July 17, 1962 L. TRENNER 3,044,772

METHOD OF AND MEANS FOR HANDLING AND STACKING FOLDED SHEETS

Filed March 11, 1960 2 Sheets-Sheet 1

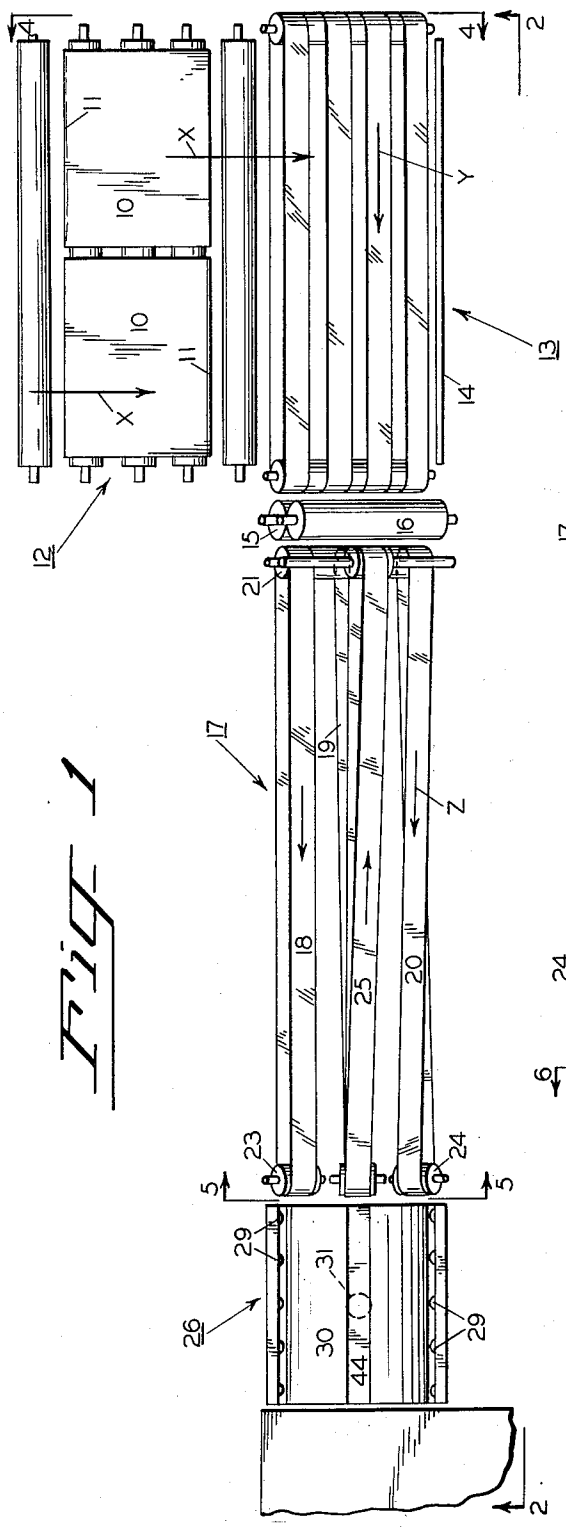


Fig. 1

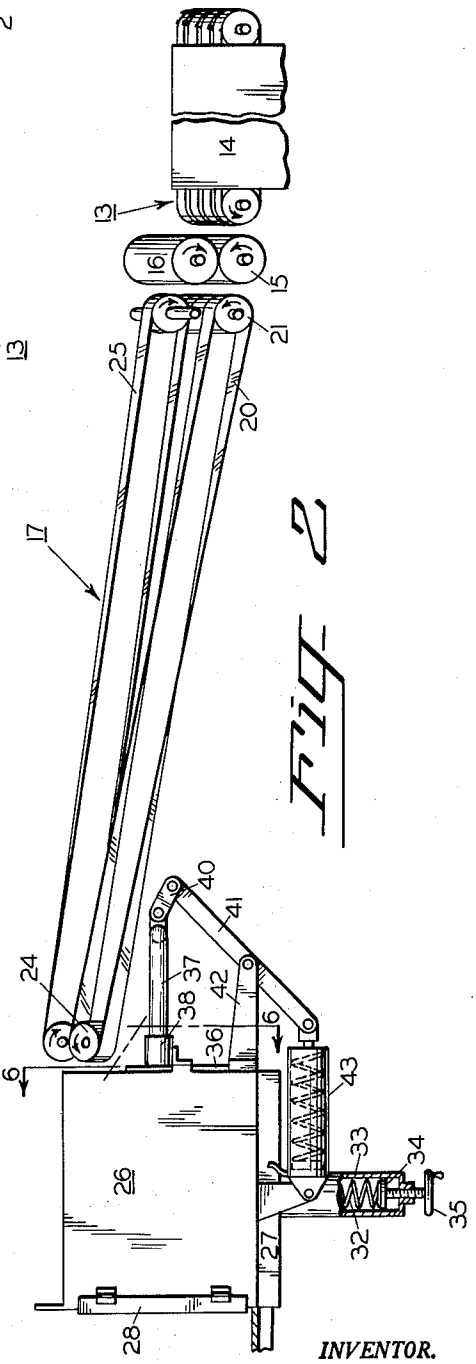


Fig. 2

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Filed March 11, 1960 2 Sheets-Sheet 2

Fig. 3

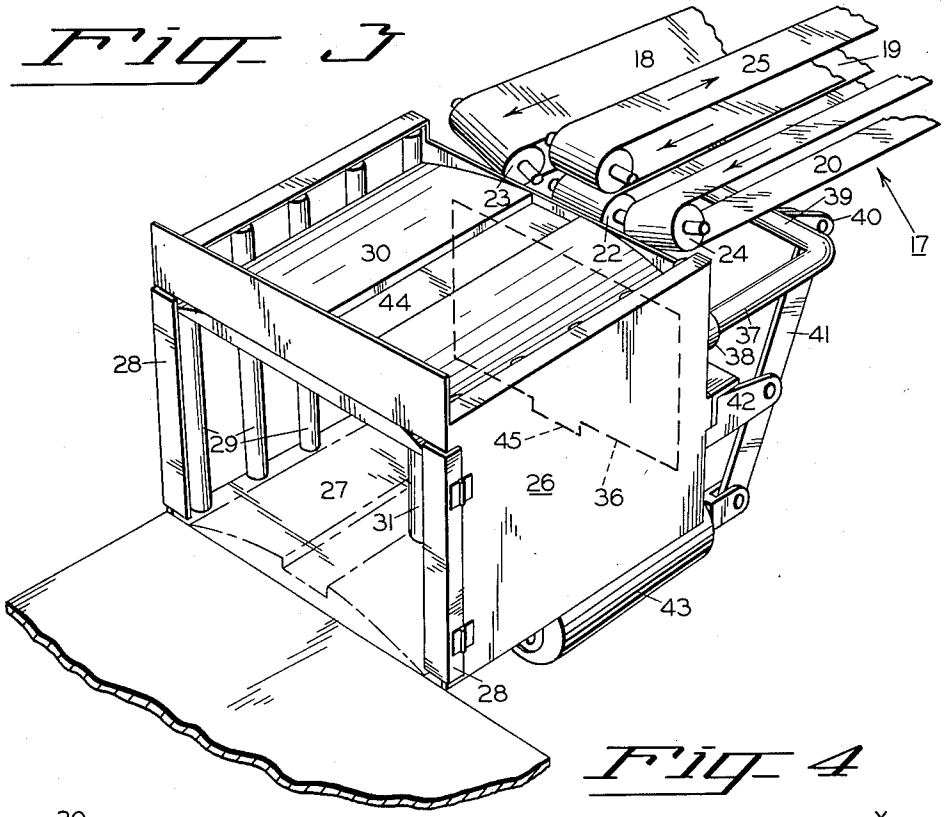


Fig. 4

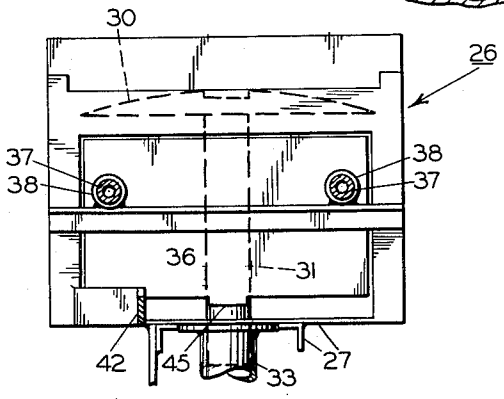


Fig. 6

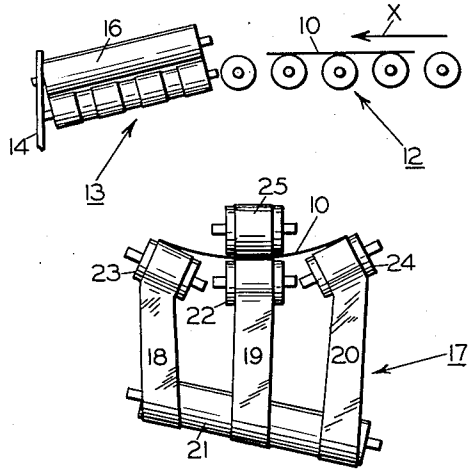


Fig. 5

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3,044,772

METHOD OF AND MEANS FOR HANDLING AND STACKING FOLDED SHEETS

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2 Claims. (Cl. 271—68)

This invention relates to the transferring and stacking of folded sheets of material, and, in particular, to sheets of paper which have been folded over once on a center fold.

The object of the invention is to provide improved method and means for transferring the sheets from the cutting and folding machines and arranging the sheets in stacks of predetermined size, or of a predetermined number of folded sheets, for subsequent packaging.

Another object of the invention is to provide improved method and means for the handling and stacking of folded sheets in which the entire operation will be largely automatic, requiring no manual handling of the folded sheets from the time they leave the cutting and folding machines until they have been deposited into stacks of desired size, and requiring only a minimum amount of attention on the part of the supervising operator.

A further object of the invention is to provide simple and practical means for handling and transferring the folded sheets which will, during the transferring of the same, cause the fold in each sheet to be completed by a pressing action so as to enable the resulting stacks of folded sheets to be more compact.

One of the common problems encountered in the handling and stacking of folded sheets is the tendency for the sheets upon folding to curl in parallelism with the folded edge, instead of remaining perfectly flat, and also, when arranged in stacks, to cause the side edges of the stacks, corresponding to the folded edges of the sheets, to build up excessively, thus making the stacks less stable and more difficult to handle and to package. An additional object of the present invention accordingly is to provide means for overcoming this tendency on the part of folded sheets to a considerable extent so that they will remain substantially flat when deposited in the desired stacks and will cause only a minimum amount of "build up" along the side edges of the completed stacks.

Other objects and advantages attained through the medium of the present invention will become apparent from the following brief description and explanation in which reference is made to the accompanying drawings.

In the drawings:

FIG. 1 is a top plan view, more or less diagrammatic, of the device employed in the carrying out of the invention, illustrating the course followed by the folded sheets from the time they leave the cutting and folding machines until they are deposited in a desired stack;

FIG. 2 is a fragmentary elevation, also largely diagrammatic, of the device taken on the line 2—2 of FIG. 1, with the various supports for the different portions of the device omitted;

FIG. 3 is a fragmentary perspective view, drawn to a larger scale, of the end portion of stacker portion of the device;

FIG. 4 is a fragmentary elevation taken on line 4—4 of FIG. 1;

FIG. 5 is a fragmentary transverse section on line 5—5 of FIG. 1; and

FIG. 6 is a fragmentary sectional elevation taken on line 6—6 of FIG. 2.

Referring to FIG. 1, the reference characters 10, 10 indicate a pair of identical sheets which have been discharged from a pair of cutting and folding machines (not shown) after being folded over on a transverse center fold line, which fold line is indicated at 11 in each of the sheets. The machines by which the paper is cut and folded are standard type and are not shown or described since they form no part of the present invention. It will be noted however that the folded over edges 11, 11 are at opposite sides of the respective sheets, for a reason which will be apparent later, but such opposite arrangement of delivered sheets from folding machines is also old in the art.

The folded sheets 10, 10, upon leaving the folding machines, are carried along simultaneously on an endless conveyor assembly, indicated as a whole by the reference character 12 and consisting of a plurality of identical endless belts moving in the direction indicated by the arrows X in FIG. 1.

The conveyor assembly 12 deposits the sheets on a second conveyor assembly 13 travelling in a direction extending at 90° with respect to the direction of travel of the first conveyor 12, and thus the endless belts comprising this second conveyor 13 move from right to left as viewed in FIGS. 1 and 2 and as indicated by the arrow Y. In consequence, the course of travel of the folded sheets 10 is changed 90° when the sheets arrive at this second conveyor 13. Furthermore the second conveyor 13, instead of being arranged on a transversely level plane, as is generally customary with endless conveyors, is arranged on a transversely sloping plane, as shown most clearly in FIG. 4, the conveyor sloping transversely downwardly in the direction in which the sheets are moving when they reach this conveyor. As a result, the sheets delivered onto the conveyor 13 immediately slide downward on the conveyor until they reach a bottom stop 14 which extends parallel to the direction of travel of the conveyor 13. The purpose of this stop 14 and of the transverse slope in which the conveyor 13 is arranged, is, as evident, to cause the edges of the sheets to be brought into correct alignment longitudinally with respect to the new direction in which the sheets will now be caused to travel.

As the pair of folded sheets are moved along the stop 14 from right to left (as viewed in FIGS. 1 and 2) on the conveyor 13 each folded sheet in turn is brought into engagement with a pair of rotating press rolls 15 and 16 and is gripped between these rolls. These rolls are rotated in unison in opposite directions by suitable means (not shown), the lower roll 15 being driven counterclockwise (as viewed in FIG. 2) and the upper roll 16 being driven clockwise. The axes of these two press rolls, instead of being horizontal, slope in parallelism with the conveyor 13 and thus continue the travel of the folded sheets consecutively without any twisting or bending of the sheets delivered by the conveyor 13. The main purpose of these press rolls is to flatten out the crease in each sheet and thus complete the folding and creasing of the sheets, since the initial creasing received by the sheets in the folding machines generally does not produce as tight a crease as is desirable for the efficient stacking of the folded sheets.

From these press rolls the folded sheets are delivered consecutively onto a third conveyor, indicated in general by the reference character 17 in FIGS. 1 and 2. The purpose of this third conveyor is to return each folded sheet into more nearly horizontal position for discharging onto a stack, and also to bend the sheets slightly into a concave form on an axis of curvature in parallelism with the creased edge, the reason for which will be presently apparent.

The conveyor 17 includes a plurality of sheet-supporting endless belts; thus, in the preferred example shown in the drawings, there are three sheet-supporting endless belts 18, 19 and 20 (see also FIGS. 3 and 5). These belts

are driven in unison by suitable means (not shown) in the direction indicated by the arrow Z. At the right hand end of this conveyor (as viewed in FIGS. 1 and 2) these belts pass around a common drive roller **21**, positioned in substantially the same inclined plane as the lower press roll **15**. However at the opposite or left hand or discharging end of this conveyor these belts pass around separate rollers the axes of which are arranged in angularity with respect to each other. Thus the center belt (FIGS. 3 and 5) passes around a roller **22**, the axis of which is substantially horizontal; the belt **18** passes around a roller **23**, the axis of which is inclined slightly upwardly from the adjacent end of the axis of roller **22**; and the belt **20** passes around an end roller **24**, the axis of which is similarly inclined upwardly but in the opposite direction from the adjacent end of roller **22**. Consequently at its discharging end this third conveyor **17** presents a substantially concave supporting surface to each of the sheets being carried along on the conveyor.

In order to hold each sheet on this conveyor **17** and to cause the sheet to bend down and conform substantially to the concave supporting surface presented as the sheet approaches the discharging end of the conveyor, an upper central belt **25** is positioned above and parallel to the central lower belt **19** throughout its extent and is driven in unison with the other belts of the conveyor. The conveyor **17** discharges the sheets consecutively onto a stacker indicated as a whole by the reference character **26** and now to be described.

The stacker **26** includes a base **27**, supported in any suitable manner (not shown), an open rectangular frame consisting of upright angle iron members **28** at the four corners, and top frame members on all four sides. The area of the open interior of the stacker is preferably only slightly larger than the size of the folded sheets. Spaced vertical guide rolls **29** form two sides of the frame. A platform or platen **30** is movable up and down within the frame, the four angle iron corner members **28** of the frame serving as a guideway for this movable platen **30**. The platen is supported on a center pedestal **31** which slides in a bearing aperture in the base **27**, and the bottom end of the pedestal rests on the top end of a coil spring **32** contained in a cylindrical housing **33**. The tension of this spring **32** is such that, when no papers rest on the platen, the platen will be in its extreme upper position (as shown in full lines in FIG. 3), but, as the papers are deposited on the platen, the platen will be gradually pushed down under the weight of the papers against the force of the spring, reaching its extreme lower position under the weight of the papers when the stack of papers on the platen has reached the desired size or height. The bottom of the spring **32** rests on a disc **34** which is adjustably positioned by an adjusting screw **35**, thus enabling the tension of the spring **32** to be adjusted when required.

The top surface of the platen **30** preferably is convex, as illustrated in FIG. 3, so as to cause the papers deposited on the platen from the conveyor **17** to bend oppositely from the bend given them in the discharging end of the conveyor **17**. This reverse bending or bowing of the papers produces a final tendency for the papers to lie entirely flat when discharged from the stacker, making each stack of papers more compact, more stable and more easily packaged.

A vertical ejection plate **36** is normally positioned in the rear side of the stacker frame and is supported by a pair of bracket arms **37** secured to the rear face of this plate **36** and slidable in stationary tubular bearing supports **38**. A cross bar **39** connects the rear ends of these bracket arms. A link **40** connects the cross bar **39** to the upper end of a lever **41**, which lever is pivoted on a fixed support **42**. The bottom end of the lever **41** is connected to the piston rod of a spring-loaded piston in an air cylinder **43** hingedly mounted below the base of the stacker. Preferably the top face of the platen **30** is

formed with a central longitudinal slot **44** and the bottom edge of the ejection plate **36** is formed with a guide tongue **45** adapted to enter and slide in the slot **44** when the plate is in extreme lowered position and the ejection plate is moved forwardly for thrusting a stack of sheets from the stacker.

When a stack of folded sheets has been deposited on the platen **30** and the platen **30** has been pushed down to its lowermost position under the weight of the folded sheets, the actuation of the air cylinder causes the ejection plate **36** to move forwardly and push the entire stack off of the platen end and onto a wrapping sheet on an adjoining counter or onto a suitable transfer table.

The actuation of the air cylinder **43** and air piston may be controlled through any one of several means (not shown). For instance, this may be controlled by a push button switch manually pressed down by the operator when the stack on the platen has been completed; or this may be controlled automatically by a contact switch engaged by the platen when the platen reaches its lowermost position, the switch momentarily opening a valve to allow compressed air to pass into the cylinder; or this could be controlled by a switch located at the discharging side of the paper cutting and folding machine so arranged to close a contact automatically when a predetermined number of sheets had consecutively engaged the switch in moving onto the device.

Various modifications in the construction of the different parts of the device would be possible without departing from the general principle of the operation of the invention or from the scope of the described method. While FIGS. 1 and 2 show a pair of folded sheets **12** being delivered simultaneously onto the second conveyor **13** it would of course be possible to vary this number. The conveyors **13** and **17** would obviously have to operate at proper speed to handle the sheets at the rate they are delivered onto the conveyor **13**.

I claim:

1. The improved method of forming a succession of identical sheets, which have been folded over on themselves with a single fold, into a compact stack of desired size, the improved method consisting in delivering the folded sheets successively onto a conveyor in such position that the folded edges of alternate sheets and the edges opposite the folded edges of the other sheets will be on the same side of said conveyor, bringing said folded edges and said opposite edges of said sheets to a predetermined line on said conveyor parallel to the direction of travel of said sheets on said conveyor, passing said sheets consecutively through press rolls at the end of said conveyor to flatten out the fold crease in each sheet, passing said sheets from said press rolls onto a second conveyor moving in the same direction as said first mentioned conveyor, gradually causing each folded sheet to become upwardly bowed on said second conveyor prior to its discharge from said second conveyor, discharging said sheets from said second conveyor onto a stacker having a vertically movable bottom platen with a downwardly bowed top surface in order that the previous bowing given to said sheets will be temporarily reversed while said sheets are stacked on said platen, and moving the sheets off of said platen as soon as a stack of desired height has been produced, whereby the successive opposite bowing of the sheets subsequent to the pressing of the fold creases will contribute to causing the sheets in the stack to assume flat compact arrangement upon removal of the stack from said platen.

2. A device for handling a succession of identical sheets which have been folded over on themselves with a single fold, and for forming compact stacks of said folded sheets, said device comprising a conveyor arranged in a transversely sloping plane, a stop extending along on the lower side of said conveyor parallel to the direction of travel of said conveyor, means for delivering the folded sheets successively onto said conveyor with the folded edges of alternate sheets and the edges opposite the folded

edges of the other sheets engaging said stop as said sheets move along on said conveyor, press rolls receiving the consecutive sheets as discharged from said conveyor and acting to flatten out the fold creases in said sheets, said press rolls arranged with their axes parallel to the sloping plane of said conveyor and normal to the direction of travel of said conveyor, a second conveyor receiving said sheets from said press rolls, said second conveyor continuing in the same direction as said first mentioned conveyor with the receiving end of said second conveyor located in substantially the same plane as said first mentioned conveyor, the sheet supporting surface of said second conveyor becoming upwardly bowed at the discharging end of said second conveyor, means engaging the top surface of each sheet on said second conveyor to cause the sheet to become upwardly bowed in conformity with the surface of said second conveyor as the sheet is discharged from said second conveyor, a stacker assembly for receiving the sheets discharged from said second conveyor, a vertically movable stack-supporting platen in

said stacker assembly, the top surface of said platen being downwardly bowed as opposed to the upward bowing of the discharging end of said second conveyor, and means for moving the sheets off of said platen and out from said stacker assembly when the number of sheets on said platen have formed a stack of desired predetermined height, whereby the successive opposite bowing of the sheets subsequent to the pressing of the fold creases will contribute to causing the sheets in the stack to assume flat compact arrangement upon removal of the stack from said platen.

References Cited in the file of this patent

UNITED STATES PATENTS

1,831,245	Hitchcock	Nov. 10, 1931
2,157,228	Buccicone et al.	May 9, 1939
2,381,430	Belluche	Aug. 7, 1945
2,531,213	Hand	Nov. 21, 1950
2,944,685	Nicolazzi	July 12, 1960