

Sept. 16, 1958

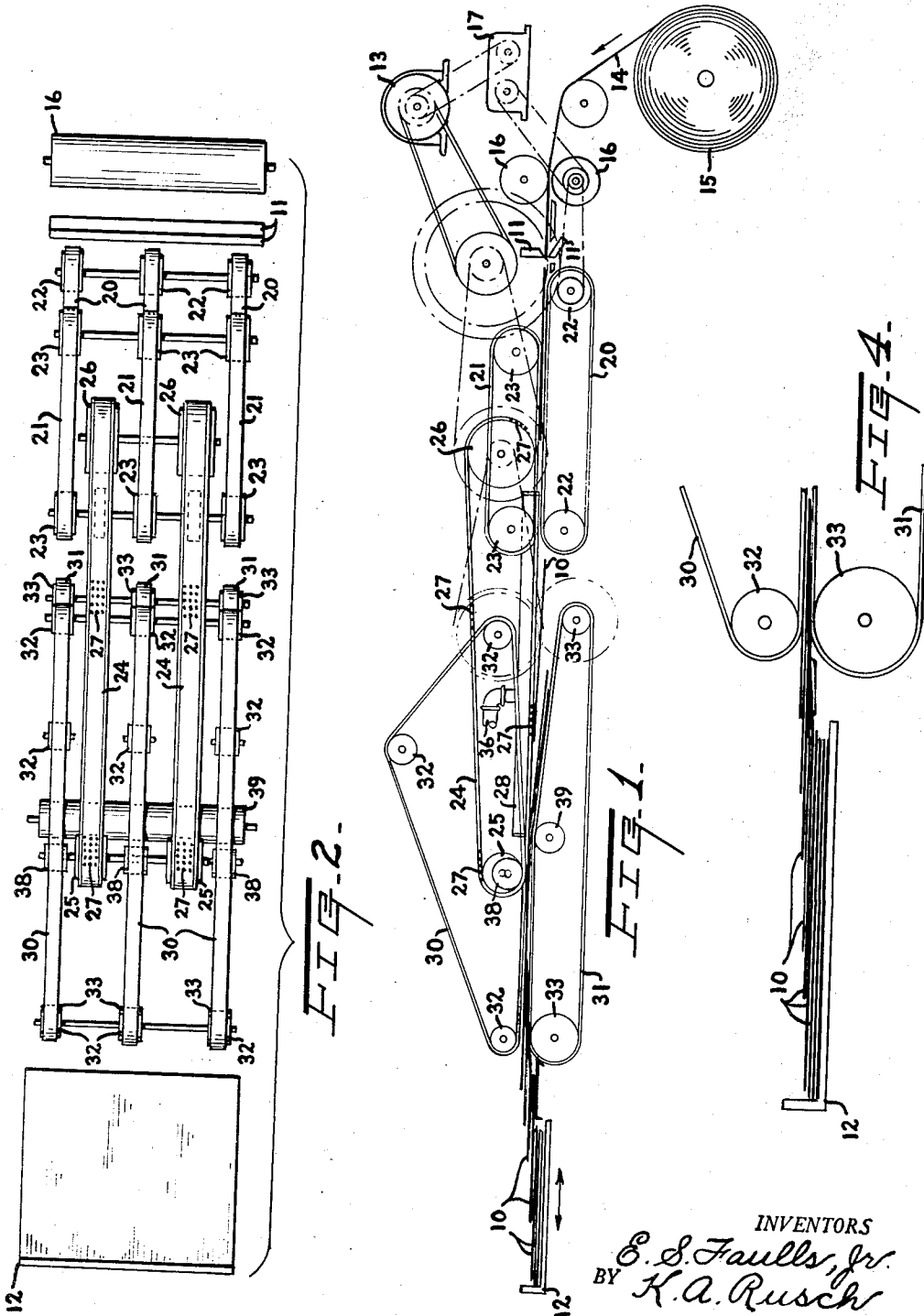
E. S. FAULLS, JR., ET AL

2,852,256

ART OF DELIVERING FLEXIBLE SHEETS

Filed Sept. 9, 1955

2 Sheets-Sheet 1



INVENTORS
BY *E. S. Faulls, Jr.*
K. A. Rusch
Lieber & Lieber
ATTORNEYS.

Sept. 16, 1958

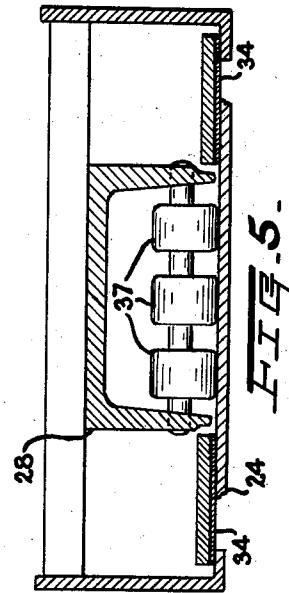
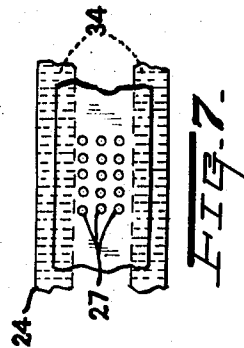
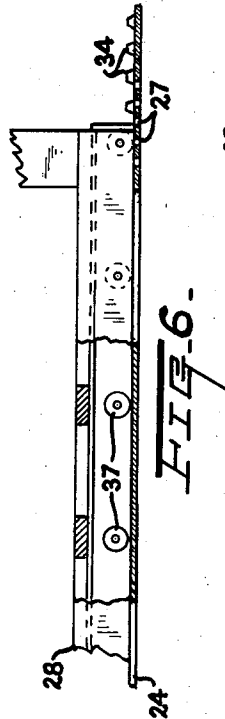
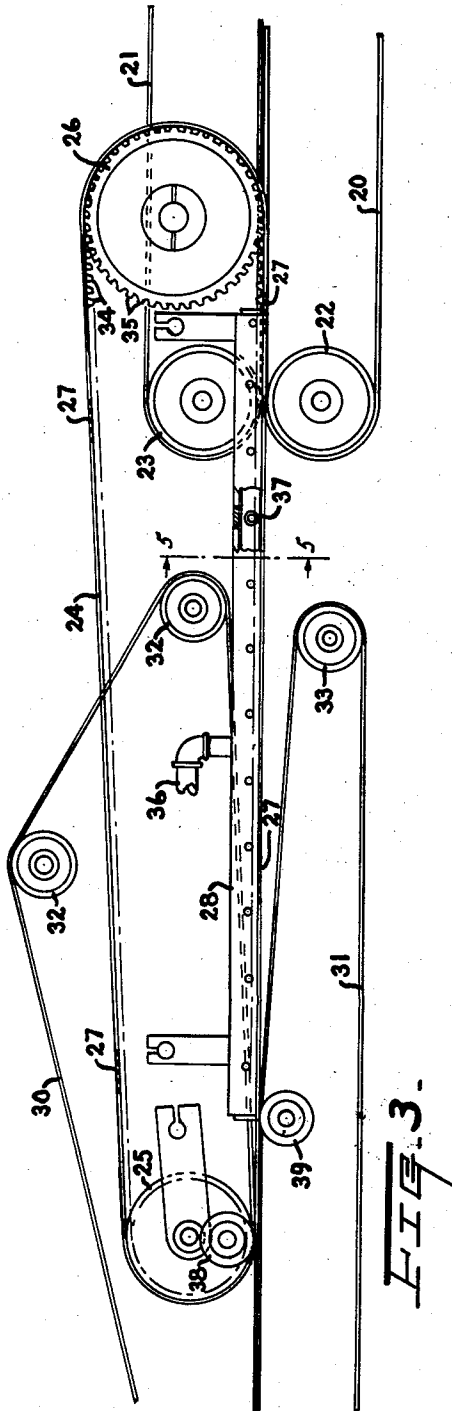
E. S. FAULLS, JR., ET AL

2,852,256

ART OF DELIVERING FLEXIBLE SHEETS

Filed Sept. 9, 1955

2 Sheets-Sheet 2



INVENTORS
E. S. Faulls, Jr.
BY H. A. Rusch
Lieber & Lieber
ATTORNEYS.

1

2,852,256

ART OF DELIVERING FLEXIBLE SHEETS

Everett S. Fauls, Jr., Whitefish Bay, and Kenneth A. Rusch, West Allis, Wis., assignors to Milprint, Inc., Milwaukee, Wis., a corporation of Delaware

Application September 9, 1955, Serial No. 533,305

8 Claims. (Cl. 271—76)

The present invention relates generally to improvements in the art of handling sheet materials, and relates more particularly to the provision of an improved method of delivering flexible sheets from a web cut-off device to a stacker and to an improved apparatus for performing the method.

A primary object of the invention is to provide an improved method of continuously delivering and neatly stacking successive sheets of flexible packaging material or the like in a most expeditious and economical manner with the aid of relatively simple, inexpensive and highly efficient automatically operable apparatus.

It is common practice in the printing and packaging industry to print desired indicia in repeated patterns on a continuous web of wrapping or packaging material and to thereafter transversely sever the web between the repeated patterns to provide successive printed wrapper sheets or the like adapted for subsequent use in protectively confining diverse commodities. Since many of these printed commodity wrappers presently in use are fabricated of various types of thin plastic films, the successive sheets are exceedingly difficult to handle after cutting due largely to the thinness of the sheets and the static electricity which is generated by friction during the several printing and fabricating operations; and while commercially available apparatus has been designed for use in handling and stacking these sheets after they have been cut from the initial web, such commercially available equipment is extremely complicated and costly and in all instances comprises many mechanically actuated components which are subject to wear and require constant maintenance.

It is therefore a more specific object of the present invention to provide an improved method of and apparatus for handling flexible sheets which obviate all of the difficulties and objections attendant prior devices intended for similar purposes.

Another specific object of our invention is to provide an improved method of and apparatus for handling successive sheets of thin flexible material and for delivering the same in a most automatic and continuous manner and with utmost rapidity and efficiency from the web cut-off element to a stacker.

Another specific object of this invention is to provide an improved simple and highly effective method of continuously delivering relatively fragile sheets to a stacker in neatly stacked formation and to provide simple and relatively inexpensive apparatus for most efficiently performing the steps of the improved method.

Still another specific object of the invention is to provide an improved method of and apparatus for conveying sheets of thin flexible material rapidly away from a web cut-off device and for thereafter delivering the same in neat overlapped or shingled formation to a sheet stacking device.

An additional specific object of our present invention is to provide an improved method of delivering and stacking flexible sheets, which comprises, conveying suc-

2

cessive sheets by means of suction applied to the leading ends thereof along a pre-determined path, and thereafter releasing the suction and continuing the advancement of the sheets beyond the vicinity of suction application at a slower rate of speed to a final delivery point.

A further specific object of the present invention is to provide an improved apparatus for handling flexible sheets comprising, means for applying suction to the leading ends of successive sheets, means for advancing the suction applying means and the sheets in succession along a pre-determined path and at a definite rate of speed, and means for releasing the successive sheets from the suction applying means and for conveying the same at a slower rate of speed to a delivery point.

These and other specific objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the several features constituting the present improvement, and of the steps of the improved method and details of apparatus for performing such steps, may be had by referring to the drawing accompanying and forming a part of this specification, wherein like reference characters designate the same or similar parts in the several views.

Fig. 1 is a more or less diagrammatic side view of a typical apparatus embodying the invention and adapted to perform the several steps of the improved sheet handling method;

Fig. 2 is a diagrammatic top view of the improved apparatus with the web and cut sheets omitted therefrom for the sake of clarity;

Fig. 3 is a somewhat enlarged fragmentary side view of the sheet conveying portions of the apparatus with parts being broken away to reveal normally concealed structure;

Fig. 4 is a similarly enlarged fragmentary side view of the delivery end of the apparatus showing sheets being delivered to a stacker;

Fig. 5 is an enlarged transverse section through one of the suction boxes and suction belt taken along the line 5—5 of Fig. 3;

Fig. 6 is an enlarged fragmentary side view of one of the suction boxes and belt, a portion of the side wall of the suction box being broken away to reveal normally concealed structure; and

Fig. 7 is an enlarged fragmentary top view of one of the suction belts.

While the improvements have been shown and described herein as being particularly applicable to the delivery of flat sheets of thin flexible wrapping material from a web cut-off device to a jogging stacker, it is not desired or intended to thereby unnecessarily limit the scope or utility of the invention, since the improvements may obviously be advantageously utilized in the handling of any flexible sheets and in conveying such sheets to any desired locality; and it is also contemplated that certain specific descriptive terms used herein shall be given the broadest possible interpretation consistent with the disclosure.

In accordance with our improved method of delivering and stacking flexible sheets as they are cut from a continuous web, the successive sheets are advanced in flat condition and at relatively high speed in spaced relationship along an approximately horizontal rectilinear path away from the cut-off device. Thereafter, the leading ends only of the successive advancing sheets are subjected on at least one side to suction transversely across each sheet while the trailing ends of the sheets are permitted to fall away from the horizontal path, and the advancement of the spaced sheets in succession is continued with the aid of the suction at approximately the same high rate of speed as the sheets are conveyed away from the cut-off device. Finally, the suction is released from the suc-

cesive sheets and the advancement thereof is continued beyond the vicinity of suction application at a sufficiently slower rate of speed than previously to permit overlapping of the successive sheets and final delivery to a stacker in overlapped or shingled condition. To finally align the sheets in vertical condition within the stacker, the stacker is reciprocated toward and away from the delivery point in a well known manner, and the stacked sheets are then ready for shipment or use.

Referring to the drawing, the improved sheet handling device has been shown as advantageously utilized in delivering successive sheets 10 of thin flexible wrapping material from a conventional web cut-off device 11 to a jogging stacker 12 which may also be of conventional design and which reciprocates longitudinally to neatly stack the sheets delivered thereto. The cutter 11 is driven in the usual manner by a suitable motor 13 and operates to transversely sever the successive sections or sheets 10 from a continuous web 14 which may be printed with repeated designs and which is fed to the cutter 11 from a supply roll 15 by suitable feed rolls 16 driven by a positive infinitely variable drive connected with the motor 13 and with one of the feed rolls 16.

The improved sheet handling apparatus comprises, in general, means such as a pair of cooperating endless belts 20, 21 driven at a relatively high rate of speed by one or more of their sheaves or pulleys 22, 23 so as to rapidly draw the successive sheets from the cut-off device 11 and separate the same to advance the sheets 10 in spaced succession along a definite path; means consisting preferably of an endless belt 24 driven about the sheaves 25, 26 in a suitable manner at approximately the same high rate of speed as the belts 20, 21 with the lower run of the belt 24 movable in an approximately horizontal plane, the belt 24 being provided with spaced sets of perforations 27 and the lower run thereof being movable directly beneath means, such as a downwardly open suction or vacuum box 28, to thereby apply a suction to the lower run as the belt is advanced so as to cause the leading ends of the successive sheets 10 to cling to the belt and convey the same with the belt 24 along the lower run thereof beneath the suction box 28 as the belt is driven; and means such as a pair of cooperating endless belts 30, 31 suitably driven about their respective sheaves 32, 33 at a slower rate of speed than the belt 24 with the cooperating adjacent runs converging gradually toward the lower run of the belt 24 and then being movable in face-to-face relationship along an approximately horizontal plane for releasing the leading ends of the successive sheets 10 from the perforated portions of the suction belt 24 and for conveying the sheets 10 in overlapped condition to a delivery point.

All of the sheaves and belts may be driven in a suitable manner as by means of chains and sprockets from the motor 13 as shown with the vacuum or suction belt 24 being driven in timed relation with the cutter 11 so that the leading end of each sheet or wrapper section 10 is fed to the belt at the same moment as one of the perforated portions 27 of the belt 24 as shown. Also, to insure against slippage of the vacuum belt 24, this belt is of special construction as shown in Figs. 3, 5, 6 and 7 with a series of special gear teeth 34 being provided on each side of the belt for cooperation with the gear teeth 35 of the drive sheave 26. The vacuum or suction box 28 is substantially enclosed along its sides, ends and top and communicates with a suitable source of vacuum, not shown, through a conduit 36; and to maintain the lower run of the belt 24 in its horizontal plane and prevent the same from being drawn into the open bottom of the suction box 28, a suitable series of spaced rollers 37 are preferably provided throughout the length of the suction box. As previously indicated, the belts 30, 31 are driven about suitable sheaves or pulleys 32, 33 respectively with the adjacent runs of the belts 30, 31 converging gradually toward each other in the direction of advancement and

then leveling off in face-to-face relation along a horizontal path extending beyond the lower run of the belt 24, and to provide for such convergence of the belts 30, 31 a pair of cooperating nip rolls 38, 39 respectively may be provided. The rate at which the belts 30, 31 are driven is extremely important since these slow speed delivery belts must be advanced at a sufficiently slower rate of speed than the rate of speed at which the belt 24 is driven so as to permit the leading ends of the successive sheets to advance to a position overlapping the trailing end of the next succeeding sheet as shown, the sheets being thus overlapped as they enter the delivery portion of the adjacent runs of the belts 30, 31 and are delivered thereby in overlapped or shingled condition to the stacker 12. It is of course obvious that the widths of the several delivery belts may be varied depending upon the sizes of the sheets being operated upon, and as shown in Fig. 2 of the drawing, any number of laterally spaced belts 20, 21, 24, 30, 31 may be utilized dependent also upon the type of material and the sizes of the sheets being handled.

From the foregoing detailed description it is believed apparent that the present invention contemplates the provision of an improved method of and apparatus for handling flexible sheets in a most expeditious and economical manner and with utmost rapidity. The improved apparatus is extremely simple and inexpensive as well as highly efficient in delivering flexible sheets from a web cut-off device in overlapped condition to a point of delivery such as the stacker 12, and the need for complicated equipment with a large number of mechanically movable parts requiring precision machining and operation is obviated by the present apparatus. The improved method and apparatus enable efficient handling of successive sheets of thin flexible material such as plastics in a most automatic and continuous manner without damage to the sheets being handled and with a minimum number of working parts with the sheets being delivered in neatly overlapped or shingled formation to the point of final delivery. As indicated, the apparatus may, of course, be modified so as to adapt the same to sheets of different sizes and to accommodate for a greater or lesser degree of overlap of the successive sheets as finally delivered. However, it is important to remove the sheets 10 from the cutting zone in rapid order and in spaced condition and to deliver the same by means of the vacuum belt 24 at a high rate of speed to the slow speed delivery belts 30, 31 which must be operated at a sufficiently slower rate of speed than the belt 24 so as to permit overlapping of the successive sheets. The improved method and apparatus have proven highly satisfactory in actual use, and the machines built to perform the steps of the improved method are far less costly than other presently available equipment intended for the same purpose and furthermore require far less maintenance than such commercially available apparatus.

It is not desired or intended to limit this invention to the exact steps of the method or to the precise details of construction of the apparatus herein shown and described, since various modifications within the scope of the appended claims may occur to persons skilled in the art to which this invention pertains.

We claim:

1. The method of delivering and stacking flexible sheets, which comprises, advancing successive spaced sheets in flat condition and at relatively high speed along an approximately horizontal rectilinear path, subjecting the leading ends only of the successive advancing sheets to suction while the trailing ends thereof fall down and away from said horizontal path by force of gravity and continuing the advancement of the sheets in succession with the aid of said suction at the same high rate of speed, and finally releasing the suction from the successive sheets and continuing the advancement thereof beyond the zone of suction application at a slower rate of speed in end overlapping condition to a delivery point.

5

2. The method of delivering and stacking flexible sheets, which comprises, advancing successive sheets along a predetermined approximately horizontal path, subjecting the leading ends only of the successive advancing sheets to suction applied from above, continuing the advancement thereof at relatively high speed with the aid of suction while the trailing ends of the sheets fall down and away from the horizontal path by force of gravity, and finally releasing the suction from the sheets and continuing the advancement thereof beyond the zone of suction application at a slower rate of speed to a delivery point.

3. The method of delivering and stacking flexible sheets, which comprises, advancing successive spaced sheets in flat condition and at relatively high speed along an approximately horizontal rectilinear path, subjecting the leading ends only of the successive advancing sheets to suction transversely thereacross while the trailing ends thereof fall down and away from said horizontal path by force of gravity and continuing the advancement of the spaced sheets in succession with the aid of said suction at the same high rate of speed, and finally releasing the suction from the successive sheets and continuing the advancement thereof beyond the zone of suction application at a sufficiently slower rate of speed to permit overlapping of the successive sheets for final delivery in overlapped condition.

4. Apparatus for handling flexible sheets comprising, means driven at a relatively high rate of speed for advancing sheets in spaced succession along a predetermined path, means for applying suction to the upper surfaces of the leading ends only of the successive spaced sheets to grip the same, means for advancing said suction applying means and said successive spaced sheets along a predetermined path at approximately the same high rate of speed, means for positively releasing the leading ends of the successive sheets from said suction applying means, and means for driving said releasing means at a sufficiently slower rate of speed to permit overlapping of the ends of adjacent sheets and final delivery thereof in such overlapped condition.

5. Apparatus for handling flexible sheets comprising, an endless belt, means for drawing a suction through the lower run of said belt at longitudinally spaced intervals to cause the leading ends only of successive sheets to cling to said belt, means for driving said belt to convey said sheets in succession along a predetermined path at a given rate of speed, and belt means driven at a slower rate of speed than said endless suction belt for releasing the successive sheets from said suction belt and for conveying the same in overlapped condition to a delivery point.

6. Apparatus for handling flexible sheets comprising, means driven at a relatively high rate of speed for advancing sheets in spaced succession along a predetermined path, an endless belt having its lower run movable in an approximately horizontal plane, said belt being provided with spaced groups of perforations, means for applying suction to the lower run of said belt to cause

6

the leading ends only of the successive sheets to cling to said belt within the zones of said perforations, means for driving said belt at approximately the same high rate of speed as that at which the sheets are fed thereto to convey said successive spaced sheets with the lower run of said belt, and a pair of cooperating endless belts driven at a slower rate of speed for releasing the leading ends of the successive sheets from said suction belt and for conveying the same in overlapped condition to a delivery point.

7. Apparatus for handling flexible sheets comprising, means driven at a relatively high rate of speed for advancing said sheets in spaced succession along a predetermined path, a pair of laterally spaced endless belts having the lower runs thereof movable in a common approximately horizontal plane, said belts being provided with similarly spaced groups of perforations, means for positively simultaneously driving said belts at approximately the same high rate of speed as that at which the sheets are fed thereto, means for applying suction to the lower runs of said belts to cause the leading ends only of the successive sheets to cling to said belts within the zones of said perforations to thereby convey said sheets with the lower runs of said belts, and a pair of cooperating endless belts driven at a slower rate of speed for positively releasing the leading ends of the successive sheets from said suction belts and for conveying the same in overlapped condition to a delivery point.

8. Apparatus for handling flexible sheets comprising, means driven at a relatively high rate of speed for advancing said sheets in spaced succession along a predetermined path, a pair of laterally spaced endless belts having the lower runs thereof movable in a common approximately horizontal plane, said belts both being provided with similarly spaced groups of perforations, means for positively simultaneously driving said belts at approximately the same high rate of speed as that at which the sheets are fed thereto, means for applying suction to the lower runs of said belts to cause the leading ends only of the successive sheets to cling to said belts within the zones of said perforations to thereby convey said sheets with the lower runs of said belts, and opposed sets of cooperating upper and lower endless belts simultaneously driven at a slower rate of speed and having their cooperating adjacent runs converging gradually toward the lower runs of said suction belts and then movable in face-to-face relationship for releasing the leading ends of the successive sheets from said suction belts and for conveying the same in overlapped condition to a delivery point, at least one upper release belt being positioned between said laterally spaced suction belts.

References Cited in the file of this patent

UNITED STATES PATENTS

1,077,399 Droitcour Nov. 4, 1913

FOREIGN PATENTS

338,050 Great Britain Nov. 13, 1930