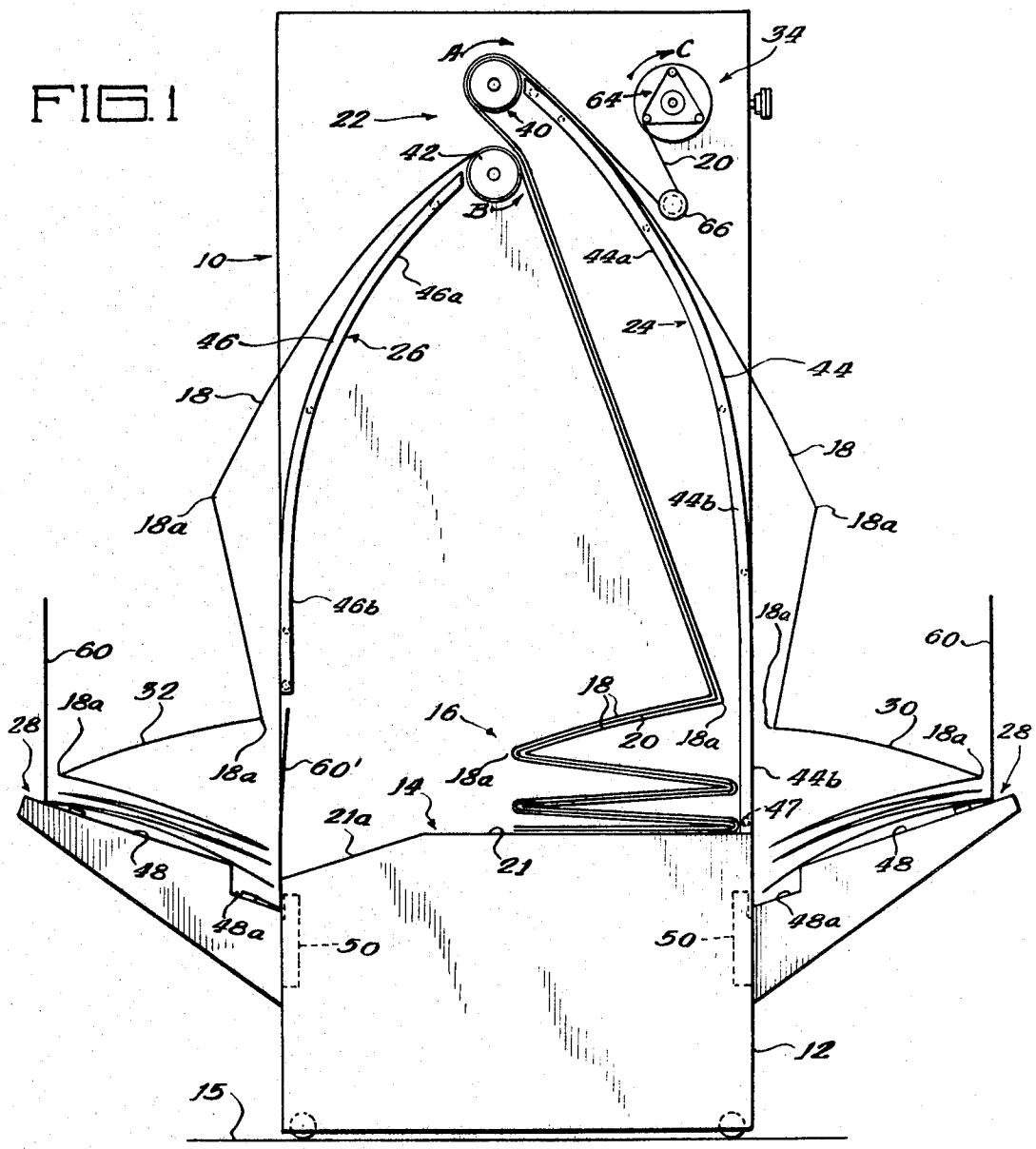
June 4, 1968 R. M. PINE 3,386,729

DELEAVER

Filed July 16, 1965 3 Sheets-Sheet 1

FIG. 1



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DELEAVER

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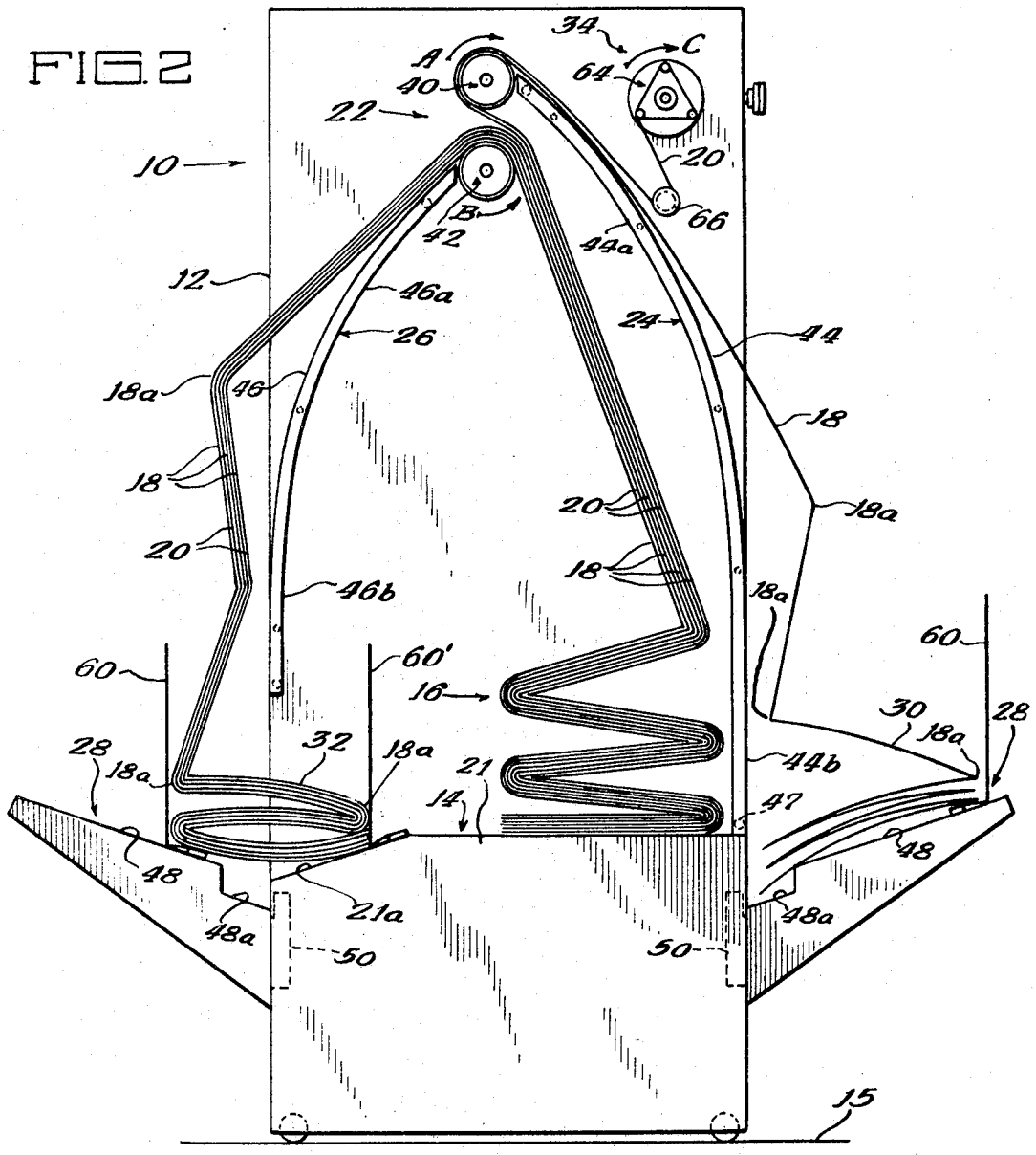
FIG. 2



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DELEAVER

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FIG. 3

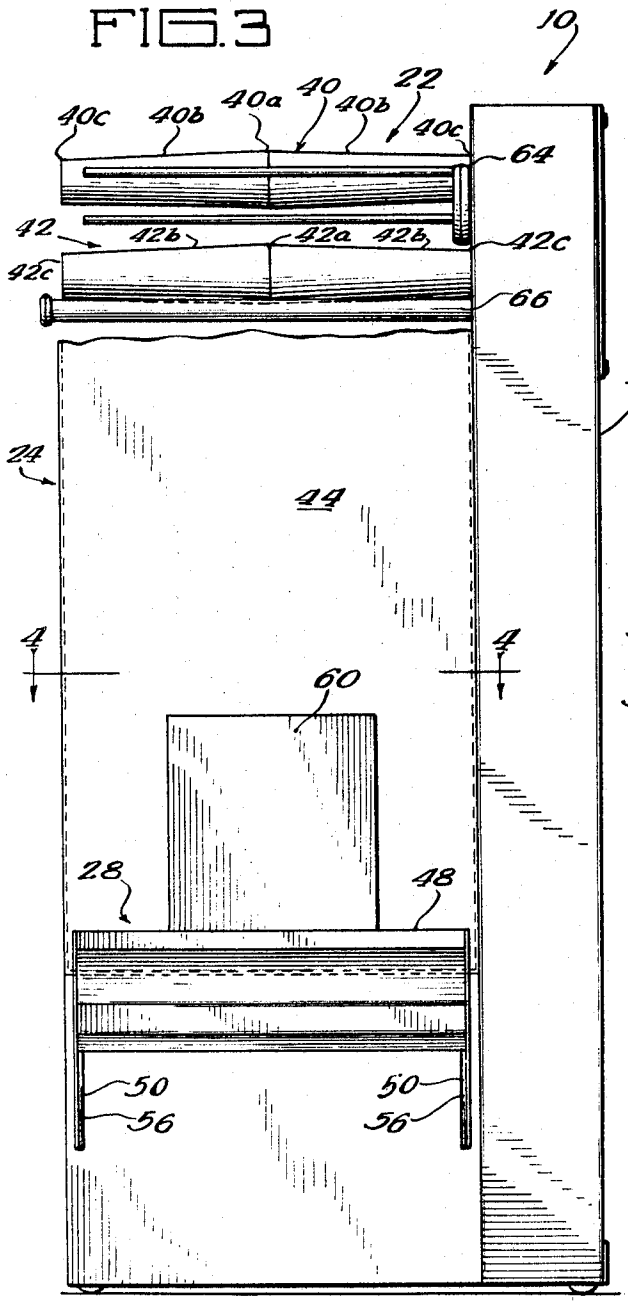


FIG. 5

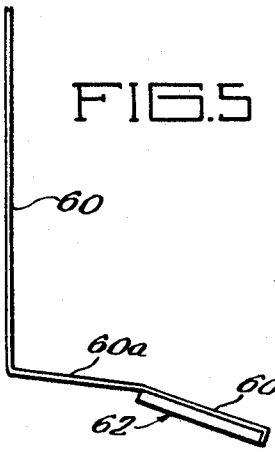
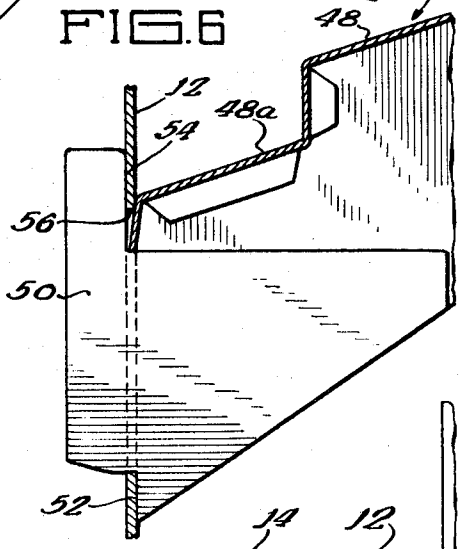


FIG. 6



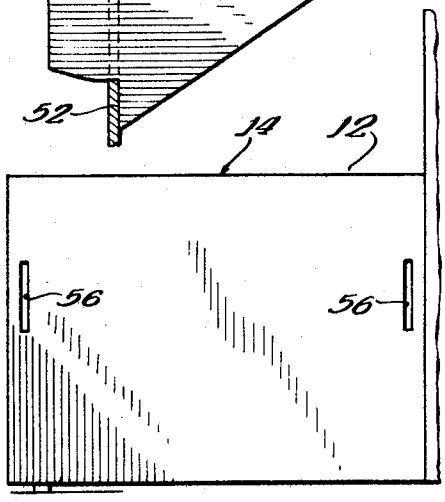
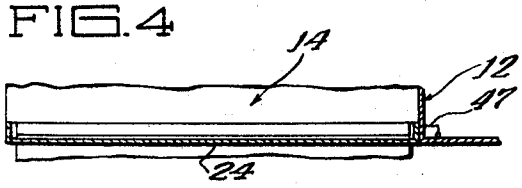


FIG. 7

FIG. 4



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DELEAVER

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19 Claims. (Cl. 270—52.5)

ABSTRACT OF THE DISCLOSURE

An improved stationery deleaver having a stack supporting surface and driving and separating rollers mounted above the stack supporting surface in vertical tandem. Arcuate paper guides extend in opposite directions downwardly away from the rollers toward angled refold shelves which are recessed at their inner ends adjacent the guides. A wrap-around bar extends across one paper guide in close proximity thereto for winding carbon thereabout to urge a separated stationery ply against the paper guide. The supporting surface has a downwardly inclined surface adjacent one refold shelf for serving as a portion of the refold shelf when multiple plies are being refolded.

This invention relates to devices for processing stationery and more particularly to a new and improved deleaver for separating and refolding zig-zag folded stacks of multiple plies of stationery.

Typically, in the deleaving process, after a ply of stationery is removed from the remainder of the stack, the ply is then refolded into a zig-zag folded stack. A great amount of time consumed in the deleaving process is spent in correcting misfolds which may occur in the refolding of the separated plies or the refolding of the remaining plies of stationery and transfer material. This is such a constant problem that increases in the speed of the machine are of little aid in accelerating the deleaving process. There are several common causes of misfold. One cause is the tendency of the refolding plies to become laterally misaligned as they descend into a refolding configuration. Another problem is the difficulty in maintaining a constant paper speed among all of the plies of stationery and transfer material as the separation of the plies takes place. A further problem is the fact that when the paper refolds into a zig-zag folded stack there is a tendency for the stack to arch upwardly and within a relatively short period of time the configuration of the stack may become so unstable and sloppy that misfolding will be self-initiated by the stationery. Furthermore, there are different conditions which make for optimum refold depending upon whether the stationery being refolded is a single ply, or whether several plies of remaining sheets of stationery and interleaved transfer material are being refolded into a single stack.

It is therefore a general object of this invention to provide a new and improved deleaver mechanism.

It is another object of this invention to provide a new and improved deleaver having novel means for encouraging proper refolding of the deleaved plies of stationery.

Another object of this invention is to provide a new and improved deleaver wherein the conditions for refolding the multiple plies of stationery may be changed

depending upon the number of remaining plies being deleaved.

Still another object of this invention is to provide a new and improved deleaver wherein the means for propelling the stationery through the deleaver is provided with means for maintaining the lateral alignment of the stationery to encourage proper refolding thereof.

Yet another object of this invention is to provide a new and improved deleaver wherein the refolded stack of undeleaved multiple plies may be properly positioned for subsequent passes through the deleaver without the necessity for lifting the remaining multiple plies from their respective refold shelf.

A further object of this invention is to provide a new and improved deleaver wherein the refold shelves are positioned on the deleaver at a slightly acute angle relative to the terminal end of the paper guide means to encourage proper refold.

Yet another object of this invention is to provide a new and improved deleaver wherein the surface to which the remaining plies are directed for refolding may be changed to accommodate the refolding of plies of different numbers.

Still a further object of this invention is to provide a new and improved deleaver for maintaining the deleaved plies of stationery adjacent the paper guide as the stationery descends to the refold stack until the stationery is directed to a point wherein gravity can naturally assist the proper refolding of the stationery.

Yet another object of this invention is to provide a new and improved deleaver wherein the stationery is supported and driven by propelling means comprising two driven rollers which are mounted in substantially vertical tandem relative to each other. A further feature of this object is that these rollers are driven at the same speed and are larger in diametral cross section at the center thereof than at the respective ends.

It is a further object of this invention to provide a new and improved deleaver mechanism for separating strips of continuous form stationery in an improved manner which prevents the misfolding of the refolded stacks of separated and remaining plies of stationery by driving the several plies of stationery at the same speed, urging the separated plies of stationery into close association with a stationery guide, to naturally direct the plies of stationery into refolded stacks on refold shelves which are slightly angled relative to the paper guides and which have surfaces for eliminating the arching of the refolding stacks of separated or remaining plies of stationery, and wherein the remaining ply refold shelf may be adapted for accommodating changes in the numbers of remaining plies of stationery to be refolded.

Other objects, features and advantages of the present invention will be apparent from the following description of the preferred embodiments illustrated in the accompanying drawings, in which:

FIGURE 1 is a side elevational view of the deleaver of this invention illustrating the deleaver in use separating plies of stationery from a zig-zag folded stack of stationery having relatively few piles of stationery and directing a separated ply and the remaining plies into refolded condition;

FIGURE 2 is a side elevational view similar to FIG-

URE 1 showing the operation of the deleaver when there are several remaining plies of stationery to be refolded;

FIGURE 3 is an end elevational view of the deleaver mechanism of this invention partially broken away to show the relationship of the rollers of the propelling and separating means and the means for rewinding the transfer material;

FIGURE 4 is a fragmentary sectional view taken along the line 4—4 of FIGURE 3;

FIGURE 5 is a fragmentary side elevational view of the end stop means used with the deleaver of this invention;

FIGURE 6 is an enlarged fragmentary sectional view showing the mounting of the refold shelf to the deleaver frame; and

FIGURE 7 is a fragmentary side elevational view of the deleaver frame showing the openings in the side of the frame for mounting the refold shelf thereon.

The deleaver **10** of this invention includes an upright frame **12** having a supporting platform **14** which extends substantially parallel to the supporting surface **15** on which the deleaver is positioned, for supporting a zig-zag folded stack of continuous form stationery **16** having multiple plies or sheets of continuous form stationery **18**. Typically each ply of stationery is divided into individual form lengths along transverse lines of weakening **18***a* about which the stationery is zig-zag folded in the stack. The plies of stationery may be interleaved with sheets of transfer material or carbon paper **20**.

The paper supporting platform **14** has a generally flat stack supporting portion **21** on which the stack is to be positioned for feeding stationery to the propelling and separating means **22**. The paper supporting platform is further provided with an outwardly and downwardly angled multiple ply refold or remaining or unseparated plies are directed. This portion of the paper supporting platform is sometimes used as a refold shelf as will be explained later.

The stack of stationery is placed on the stack supporting portion of the supporting platform for deleaving. A leading strip of the multiple plies is fed upwardly to a propelling and separating means **22** which propels the stationery through the machine and separates a deleaved ply **18** and (if present) a sheet of carbon material **20** from the remaining plies, directing the separated ply **18** and sheet **20** toward the paper guide means **24**. The remaining plies of stationery and carbon material are directed to paper guide means **26**. The separated and remaining plies are directed by their respective guide means **24** and **26**, respectively, to refold shelves **28** where they are refolded into a zig-zag folded stack of a deleaved or separated ply **30** and a stack of remaining or multiple plies **32**. Carbon rewind means **34** is provided for removing the sheet of transfer material or carbon paper which is directed to paper guide means **24** together with the separated ply.

The propelling and separating means **22** includes a pair of driven rollers **40** and **42** mounted in the frame in substantial vertical tandem relative to each other. The upper roller **40** is driven in a clockwise direction as indicated by the arrow A and the lower roller **42** is driven in a counterclockwise direction as indicated by the arrow B. The stationery is webbed so that the top ply of stationery **18** is wrapped around the upper clockwise driven roller **40** and one sheet of transfer or carbon material (if the stack is so interleaved) is wrapped about the roller **40** over the stationery ply so that the stationery ply and carbon sheet are driven and turned to the right of the machine as shown in FIGURES 1 and 2 with the carbon ply superposed over the stationery ply. The remaining plies of stationery and transfer material are webbed over the lower counterclockwise driven roller **42** and directed to the left of the machine as shown in FIGURES 1 and 2.

The rollers **40** and **42** may be driven by a motor mounted in the interior of the frame. The driving means is not shown herein for such means are notoriously old and well-known in the art. These rollers are preferably to be driven at the same speed and the combination of the vertical tandem mounting of the rollers and the driving of the rollers at the same peripheral speed contributes to the uniformity of the paper feed which, in turn, contributes to proper refold of the separated and remaining plies of stationery.

Another factor which may cause misfold of the stationery plies is the lateral misalignment of the stationery as it descends from the driven rollers. In an effort to maintain the stationery substantially upright upon its descent so that the successive portions of the stationery will strike and refold in the same general surface area, means are provided in the propelling and separating means for maintaining the paper in a given driven path. To this end, the rollers **40** and **42** are "crowned"; that is they have peripherally enlarged medial portions **40***a* and **42***a*, respectively. From the peripherally enlarged medial portions, the rollers taper downwardly and outwardly to either side such as at **40***b* and **42***b*, respectively, and terminate in end portions of reduced peripheral extent **40***c* and **42***c*, respectively.

From the propelling and separating means, the separated or deleaved ply and remaining plies are directed down the paper guide means **24** and **26**, respectively. Each paper guide means **24** and **26** includes a substantially smooth, peripherally uninterrupted, curved, paper guiding surface **44** and **46**, respectively, of sheet metal or the like. These guides include a first arcuate portion **44***a* and **46***a* which leads the paper away from a point immediately adjacent the rollers **40** and **42**, respectively, to a second terminal or substantially upright portion **44***b* and **46***b*, respectively. Preferably, the terminal end **46***b* of the paper guide means **26** terminates at a point well spaced above the refold shelf **28**. Suitable fasteners, such as rivets, bolts, or sheet metal screws **47** may be utilized to secure the paper guides to the frame of the deleaver. The configuration of the guides is such that the paper is gently and progressively led away from the propelling means and returned almost substantially 180 degrees from its original upright attitude in which is was fed into the propelling means.

The refold shelves **28** have a paper receiving surface **48** which is inclined relative to the end portions of the paper guides for encouraging proper refold of the paper. Preferably the relative angle between the refold shelf **48** and the end of the paper guides is somewhere between 70 and 90 degrees, and 82 degrees has been found to be a satisfactory angle. Furthermore, it has been found even further preferable that the refold shelf should be angled slightly upwardly with respect to horizontal. Each refold shelf is substantially coextensive in width with the paper guides presenting a flat refold surface area. The inner end of each refold shelf adjacent the frame of the deleaver is notched or recessed as at **48***a* to provide a means for reducing the arching of the refolded stacks and therefore contribute to neat and proper refolding. As can be seen in both the right and left side of FIGURE 1 and the right side of FIGURE 2, the purpose of the recess is to permit portions of the refolded stack adjacent the fold lines **18***a* to curve downwardly in the recess. Normally when deleaved stationery is refolded, it tends to arch upwardly in a concave fashion, and the provision of this notched recess permits the accumulation of a larger stack of refolded stationery.

As illustrated in FIGURES 1 and 2, as the stationery descends down the paper guide means towards the refold shelves, the weight of the stationery causes it to bend about lines of weakening **18***a*. The natural tendency, responsive to the forces of the continuous feed of the stationery as well as the pull of gravity, is for the stationery to refold in zig-zag fashion about these lines of weaken-

ing to assume a configuration substantially similar to that in the original pack 16.

The innermost end of each refold shelf 28 is provided with a pair of inwardly extending ears 50. These ears project outwardly from the inner end of the shelf from a point spaced upwardly from the bottom of the shelf, forming a rearwardly facing shoulder 52 on the bottom of the refold shelf. The ears further have a portion 54 which extends above the recess 48 and is slightly spaced inwardly therefrom to form a forwardly facing shoulder for mounting the shelf to the frame through elongate upright notches 56 which are formed in the deleaver frame. When so positioned through the notches, the shoulder portion 52 abuts the outside of the deleaver frame and the portion 54 abuts the inside of the deleaver frame so that the refold shelf is effectively mounted to the frame in a cantilever fashion for the reception of stationery.

Means are provided for limiting the outward extent of the refolding stack of stationery. This means is shown as an end stop 60 which is a substantially L-shaped member of sheet metal. The leg 60*a* of the L is slightly angled relative to the remaining portion of the end stop and at the terminal end 60*b*, there is provided a magnet 62 for removably securing the end stop to the refold shelf in a desired position. With the end stop mounted at the free end of the refold shelf, the outward extent of the descending and refolding plies of stationery is limited and the stationery is encouraged to refold within a limited distance, thus eliminating another possibility of misfold.

It is to be noted that on the remaining ply refold side of the deleaver (the left side as shown in the drawings), a stop member 60′ may be provided which has a leg portion which is bent slightly upwardly as opposed to the slightly downward bend of the leg members of the end stops 60. This stop member may occupy the space between the terminal end of the paper guide 46*b* and the recess in 48*a* of the shelf 28 to prevent the stationery from refolding to the rear and confine the stack within a given area on the refold shelf. The end stops are movable so that when several plies of stationery are being refolded, the refolding may be accomplished as shown in FIGURE 2 where the multiple plies are refolded on the mutually inwardly and downwardly inclined surfaces 21*a* of the supporting platform and surface 48 of the refold shelf. It has been found that when refolding several plies of stationery, the most effective and neat refold is accomplished in a trough, such as that formed by the surfaces 21*a* and 48. By merely moving stop members 60 and 60′ to the position shown in FIGURE 2, and directing the plies inwardly to this trough, the deleaver is readily adapted for optimum refolding of remaining plies of stationery which are several in number. Thus this deleaver is further provided with a means for adjusting the refold conditions to accommodate the number of remaining plies which are being refolded. It should be mentioned that if, because of some unusual circumstances, the refolding of the remaining plies results in misfolding, this will not impair further deleaving with the deleaver of this invention. The refolded stack may be physically shoved to the general area of the surface 21 without the need for lifting the stack by merely removing end stop 60′. The misfolded stack is then webbed through the deleaver in the same fashion as a properly folded stack and the deleaving may be continued.

The carbon rewind means 34 includes a carbon rewind reel 64 which is driven in a clockwise direction as indicated by the arrow C. As the reel is driven, the carbon is wound about the reel and collected thereon. Also included in the carbon rewind means is a carbon wrap-around bar 66 which is mounted to the frame in a position wherein it extends generally across the paper guide 24, closely spaced therefrom. The carbon sheet is webbed around the bar 66 and returned rearwardly and upwardly to the carbon rewind reel. It is to be understood that the bar 66 may be rotatable or non-rotatable as desired. This has the effect of causing the carbon sheet 20 to urge the stationery ply 18 towards the paper guide for a substantial distance of the descent of the stationery along the paper guide and thus encourages proper refolding since the carbon will urge the deleaved ply along the guide to a point wherein gravity may have a substantially full effect on the deleaved ply and tend to draw it into a proper refold orientation.

The deleaver of this invention provides a means for separating individual plies of stationery from the remaining plies of a zig-zag folded stack of stationery in such a manner as to virtually eliminate the possibility of misfolding which is the most common cause of interruption of the deleaving process. The stationery is propelled through the deleaver by a pair of substantially vertically oriented, "crowned" rollers, which are driven at the same speed; carried away from the propelling means by curved paper guides which descend away from the roller to smoothly feed the stationery in its path of descent toward the refold shelf; and held adjacent to the curved portion of the guide means by the combination of the carbon wrap-around bar and the carbon rewind means. In addition, the refold shelf is oriented relative to the terminal end of the paper guide at an angle of between 70–90 degrees which provides optimum refold performance. Furthermore, the refold shelf is recessed or notched at its inner end adjacent the deleaver to reduce the arching which prevails in refolded stacks of stationery. Finally, the portion of the machine wherein the remaining plies are refolded is so constructed as to adapt the machine for optimum refolding of a few or singular plies or for multiple plies.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as some modifications may be obvious to those skilled in the art.

I claim:

1. A deleaver for deleaving a folded stack of continuous form stationery, comprising: a frame having a stack supporting platform; means spaced from said platform for propelling stationery through said deleaver and separating the stack into separate plies; guide means on said frame extending from said propelling means to a substantially upright terminal end for guiding said plies away from said propelling means; and a refold shelf mounted adjacent the terminal end of said guide means having a substantially flat surface for receiving and refolding separated plies of stationery, said refold shelf flat surface underlying more than half of said stack, said refold shelf having a recessed surface extending from said flat surface closely adjacent said guide means.

2. The deleaver of claim 1 wherein said propelling means comprises a pair of driven rollers mounted in the frame in substantial vertical tandem relative to each other above the stack supporting platform.

3. A deleaver for deleaving a stack of zig-zag folded continuous form stationery having interleaved plies of transfer material, comprising: a frame having a stationery supporting platform; a pair of driven rollers mounted on the frame at points vertically spaced from the supporting platform, said rollers mounted in substantially vertical tandem relative to each other for propelling stationery through the deleaver and separating a ply of stationery and transfer material fom the remaining plies, one of said rollers being driven in a clockwise direction so that one ply of stationery and transfer material may be fed over said one roller and turned therefrom in one direction and the other of said rollers being driven in a counterclockwise direction so that the remaining plies may be fed over the other roller and turned in the opposite direction; a first guide means mounted on one side of the frame for guiding the separated ply of stationery and transfer material away from one roller; a second guide means mounted on the other side of the frame for guiding the remaining plies away from the other roller;

and refold shelves mounted near the terminal ends of each of said guide means for receiving and refolding the separated and remaining plies of stationery.

4. A deleaver for deleaving a stack of zig-zag folded continuous form stationery having interleaved plies of transfer material, comprising: a frame having a stationery supporting platform; means spaced from the platform for propelling stationery through the deleaver and separating a ply of stationery and transfer material from the remaining plies; first guide means mounted on said frame for guiding the separated ply and transfer material away from said propelling means; second guide means mounted on said frame for guiding the remaining separated plies away from said propelling means, each of said guide means extending from said propelling means to a substantially upright terminal end; means for disposing of said ply of transfer material including a member positioned on said frame a substantial distance from the propelling means and close to one of said guide means for urging the stationery ply toward said one guide means; and refold shelves mounted on said frame adjacent the terminal ends of said first and second guide means for receiving and refolding separated plies of stationery.

5. The deleaver of claim 4 wherein said propelling means comprises a pair of driven rollers mounted to the frame in substantial vertical tandem relative to each other.

6. The deleaver of claim 4 including means for collecting the transfer material, said transfer material collecting means having a member positioned on the frame a substantial distance from the propelling means and close to the first guide means for urging the stationery ply toward the first guide means.

7. A deleaver for deleaving a stack of zig-zag folded continuous form stationery having interleaved plies of transfer material, comprising: a frame having a stationery supporting platform; a pair of driven rollers mounted on the frame at points vertically spaced from the supporting platform, said rollers mounted in substantial vertical tandem relative to each other for propelling stationery through the deleaver and separating a ply of stationery and transfer material from the remaining plies, one of said rollers being driven in a clockwise direction and the other of said rollers being driven in a counterclockwise direction so that one ply of stationery and transfer material may be fed over one roller and turned therefrom in one direction and the remaining plies may be fed over the other roller and turned in the opposite direction; first guide means mounted on one side of the frame for guiding the separated ply of stationery and transfer material away from one roller; second guide means mounted on the other side of the frame for guiding the remaining plies away from the other roller; means for holding said separated stationery ply closely adjacent to said first guide means for a substantial distance of travel; means for disposing of said ply of transfer material; and refold shelves mounted near the terminal ends of each of said guide means for receiving and refolding separated plies of stationery.

8. The deleaver of claim 7 wherein a bar is mounted on the frame across, and closely spaced from, the first guide means at a point substantially spaced from the propelling and separating means and wherein the transfer material is separated from the stationery by being webbed about a portion of the periphery of the bar.

9. A deleaver for deleaving a stack of zig-zag folded continuous form stationery having interleaved plies of transfer material, comprising: a frame having a stationery supporting platform; means mounted on said frame spaced from said platform for propelling stationery through the deleaver and separating a ply of stationery and transfer material from the remaining plies of the stack; guide means mounted on said frame for guiding a separated ply of stationery and transfer material away from said propelling means; means for disposing of said ply of transfer material including a member positioned on said frame a substantial distance from the propelling means and close to the guide means for urging the stationery ply toward the guide means; and refold shelf means spaced from the terminal ends of said guide means for receiving and refolding said separated stationery ply.

10. The deleaver of claim 9 wherein the propelling means comprises a pair of driven rollers mounted in the frame in substantially vertical tandem relative to each other.

11. The deleaver of claim 9 wherein the means for holding the stationery ply close to the guide means includes a bar mounted on the frame across, and closely spaced from, the guide means at a point spaced a substantial distance from the propelling and separating means, the stationery ply being fed through the deleaver so as to be adjacent the guide means and transfer material being separated from the stationery by being webbed about a portion of the periphery of the bar.

12. The deleaver of claim 11 wherein the means for disposing of a ply of transfer material includes a rewind reel about which the transfer material is wrapped after it is separated from a stationery ply.

13. The deleaver of claim 12 wherein the rewind reel is generally vertically spaced from the bar so that transfer material is returned upwardly after separation from a stationery ply and wound about the rewind reel.

14. A deleaver for deleaving a stack of zig-zag folded continuous form stationery, comprising: a frame having a stationery supporting platform; means mounted on the frame and spaced from the platform for propelling stationery through said deleaver and separating a ply of stationery from the remaining plies; guide means on said frame extending from said propelling means to a substantially upright terminal end for guiding and separating remaining plies away from said propelling means; refold shelves mounted on the frame and spaced below the terminal end of said guide means adjacent the supporting platform, at least one refold shelf and adjacent portion of the supporting platform being angled downwardly towards each other to provide a trough which encourages proper multiple ply refold.

15. The deleaver of claim 14 wherein said paper guide has an arcuate paper guiding surface which extends from said propelling means to the terminal end thereof.

16. A deleaver for deleaving a stack of zig-zag folded continuous form stationery having interleaved plies of transfer material, comprising: a frame having a stationery supporting platform; a pair of driven rollers mounted on the frame at points vertically spaced from the supporting platform, said rollers mounted in substantial vertical tandem relative to each other for propelling stationery through the deleaver and separating a ply of stationery and transfer material from the remaining plies, one of said rollers being driven in a clockwise direction, and the other of said rollers being driven in a counterclockwise direction so that one ply of stationery and transfer material may be fed over one roller and turned therefrom in one direction, and the remaining plies may be fed over the other roller and turned in the opposite direction; first guide means mounted on one side of the frame for guiding the separated ply of stationery and transfer material away from one roller; second guide means mounted on the other side of the frame for guiding the remaining plies away from the other roller; means for holding said separated ply of stationery closely adjacent to said first guide means for a substantial distance of travel; means for disposing of said ply of transfer material; and refold shelves mounted on the frame adjacent the supporting platform and spaced below the terminal ends of each of said guide means for receiving and refolding separated plies of stationery, the remaining ply refold shelf and the supporting platform adjacent thereto being angled downwardly toward each other to provide a trough for encouraging multiple ply refold.

17. The deleaver of claim 16 wherein the surface of

the refold shelves is recessed adjacent the paper guide means.

18. The deleaver of claim **17** wherein said paper guides have smooth, arcuate paper guide surfaces extending from said propelling means toward the refold shelves.

19. The deleaver of claim **18** wherein the rollers are driven at the same speed.

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