles of the stack extending between said opposite corners, pivotably mounted support rockers located to each side of said support roll in a direction towards said article-corner support elements and bearing against the underface of the lowermost article of said stack, and drive means for operating said pivotable sucker means and said pivotably mounted sup-

port rockers in properly timed relationship to one another.

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EDWARD A. SROKA, Primary Examiner.