

Nov. 7, 1972

C. V. HAGEMAN ET AL

**3,702,187**

APPARATUS FOR SEPARATING SIGNATURES IN A GATHERER

Filed Aug. 13, 1971

4 Sheets-Sheet 1

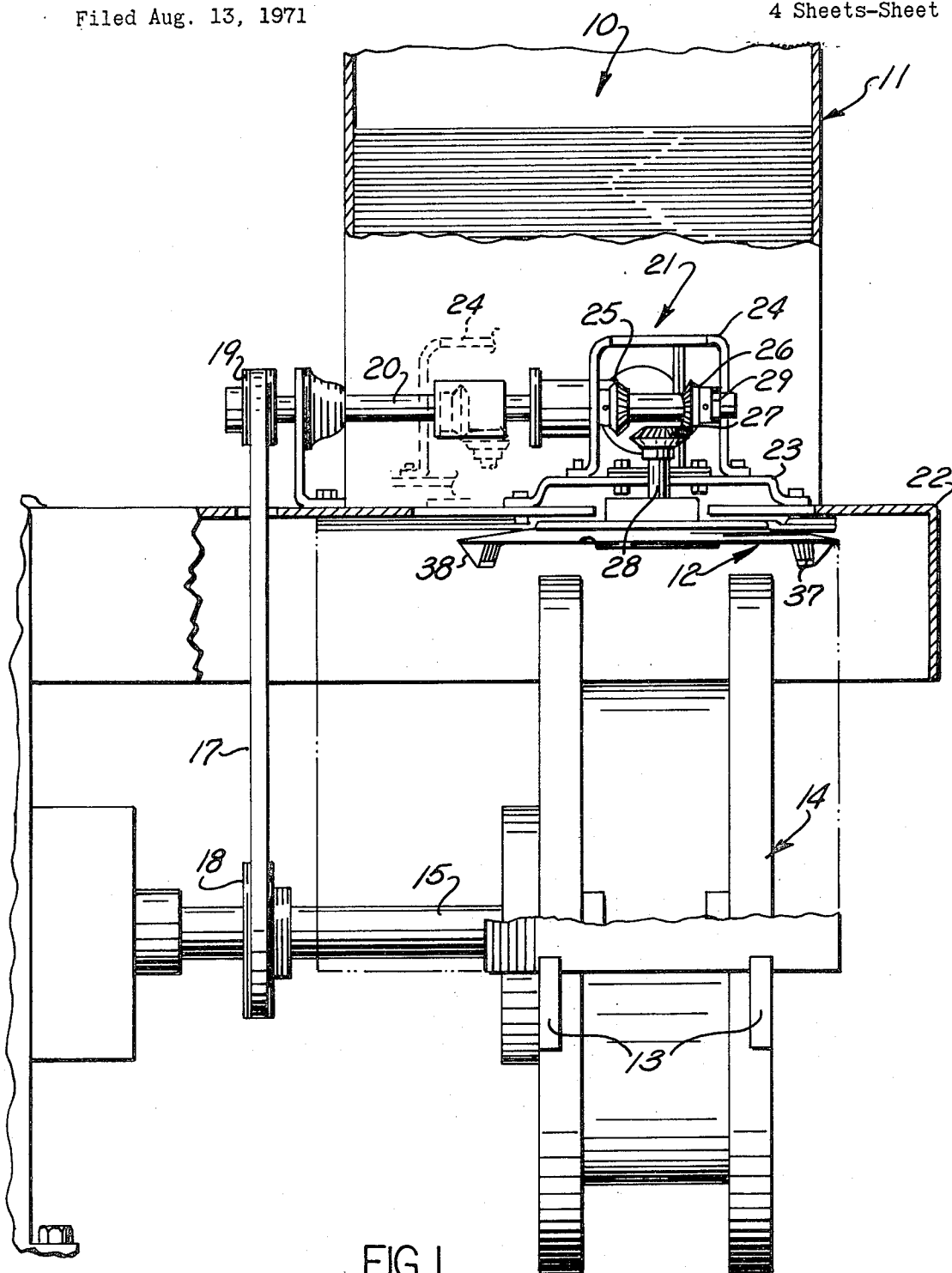


FIG. 1

Nov. 7, 1972

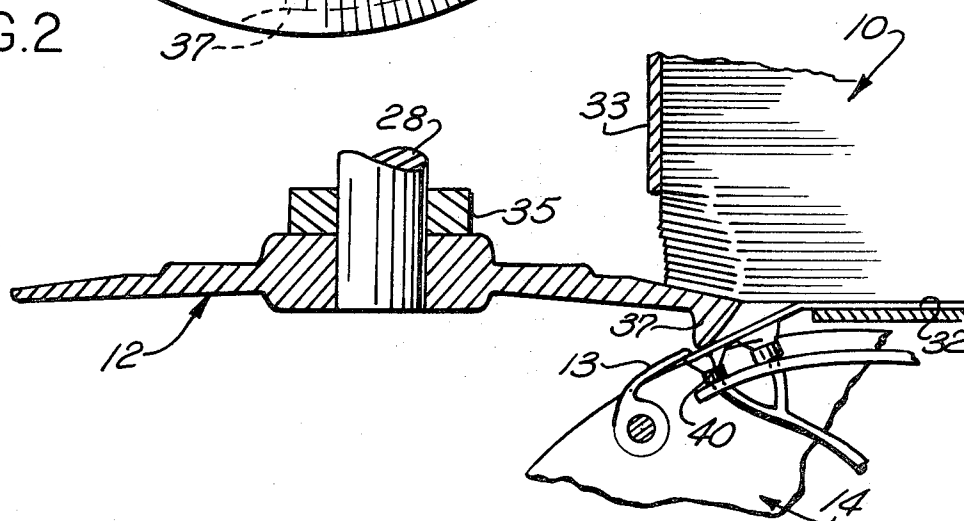
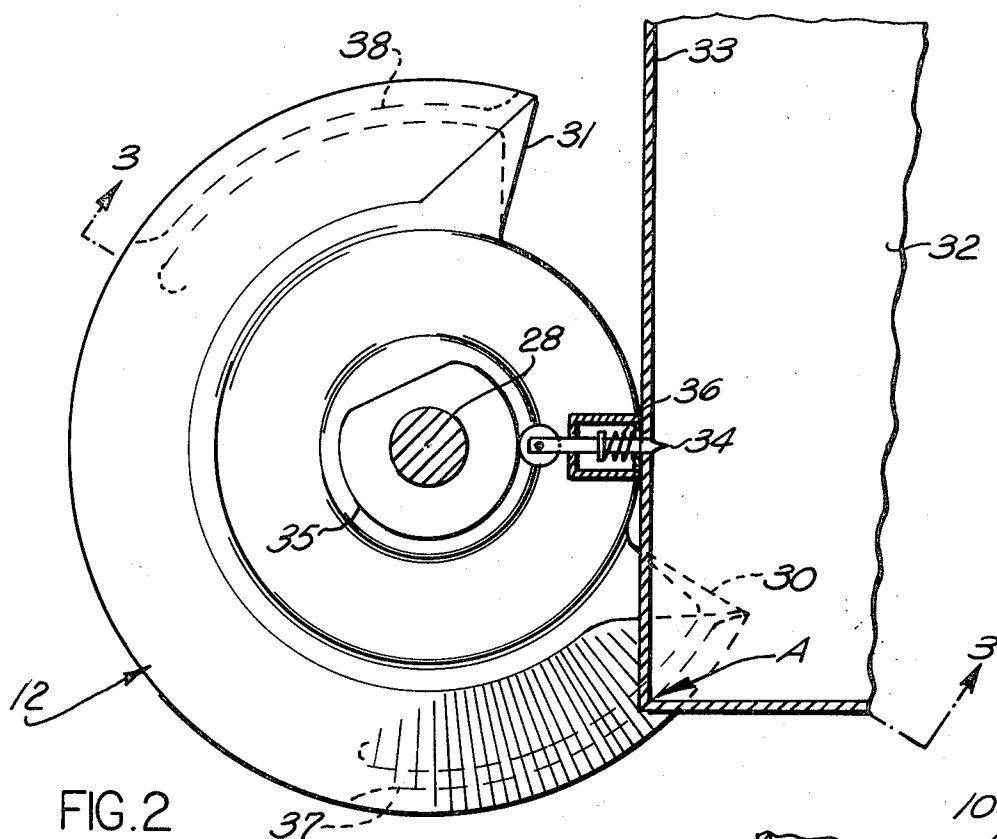
C. V. HAGEMAN ET AL

**3,702,187**

# APPARATUS FOR SEPARATING SIGNATURES IN A GATHERER

Filed Aug. 13, 1971

4 Sheets-Sheet 2



Nov. 7, 1972

C. V. HAGEMAN ET AL

3,702,187

APPARATUS FOR SEPARATING SIGNATURES IN A GATHERER

Filed Aug. 13, 1971

4 Sheets-Sheet 3

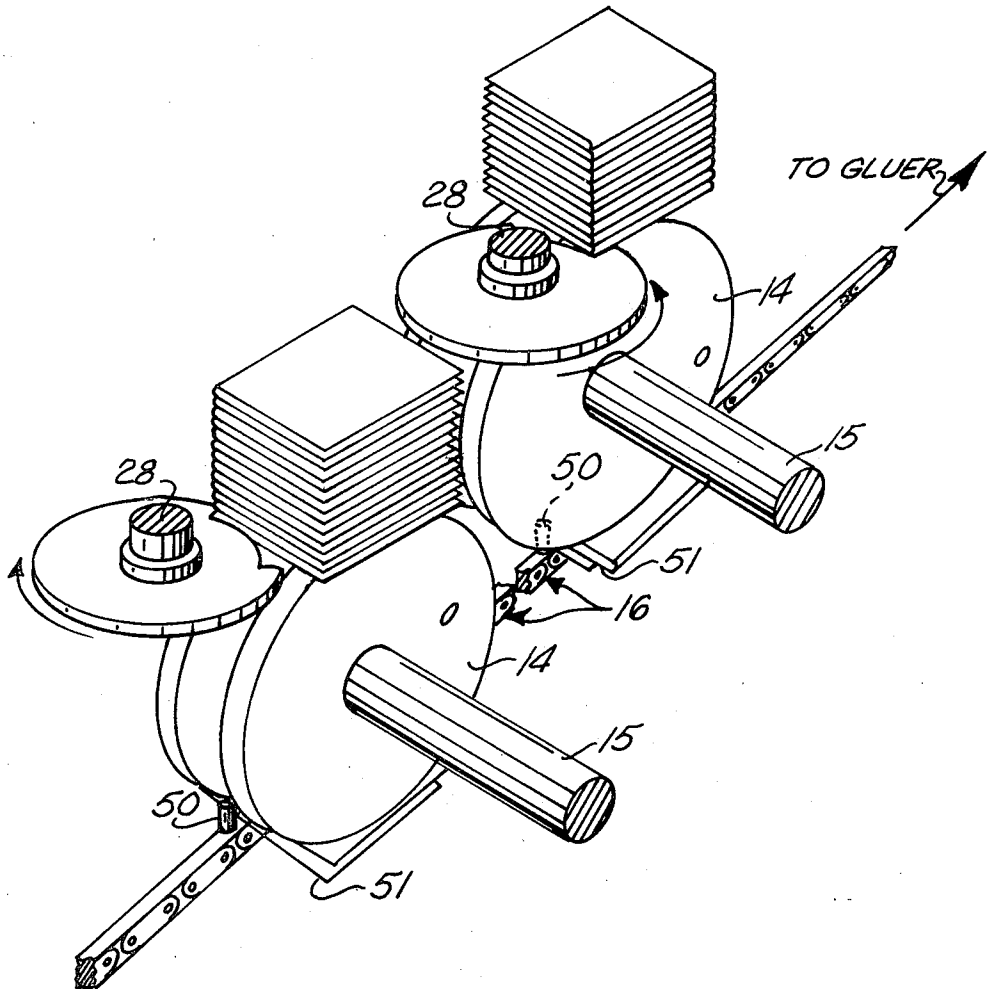


FIG. 4

Nov. 7, 1972

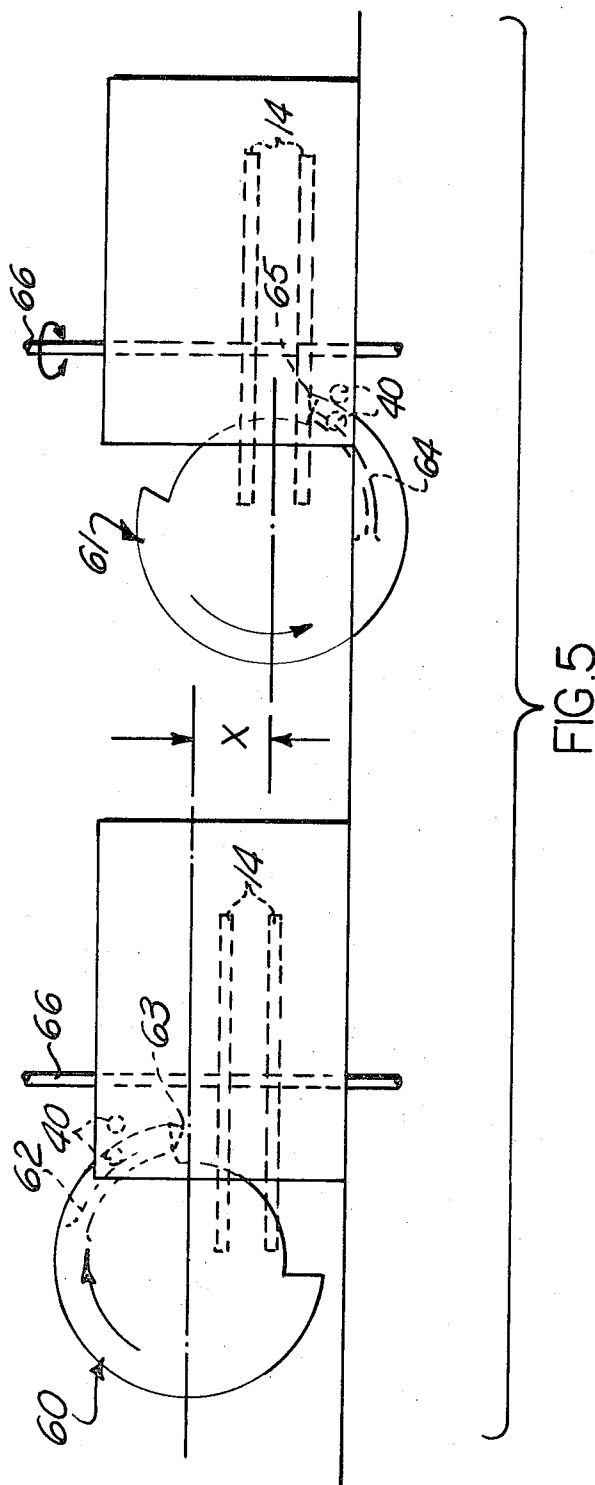
C. V. HAGEMAN ET AL

3,702,187

# APPARATUS FOR SEPARATING SIGNATURES IN A GATHERER

Filed Aug. 13, 1971

4 Sheets-Sheet 4



1

2

3,702,187  
**APPARATUS FOR SEPARATING SIGNATURES  
IN A GATHERER**

Carlton V. Hageman and Victoriano F. Rana, Easton,  
Pa., assignors to Harris-Intertype Corporation, Cleve-  
land, Ohio

Continuation-in-part of application Ser. No. 45,010, June  
10, 1970, now Patent No. 3,650,525. This application  
Aug. 13, 1971, Ser. No. 171,534

Int. Cl. B65h 3/08, 3/50

U.S. Cl. 271—29

10 Claims

## ABSTRACT OF THE DISCLOSURE

A signature gatherer for the production of books or  
booklets with gate-folded pages which includes a bi-direc-  
tional rotary disc separator for separating signatures at  
their folded corners, whether stacked for feeding gate-  
folded or standard-folded signatures.

This invention relates to signatures gathering machines  
and, more particularly, to a rotary lifter separator for  
separating successive lowermost signatures from a stack  
of signatures in a stack hopper.

## CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of co-pending  
U.S. application Ser. No. 45,010, filed June 10, 1970, now  
Pat. No. 3,650,525.

## BACKGROUND OF THE INVENTION

Rotary disc separators for various types of sheet-like  
material such as signatures or envelopes have been used  
to separate individual sheets or folded signatures from  
the bottom of a stack. Their primary function is to posi-  
tively physically separate the bottom items from the re-  
mainder of the stack in order to present it to grippers or  
rollers which carry it away from the stack and deposit it  
on a moving conveyor. An example of such a separator is  
shown in U.S. Pat. 2,020,321 to Kleineberg. One of the  
problems with the Kleineberg type of device was its in-  
ability to feed gate-folds, i.e., signatures with their folds  
on the side remote from those in a stack having standard  
folds. For best and most positive results, the disc separator  
should enter between the bottom signature and the re-  
mainder of the stack at a corner along the folded side  
of the stack, to assure separating complete signatures.  
The Kleineberg separator can work only on one corner  
of the stack, because of the small diameter of the disc, and  
because of the angle at which the disc axis is inclined with  
respect to the signatures. If provision were to be made for  
feeding gate-folds with the Kleineberg device, it would  
be necessary to duplicate opposite-handed disc separator  
mechanisms at two adjacent corners, thus increasing the  
cost and complexity of the mechanism, as well as neces-  
sitating provision for inactivating one separator while  
using the other.

## SUMMARY OF THE INVENTION

The afore-mentioned co-pending parent application dis-  
closes a signature separator for the bottom signature of  
a stack which rotates on a substantially vertical axis  
parallel to two adjacent corners of a stack of signatures.  
The rotary disc is provided with an interrupted portion  
or segment in its periphery, and is so located with respect  
to a feeding side of the stack whereby that side of the  
bottom of the stack is always supported by the disc.  
Sucker means is arranged to grip the lowermost signature  
near its folded corner, pull it downwardly, and permit a  
lead edge of the disc adjacent the interrupted portion to

enter into the space provided by the pulled-down lower-  
most signature. Shortly after the lead edge enters, the trail-  
ing edge adjacent the interrupted portion exits from the  
stack. A cam surface on the underside of the disc urges  
the separated signature downwardly within the grasp of  
grippers on a rotating drum, and the drum grippers take  
the separated edge of the lowermost signature and trans-  
port it to a conveyor pusher. In conventional fashion the  
conveyor carries an assembly of signatures from each  
of a plurality of feeding stations to a binding section,  
which may be in the form of a gluer for binding one edge  
of the assembled booklet.

As noted above, it is frequently desired to produce  
gate-folded booklets, i.e., booklets with some larger pages  
which have folded edges at the open face of the book. To  
this end, the said co-pending application discloses a bi-  
directional disc which may be rotated in either direction  
and which is of a dimension relative to the dimensions of  
the signatures that the disc may enter the stack from either  
corner. In accordance with this invention, gate-folds are  
accommodated by a selectively positionable rotary disc  
which may be positioned so that the disc edge which nor-  
mally constitutes the trailing edge becomes the leading  
edge to separate the folded signatures at the opposite  
corner of the feeding side of the pile. The disc is driven  
in a reverse direction and performs identically with that  
just described, except that the suckers must now be ar-  
ranged to grip the lowermost signature from a different  
corner. The leading and trailing edges of the disc are  
inverted under this condition. The disc may be a single  
bi-directional disc, or may be two different discs which  
have specially-constructed portions which enable them to  
be substituted for one another and driven in one direction  
or the other.

## BRIEF DESCRIPTION OF DRAWINGS

Referring now to the drawing wherein like reference  
numerals indicate like parts in the various views:

FIG. 1 is an elevational view, partly in cross section,  
looking in the direction in which signatures are fed along  
a gathering machine.

FIG. 2 is a plan view of a portion of the mechanism of  
FIG. 1, illustrating a first modification of the invention  
in which a single disc may be used for feeding either  
standard folded or gate-folded signatures.

FIG. 3 is a view taken substantially along lines 3—3  
of FIG. 2.

FIG. 4 is a schematic view of the principal elements of  
the invention illustrating two stations from which signa-  
tures are fed, one as a gate-fold and the other as a  
standard fold.

FIG. 5 is a schematic plan view illustrating a second  
modification of the invention in which two different discs  
are replaceable and are driven in opposite directions.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

A vertically-arranged stack 10 of horizontally-lying  
folded signatures is located within a hopper 11. The  
hopper has side, front and rear walls, as well as a bottom  
plate which supports the primary area of the stack except  
in a given area adjacent a rotary disc separator 12. As  
discussed in parent U.S. application Ser. No. 45,010, the  
disc 12 is adapted to physically separate signatures one  
at a time from the bottom of the stack 10 and present  
them to grippers 13 carried by a drum 14 which is  
mounted on a shaft 15 for rotation in timed relationship  
with the disc 12.

The shaft 15 is also timed with a conveyor chain 16  
(see FIG. 4). Signatures carried by the grippers 13 are  
dropped onto a table along which the conveyor 16 runs,

whereby signatures at different stations are assembled and registered in a loose assembly, after which they are carried to a binding section (not shown) in which they may be glued along one edge for making into a booklet or the like. The disc 12 is driven from the shaft 15 by means of a toothed timing belt 17 which runs between toothed pulleys 18 and 19, the latter of which is fastened to a shaft 20.

A gear box 21 journals one end of the shaft 20, and is mounted to be adjustably positioned on a frame portion 22 of the mechanism. The gear box 20 is made up of a lower plate 23 and an inverted housing 24. The housing 24 contains a pair of bevel drive gears 25 and 26, only one of which at any given time is adapted to mesh with a bevel driven gear 27 connected to a shaft 28 to which the disc 12 is fastened. As shown in FIG. 1, bevel gear 26 is in mesh with gear 27 and is adapted to rotate the disc 12 in a direction to separate signatures with the standard fold on the right hand side of FIG. 1.

The gear box 21 and its contents are adapted to be adjustable between the dotted-line position and the full-line position in FIG. 1 to accommodate different-width gate-folded signatures. When in the dotted-line position, the disc 12 will be driven in the direction opposite from that shown in full lines, and is therefore adapted to separate signatures by entering from the left front corner of the stack 10. In this latter arrangement, bevel gear 25 will be placed into mesh and bevel gear 26 will be withdrawn from mesh with gear 27. This is accomplished by removing a C-shaped collar 29 from its position on the shaft 20 shown in FIG. 1, sliding the bevel gear 26 rightwardly until it engages the side of the housing 24, and inserting the collar 29 between the gear 25 and the left-hand side of the housing 24. Both bevel gears 25 and 26 are provided with set screws for locating them in position along the shaft. The shaft and gears are further provided with keys and keyway to maintain their proper angular position on shaft 20.

Referring now to FIG. 2, it will be seen that the periphery of the disc 12 has an interrupted portion defined by a leading edge 30 and trailing edge 31. A bottom hopper plate 32 supports the principal portion of the stack, leaving an opening between the edge of the plate 32 and a front wall 33 of the hopper. The lower portion of the front wall 33 and the corner areas of the sidewalls of the hopper are open to permit entrance of the disc into the signature stack, as well as to permit a pin 34 to be intermittently placed in engagement with the signatures by a cam 35 and removed therefrom by a return spring 36. As described in the aforementioned co-pending application Ser. No. 45,010, the purpose of the pin 34 is to reduce the weight and thus the friction of the signatures resting upon the upper surface of the rotary disc. Cams surfaces 37 and 38 are provided on the underside of the disc 12, to enable separated signatures to be physically pushed into position to be received by the grippers 13 as can be noted in FIG. 3.

In the embodiment shown in FIG. 2, the disc 12 is adapted to be driven counterclockwise for separating standard-fold signatures at the side of the hopper at which leading edge 30 of the disc has just entered. In this case cam surface 37 performs the entire function of moving the separated signature to the grippers 13, it being understood of course that the corner of the lowermost signature was first pulled downwardly by suckers 40. The suckers are carried on a pivoted arm to move up and down in timed relationship with the remainder of the machine. One of the suckers 40 enters into the space provided by the interrupted portion of the disc, in order to get the corner downwardly shortly after the trailing edge 31 passes the location of the sucker, whereupon the sucker is then pivoted down prior to entrance of the leading edge 30 into the space provided between the bottom two signatures. For best results in separating complete signatures, it is

desired that the leading edge enter into the stack of signatures at the folded side, slightly inwardly of the corner of the stack, which in this case is located at point A in FIG. 2.

When it is desired to utilize the disc 12 to separate gate-folded signatures, it is necessary (unless feeding small signatures) to reposition the shaft 28 and its disc and drive mechanism, change the direction of the disc 12 to clockwise rotation, and make certain that the edge 31 (which was formerly the trailing edge but is now the leading edge of the clockwise rotating disc) enters the stack 10 at the opposite corner of the stack. Cam 35 may be timed differently in order to accomplish the insertion and withdrawal of pin 34 as desired. When edge 31 becomes the leading edge, the cam surface 38 performs the function of physically moving the lowermost separated signature into the range of operation of the grippers 13 on the drum 14. Obviously, the suckers 40 must be positioned adjacent the corner being separated by the edge 31, so as to pull down the lowermost signature when permitted to do so by the gap in the disc 12, for entrance of the edge 31 into the corner of the stack.

Referring now to FIG. 4, it will be seen that the chain conveyor 16 has pusher pins 50 which collect assemblies of the signatures for making them into the book, after which they may be bound by gluing. It is to be understood that several signature stations are normally provided, only two being shown herein for purposes of illustrating separation of standard-folded and gate-folded signatures. In the first location in FIG. 4, signatures which are to become gate-folds in the final book are provided in the stack and are separated by disc 12 while rotating in a clockwise direction on its vertical axis. The folds in this case are at the left side of the stack, as can be seen from the signature 51 which has been dropped in position to be engaged by one of the pins 50 of conveyor 16. Standard-folded signatures in the second hopper are separated from the bottom by a disc 12 rotating in the counterclockwise direction. It will be noted that the signature deposited on the conveyor 16 by the drum from the second stack has come to rest on top of a gate-fold 51. As shown, the rightward edges of the assembled signatures will be bound, it being understood that the gate-folded signature has one flap of lesser width than the other to prevent its being bound with the remainder of the booklet. In this fashion, the gate-folded signature 51 can be opened from the face of the book as an enlarged page.

FIG. 5 illustrates a second embodiment of the invention in which, instead of using a single bi-directional disc 12, a pair of opposite-hand discs 60 and 61 are used, either one of which can be substituted for the other when converting between standard-fold and gate-fold signatures. Disc 60 is provided with a cam surface 62 on its underside, adjacent leading edge 63. Edge 63 is shown in this embodiment as being pointed for enabling easier entrance of the leading edge 63 into the pile. Likewise, disc 61 has a cam surface 64 adjacent the leading edge 65 of the disc 61. It will be noticed that the suckers 40 have been positioned on opposite edges of shaft 66, so that they function adjacent the corner to be separated. It will be seen that the two discs 60 and 61 are offset in a horizontal direction in the machine by the dimension "X," which of course can vary with the dimension of the signatures between the folded edges of the standard and gate-folds. This enables the handling of a wide variety of signature sizes and is made possible through use of a disc which is of sufficient diameter to provide substantial support for the bottom of the pile along whichever edge is separated. It further enables the use of a common driving mechanism for the disc separator, whether it is in the form of a single bi-directional disc, or a pair of replaceable discs which are driven in opposite directions.

While the invention has been described with reference to certain specific embodiments, neither the illustrated

5

embodiments nor the terminology employed in describing them is intended to be limiting; rather, it is intended to be limited only by the scope of the appended claims.

We claim:

1. In a separator for folded signatures wherein the bottom signature of a stack of horizontally-lying signatures is initially separated at a corner adjacent the fold therein, and wherein the separator is adapted to separate signatures from either of two corner edges which define a feeding side of said stack,

relatively flat rotary disc means substantially coplanar with the bottom of the stack and rotatable on an axis generally parallel with the corner edges of said stack, said disc means having a circular periphery and an interrupted portion therein, the extent of the interrupted portion and the position of said disc means relative to the feeding side of said stack being such that at all times at least a portion of the circular periphery is within the feeding side of said signature stack so as to provide support for said stack along said side,

a hopper aligning the sides of said stack and supporting the principal area of the bottom of said stack except in the area of entrance of the disc means into said feeding side, said hopper having the side and corners thereof adjacent the disc means near the bottom of the stack open for entrance therinto of said disc means in either one of two different rotational directions depending on the location of the folds in the signatures of said stack,

transporting means below the stack for receiving signatures separated by said disc means and carrying them away from said stack,

grasping means acting on the bottom signature of the stack, said grasping means being operable to reach from below through the interrupted portion of the disc means to pull the folded corner of each signature downwardly in turn, whereby further rotation of said disc means causes its circular periphery to enter the space between the grasped signature and the next adjacent signature,

means for operating said grasping means in timed relation with disc rotation to separate one signature from the stack at each disc revolution,

disc drive means including means for reversing the direction of rotation of said disc means, and

means for selectively positioning the axis of rotation of said disc means whereby the circular periphery of the disc means may enter from either of said corner edges.

2. The invention set forth in claim 1 wherein said disc means comprises a single disc which is utilized for rotation in either of said directions.

3. The invention set forth in claim 1 wherein said disc means comprises a pair of replaceable discs, one for each direction, and

cam means on the underside of the periphery of each disc adjacent the interrupted portion on that side first to enter the stack, said cam means physically forcing a separated signature within the reach of said transporting means.

4. The invention set forth in claim 1 wherein said grasping means is adjustably positionable to operate near either corner edge of the stack.

5. In a signature gatherer having at least two substantially vertical stacks of horizontally-lying signatures, a separator for bottom-feeding of folded signatures from each stack, a conveyor travelling in a substantially horizontal path below said stacks and arranged to receive signatures in serial fashion whereby to make an assembly of signatures to be bound, the signatures in one of said stacks having their folded edges parallel to said path and along one side of its stack and the signatures in the other of said stacks having their folded edges parallel to said path but along the opposite side of its stack, whereby, when said assembly

6

is subsequently bound along one of its folded edges, the other folded edge will remain unbound, and transporting means adjacent the bottom of each stack for receiving separated signatures therefrom and presenting them to said conveyor,

each separator comprising:

relatively flat rotary disc means substantially coplanar with the bottom of each stack and rotatable on an axis generally parallel with the corner edges of said stack, said disc means having a circular periphery and an interrupted portion therein, the extent of the interrupted portion and the position of said disc means relative to the adjacent side of said stack being such that at all times at least a portion of the circular periphery is within said stack so as to provide support for said stack along said side,

a hopper aligning the sides of each stack and supporting the principal areas of the bottom of said stack except in the area of entrance of the disc means into said stack, said hopper having the side and at least one corner thereof adjacent the disc means near the bottom of the stack open for entrance therinto of said disc means, suction gripper means acting on the bottom signature of each stack adjacent the corner being separated by said disc means for grasping the bottom signature and pulling it downwardly within the reach of said transporting means,

means for operating said gripper means in timed relation with the disc rotation to separate one signature from the stack at each disc revolution, and

drive means for driving the disc means for each stack in opposite directions.

6. The invention set forth in claim 5 wherein the drive means for at least one of said disc means is reversible.

7. The invention set forth in claim 6 wherein the disc means driven by said reversible drive means comprises a single disc which is utilized for rotation in either of two directions, and wherein a pair of cam surfaces are provided on the peripheral underside of the disc, one adjacent each side of the interrupted portion.

8. The invention set forth in claim 6 wherein the disc means driven by said reversible drive means comprises a pair of opposite-hand removable discs each with a single cam surface on its underside adjacent that edge nearest the interrupted portion first to enter the corner of the stack, said cam surfaces extending peripherally for a distance sufficient to force signatures within the reach of the transporting means.

9. The invention set forth in claim 6 including means for horizontally repositioning the axis of rotation of said disc means.

10. The invention set forth in claim 5 wherein said disc means comprise a pair of opposite-hand removable discs each with a single cam surface on its underside adjacent that edge nearest the interrupted portion first to enter the corner of the stack, said cam surfaces extending peripherally for a distance sufficient to force signatures within the reach of the transporting means.

## References Cited

### UNITED STATES PATENTS

1,709,857	4/1929	Kleineberg	271—29
1,794,198	2/1931	Murray	271—29 X
2,020,321	11/1935	Kleineberg	270—56
3,045,867	7/1962	Flynn	271—29 X

EVON C. BLUNK, Primary Examiner

B. H. STONER, Jr., Assistant Examiner

U.S. Cl. X.R.

271—9, 41