United States Patent [19]

Wong

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[54] **COLLATING AND BINDING SYSTEM AND METHOD WITH POSTAGE INDICATION**

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[73] Assignee: **R. R. Donnelley & Sons Company**, Chicago, Ill.

[21] Appl. No.: **898,359**

[22] Filed: **Aug. 20, 1986**

Related U.S. Patent Documents

Reissue of:

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Filed: **Dec. 8, 1983**

[51] **Int. Cl.**[4] **B65H 39/02**

[52] **U.S. Cl.** **270/54**; 364/464; 270/58

[58] **Field of Search** 270/55–58, 270/1, 4, 12, 18, 20, 52; 364/464; 101/2

[56] **References Cited**

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2066734	7/1981	United Kingdom	364/464
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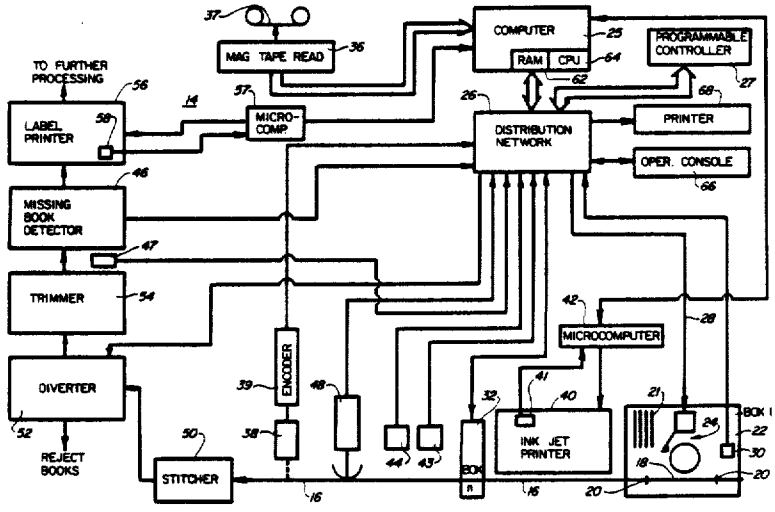
Primary Examiner—E. H. Eickholt
Attorney, Agent, or Firm—Wood, Dalton, Phillips, Mason & Rowe

[57] **ABSTRACT**

A collating and binding system for producing customized versions of books includes means for detecting a defective book, means responsive to the detecting means for rejecting the defective book and means for reordering the rejected book at a point in an original production sequence determined in accordance with a comparison of the postal information of the rejected book with the postal information of a book currently being produced. An indication of the postage required to mail the produced books is derived from an amount calculated before the books are produced and from indications of postage increases for those books which were reordered at subsequent portions in the original production sequence.

42 Claims, 8 Drawing Sheets



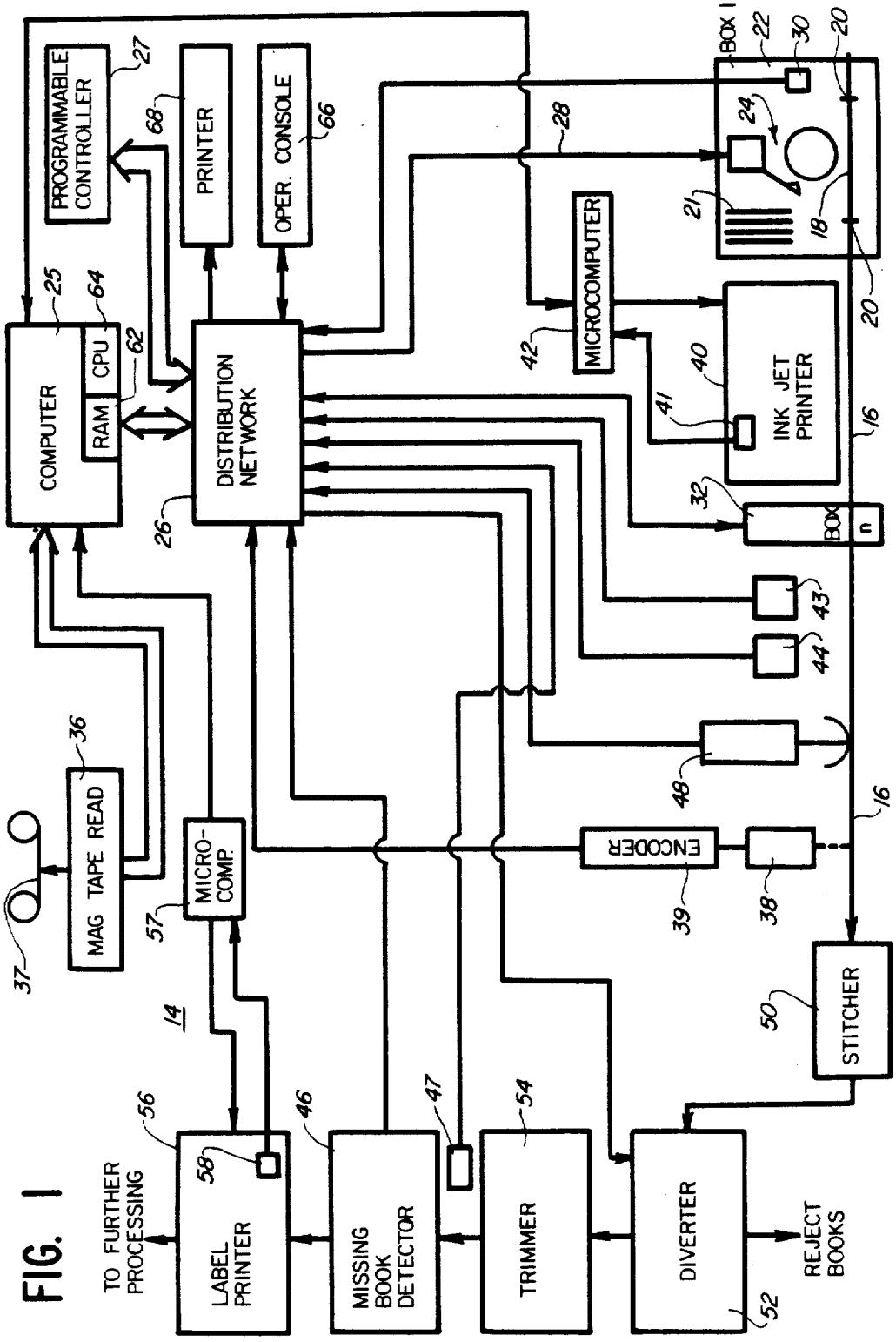

PROGRAMMABLE CONTROLLER
27
PRINTER
68
OPER. CONSOLE
66
BOX 1
22
30
20
28
24
21
18
MICROCOMPUTER
42
INK JET PRINTER
40
41
16
COMPUTER
25
CPU
64
RAM
62
DISTRIBUTION NETWORK
26
32
BOX n
43
44
36
MAG TAPE READ
37
MICRO-COMP.
57
48
ENCODER
39
38
14
50
STITCHER
56
58
LABEL PRINTER
46
MISSING BOOK DETECTOR
47
54
TRIMMER
DIVERTER
52
TO FURTHER PROCESSING
REJECT BOOKS

FIG. 1

FIG. 2

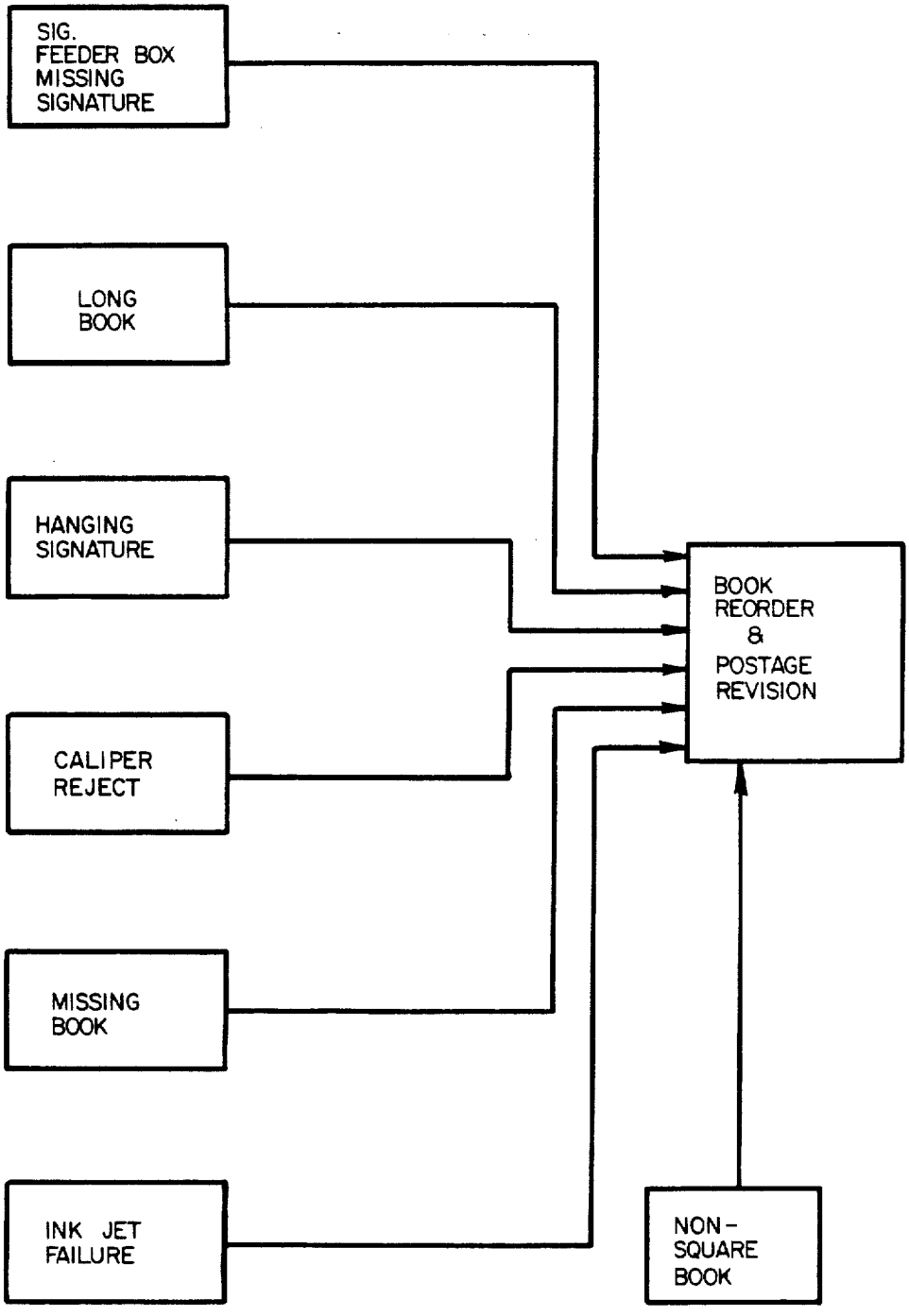
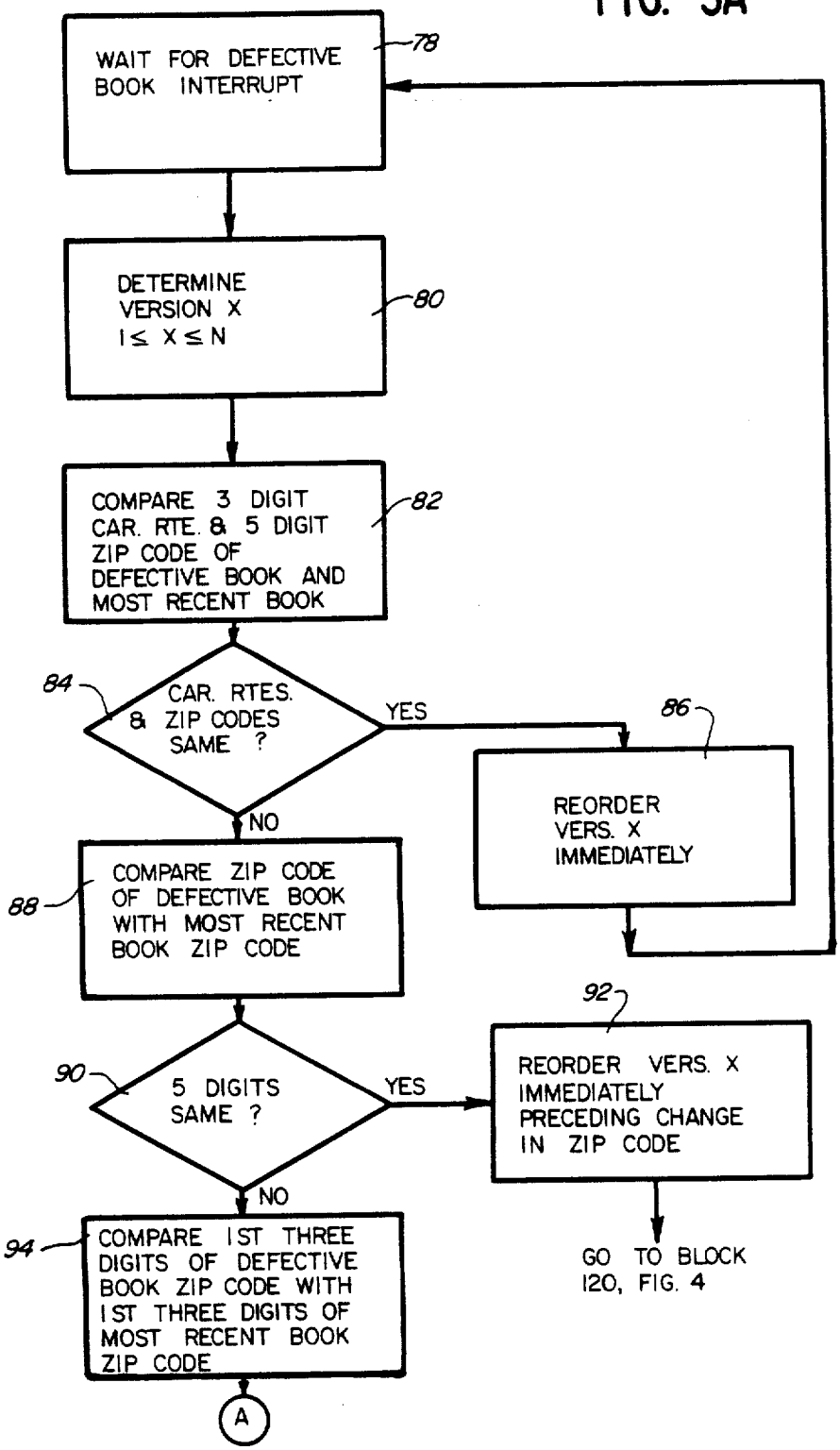

SIG. FEEDER BOX MISSING SIGNATURE
LONG BOOK
HANGING SIGNATURE
CALIPER REJECT
MISSING BOOK
INK JET FAILURE
BOOK REORDER & POSTAGE REVISION
NON-SQUARE BOOK

FIG. 3A


WAIT FOR DEFECTIVE BOOK INTERRUPT
78
DETERMINE VERSION X 1≤ X≤ N
80
COMPARE 3 DIGIT CAR. RTE. & 5 DIGIT ZIP CODE OF DEFECTIVE BOOK AND MOST RECENT BOOK
82
84
CAR. RTES. & ZIP CODES SAME ?
YES
86
REORDER VERS. X IMMEDIATELY
NO
88
COMPARE ZIP CODE OF DEFECTIVE BOOK WITH MOST RECENT BOOK ZIP CODE
90
5 DIGITS SAME ?
YES
92
REORDER VERS. X IMMEDIATELY PRECEDING CHANGE IN ZIP CODE
NO
94
COMPARE 1ST THREE DIGITS OF DEFECTIVE BOOK ZIP CODE WITH 1ST THREE DIGITS OF MOST RECENT BOOK ZIP CODE
A
GO TO BLOCK 120, FIG. 4

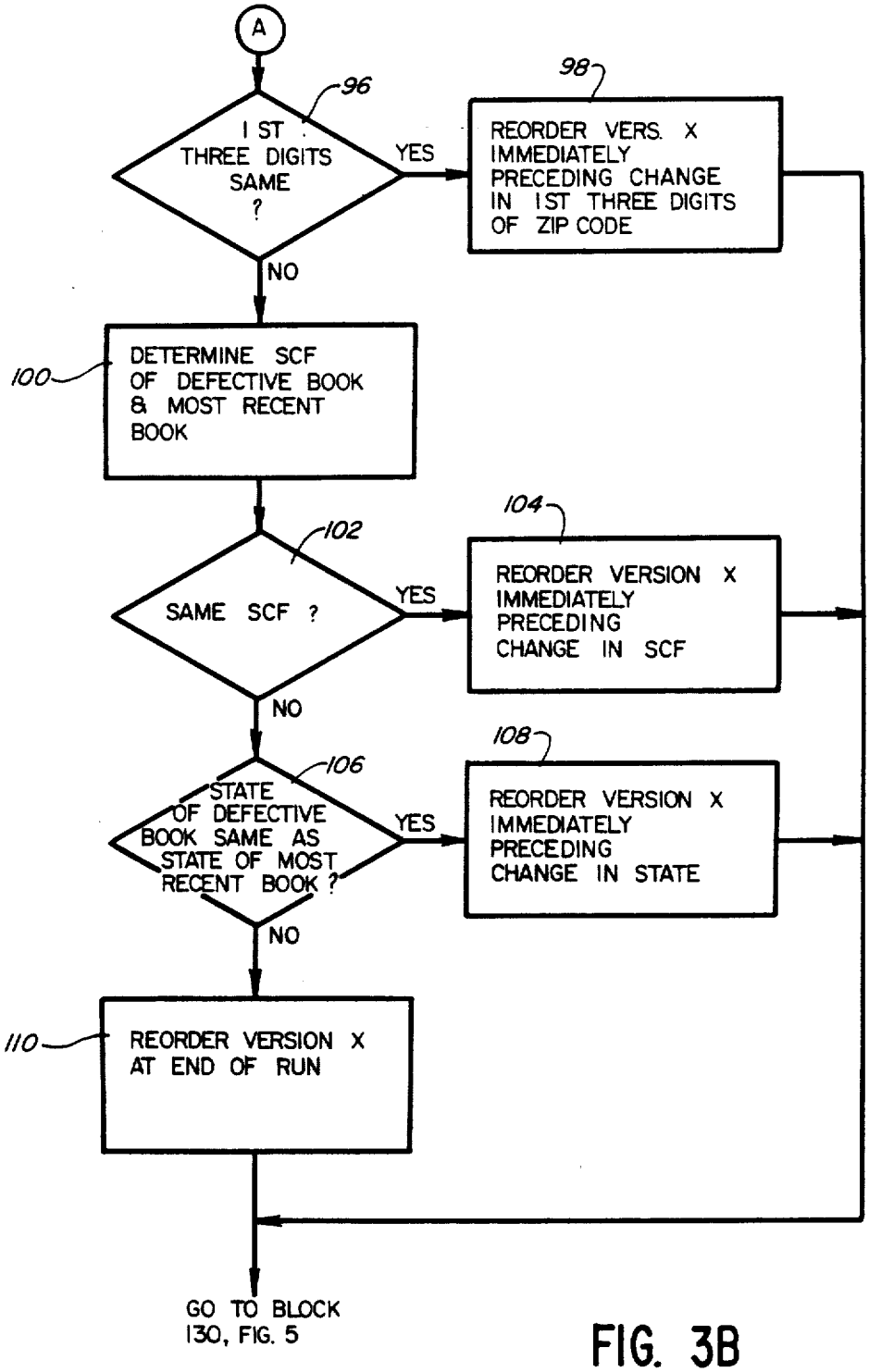

A
96
1 ST THREE DIGITS SAME ?
YES
98
REORDER VERS. X IMMEDIATELY PRECEDING CHANGE IN 1ST THREE DIGITS OF ZIP CODE
NO
100
DETERMINE SCF OF DEFECTIVE BOOK & MOST RECENT BOOK
102
SAME SCF ?
YES
104
REORDER VERSION X IMMEDIATELY PRECEDING CHANGE IN SCF
NO
106
STATE OF DEFECTIVE BOOK SAME AS STATE OF MOST RECENT BOOK ?
YES
108
REORDER VERSION X IMMEDIATELY PRECEDING CHANGE IN STATE
NO
110
REORDER VERSION X AT END OF RUN
GO TO BLOCK 130, FIG. 5

FIG. 3B

FIG. 4

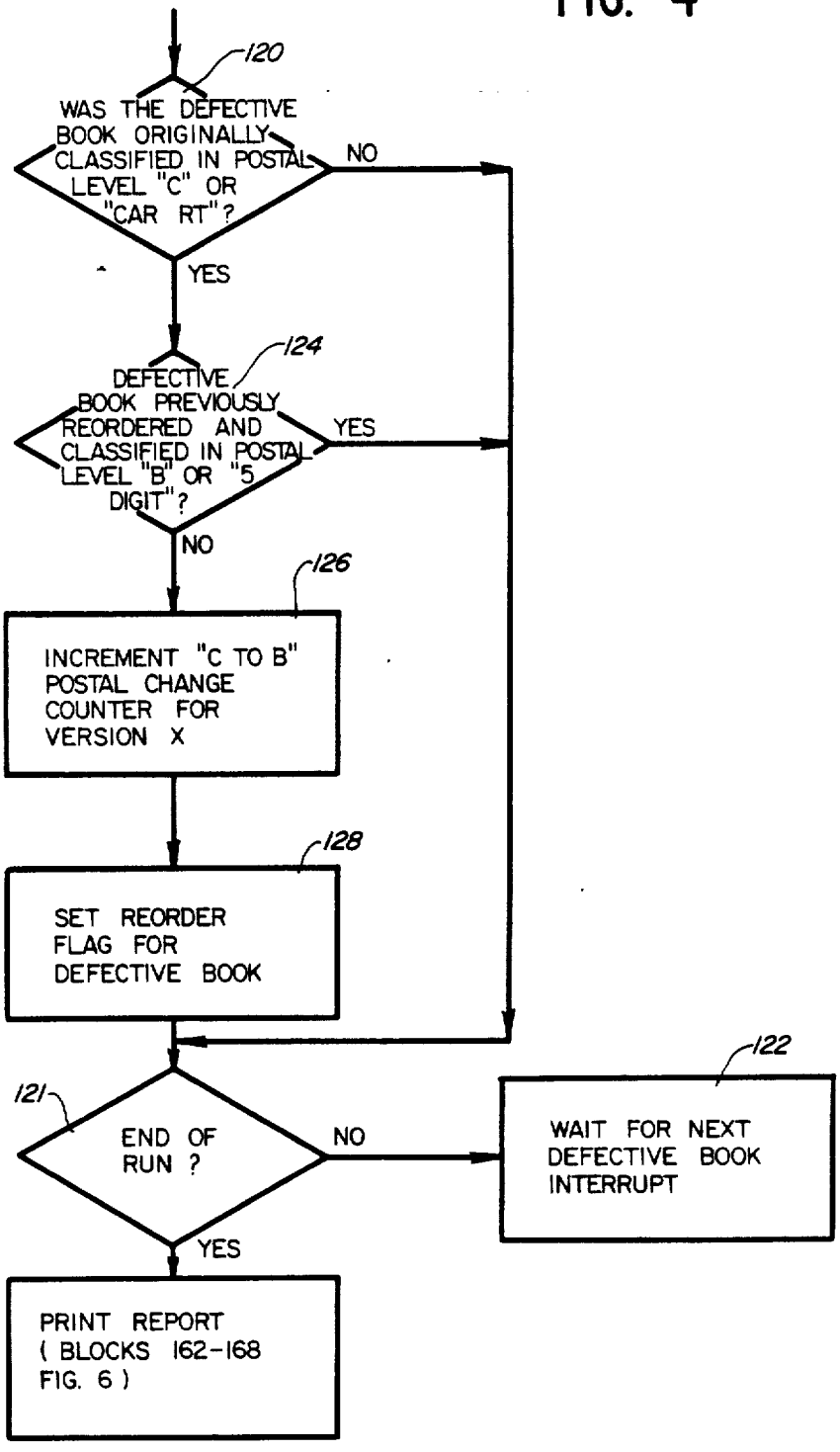

120
WAS THE DEFECTIVE BOOK ORIGINALLY CLASSIFIED IN POSTAL LEVEL "C" OR "CAR RT"?
NO
YES
124
DEFECTIVE BOOK PREVIOUSLY REORDERED AND CLASSIFIED IN POSTAL LEVEL "B" OR "5 DIGIT"?
YES
NO
126
INCREMENT "C TO B" POSTAL CHANGE COUNTER FOR VERSION X
128
SET REORDER FLAG FOR DEFECTIVE BOOK
121
END OF RUN ?
NO
122
WAIT FOR NEXT DEFECTIVE BOOK INTERRUPT
YES
PRINT REPORT (BLOCKS 162-168 FIG. 6)

FIG. 5A

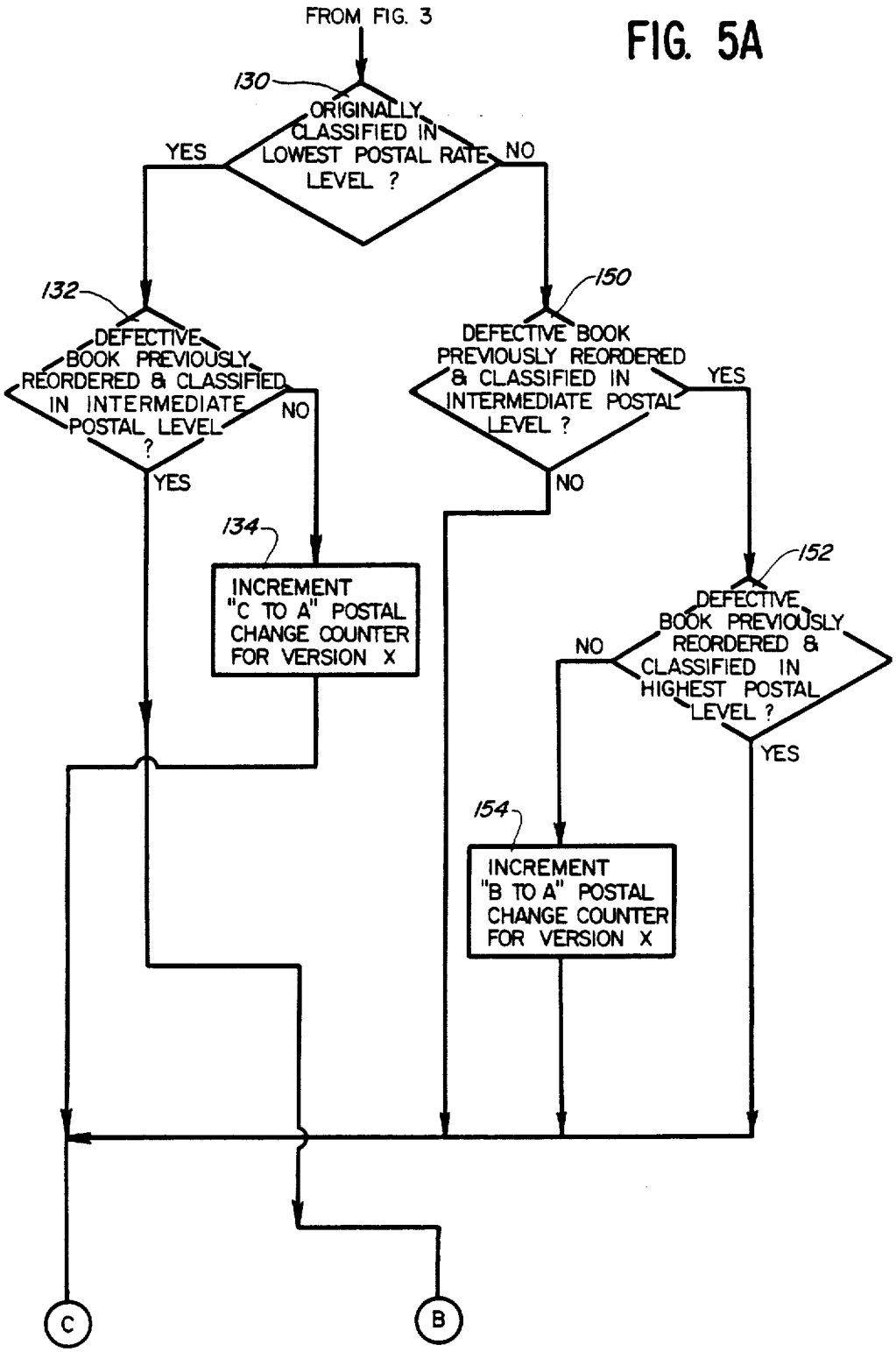

FROM FIG. 3
130
ORIGINALLY CLASSIFIED IN LOWEST POSTAL RATE LEVEL ?
YES
NO
132
DEFECTIVE BOOK PREVIOUSLY REORDERED & CLASSIFIED IN INTERMEDIATE POSTAL LEVEL ?
NO
YES
134
INCREMENT "C TO A" POSTAL CHANGE COUNTER FOR VERSION X
150
DEFECTIVE BOOK PREVIOUSLY REORDERED & CLASSIFIED IN INTERMEDIATE POSTAL LEVEL ?
YES
NO
152
DEFECTIVE BOOK PREVIOUSLY REORDERED & CLASSIFIED IN HIGHEST POSTAL LEVEL ?
NO
YES
154
INCREMENT "B TO A" POSTAL CHANGE COUNTER FOR VERSION X
C
B

FIG. 5B

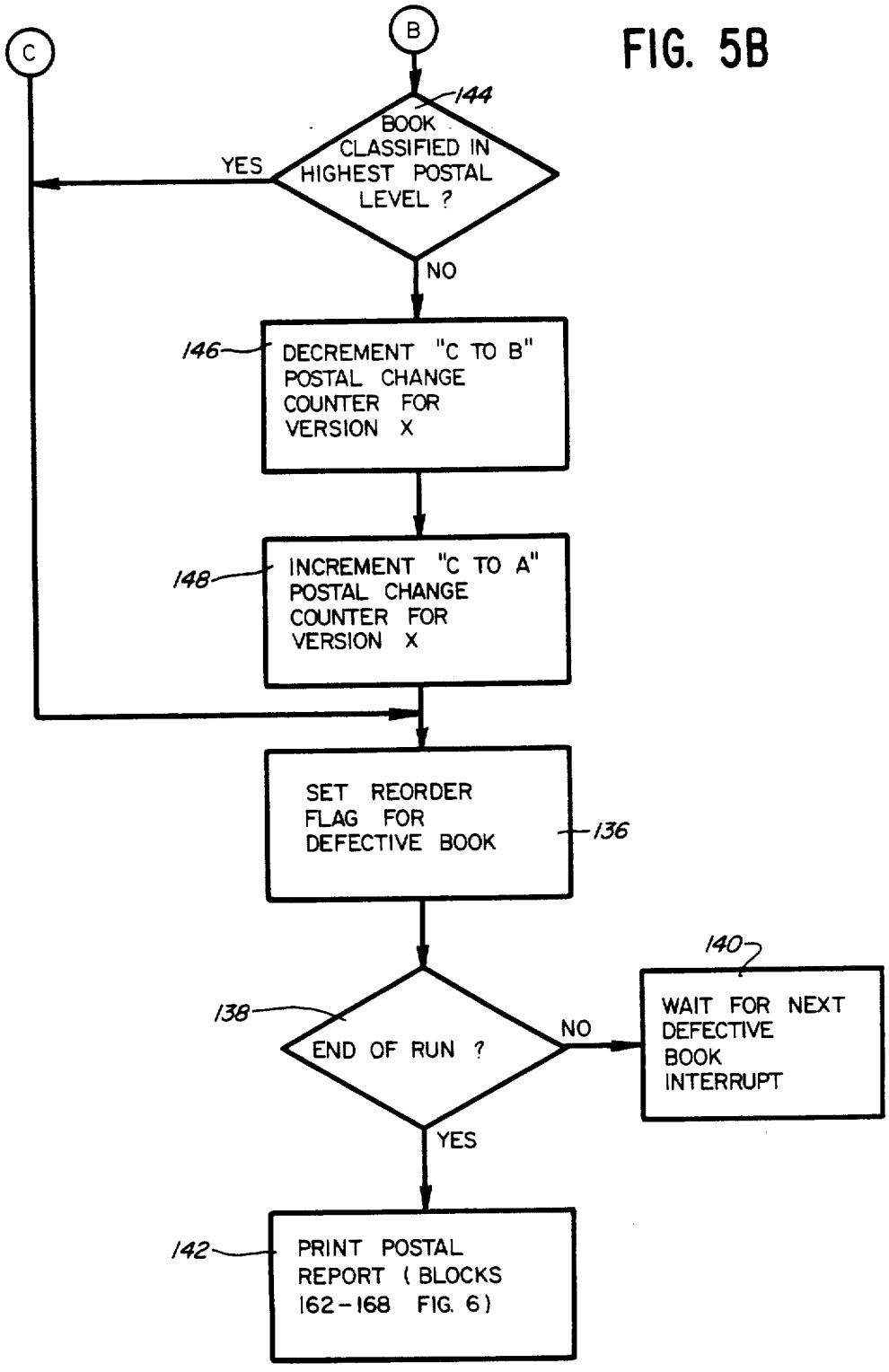
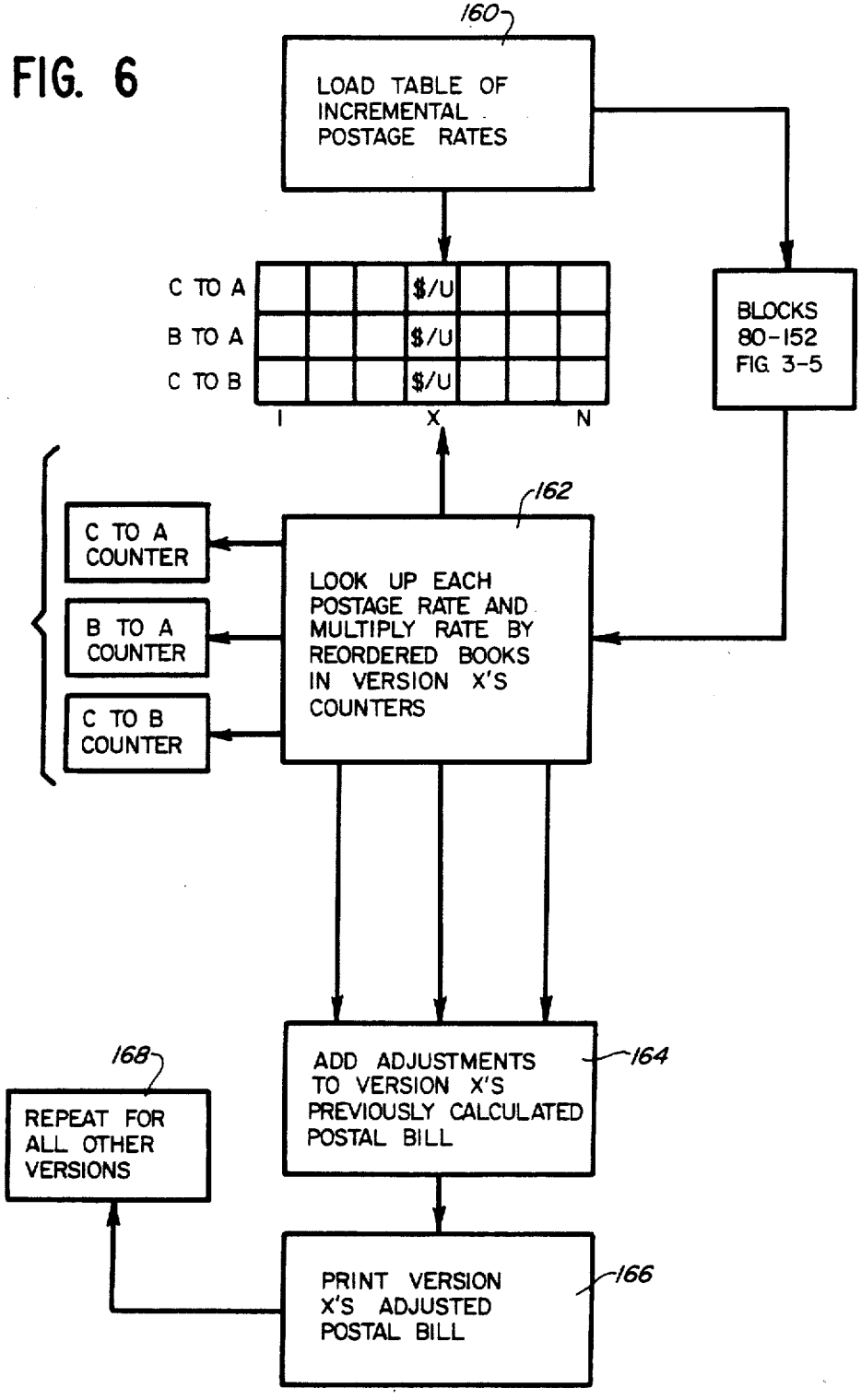

B
C
144
BOOK CLASSIFIED IN HIGHEST POSTAL LEVEL ?
YES
NO
146
DECREMENT "C TO B" POSTAL CHANGE COUNTER FOR VERSION X
148
INCREMENT "C TO A" POSTAL CHANGE COUNTER FOR VERSION X
SET REORDER FLAG FOR DEFECTIVE BOOK
136
140
138
END OF RUN ?
NO
WAIT FOR NEXT DEFECTIVE BOOK INTERRUPT
YES
142
PRINT POSTAL REPORT (BLOCKS 162-168 FIG. 6)

FIG. 6


160
LOAD TABLE OF INCREMENTAL POSTAGE RATES
C TO A
B TO A
C TO B
$/U
$/U
$/U
I
X
N
BLOCKS 80-152 FIG. 3-5
162
C TO A COUNTER
B TO A COUNTER
C TO B COUNTER
LOOK UP EACH POSTAGE RATE AND MULTIPLY RATE BY REORDERED BOOKS IN VERSION X'S COUNTERS
168
REPEAT FOR ALL OTHER VERSIONS
ADD ADJUSTMENTS TO VERSION X'S PREVIOUSLY CALCULATED POSTAL BILL
164
PRINT VERSION X'S ADJUSTED POSTAL BILL
166

COLLATING AND BINDING SYSTEM AND METHOD WITH POSTAGE INDICATION

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

DESCRIPTION

Background of the Invention

The present invention relates generally to collating and binding systems and methods, and more particularly to a system for collating signatures into individual books, arranging the books for efficient mailing and generating an indication of postage therefor.

One prior type of collating and binding system is disclosed in Riley at al U.S. Pat. No. 4,121,818, assigned to the assignee of the instant application. This collating and binding system discloses a plurality of signature feeders disposed adjacent a conveyor, the signature feeders being individually operated by a programmable controller so that customized books are built in accordance with information contained on a magnetic tape. Means are provided along the conveyor to detect defective books. These defective books are removed from the conveyor by a diverter which is operated by the programmable controller.

The above system disclosed in Riley et al is useful to permit customized information and/or signatures to be placed in books produced during a single production run. In other words, each book can be customized for the person to whom it is to be sent.

These books are then collated and bound in a sequence such that the resulting books can be easily bundled to take advantage of postal discounts or to meet Post Office requirements.

The assembling of customized books in a particular sequence to permit bundling according to postal regulations is difficult to achieve in an optimal fashion in the event a defective book is detected, rejected and reordered by the system. In such a case, the Riley et al system compares the mailing information of the defective book with the mailing information of the book adjacent the first signature feeder (or the "most recent book") to determine the optimal time to reorder the book. For example, if the defective book and the most recent book have the same zip code, the defective book can be immediately reordered and grouped with other books having the same zip code to obtain postal discounts. However, if the zip code of the most recent book is different than that of the defective book, then the defective book is reordered following the last book within the same sectional center facility, or SCF, destination. As these examples illustrate, the time for reordering is determined in accordance with a comparison of the mailing information of the defective book with the mailing information of the most recent book on the conveyor.

In some cases when a book is found to be defective and is reordered, the book may no longer qualify for a certain postal discount and may instead be subject to a higher postal rate. For example, a book may be originally classified in a discount classification along with other books to be delivered to the same five digit zip code area. If this book is found to be defective and is reordered at a time such that it no longer is grouped with other books of the same zip code, then this book could not qualify for the discount postage rate previously applicable. The Riley et al system noted above is not capable of generating an indication of the change in postage, if any, caused by the reordering of the defective book.

SUMMARY OF THE INVENTION

In accordance with the present invention, a collating and binding system includes means for deriving an indication of postage increase caused by the rejection and reordering of defective books.

The collating system of the present invention includes a plurality of signature feeders for delivering signatures to a plurality of stations along a collating conveyor. A computer controls the signature feeders to progressively assemble different groups of signatures on the conveyor and thereby build a series of defective books in an original or predetermined sequence to take advantage of postal discounts. Means are disposed along the conveyor for detecting a defective book and means responsive to the detecting means reject the defective book at a point downstream from the signature feeders.

The collating system further includes means for reordering the rejected book at a point in the sequence determined in accordance with a comparison of the postal information of the rejected book with the postal information of a book on the conveyor, typically the current or most recent book being assembled by the system. The computer generates an indication of the incremental increase in postage for the reordered book based upon the point in the sequence at which the defective book was reordered and adds this increase to a precalculated indication of such postage computed before the collating and binding has begun.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a signature collating and binding system according to the present invention;

FIG. **2** is a generalized block diagram of the control program stored in the computer shown in FIG. **1**;

FIGS. **3A** and **3B**, when joined along similarly lettered lines, comprise a flow chart of the book reordering control program stored in the computer shown in FIG. **1**;

FIGS. **4**, **5A** and **5B** are flow charts of the postage revision control program stored in the computer of FIG. **1**;

FIG. **6** is a flow diagram of steps for generating an indication of postage due to the reordering of defective books, such steps being implemented either manually or in the computer shown in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1**, a signature collating and binding system **14** is disclosed, such system being preferably of the type disclosed in Riley et al U.S. Pat. No. 4,121,818, assigned to the assignee of the instant application and the disclosure of which is hereby incorporated by reference. The description of the Riley et al system in this application is limited to those portions which are pertinent to an understanding of the present invention, it being understood that a more complete description may be had by reference to the above-identified patent.

The system **14** includes a conveyor **16** having a plurality of stations, such as station **18**, each station being

separated from other stations by pusher pins shown schematically at 20. The station 18 is illustrated as being positioned to receive a signature 21 stored in a first signature feeder box 22. The feeder box 22 includes feeder apparatus 24 selectively operated by a main computer 25 through a distribution network 26. The feeder apparatus 24 is disclosed in the above-mentioned Riley et al patent and reference may be had thereto for a full description. At this point, it need only be mentioned that the signature 21 may or may not be placed on the conveyor 16 at the station 18 depending upon the state of a signal on a line 28 from the distribution network 26.

The signature feeder box 22 also includes a detector 30 which detects when a signature has been placed on the conveyor 16. The output from the detector 30 is coupled to the computer 25 through the network 26.

Second through nth signature feeder boxes are also disposed along the conveyor 16, only the nth box 32 being shown schematically for purposes of simplicity. Each of the second through nth signature feeder boxes is essentially identical to the first feeder box 22, the feeding of signatures by the boxes being individually controlled by the main computer 25. The computer 25 in turn receives information from a magnetic tape reader 36 which senses information stored on a magnetic tape 37 regarding the particular signatures to be assembled for each book. As noted in the above-mentioned Riley et al patent, different versions of books may be built at different stations of the conveyor 16 by controlling the feeding of signatures by each of the feeder boxes.

A programmable controller 27 is also coupled to the distribution network 26 and is capable of controlling various book-processing apparatus noted more specifically below.

The conveyor 16 is driven by a chain motor 38 and information regarding the position of the stations of the conveyor 16 is developed by an encoder 39 and is coupled to the distribution network 26.

A non-contact printer, such as an ink jet printer 40, is disposed between the first and nth signature feeder boxes at a point which permits ink jet printing of customized information under control of the computer 25 on one or more signatures. The ink jet printer 40 includes a detector 41 which detects whether the printer is operating correctly. A microcomputer 42 controls the printer 40 in response to commands from the computer 25.

Alternatively, the ink jet printer 40 may be located at another point, as desired.

Also disposed along the length of the conveyor 16 is means for detecting a defective book. One of these means is the detector 41 in the ink jet printer 40 described above. Other means include a long book detector 43, a hanging signature detector 44, a missing book detector 46 and a square book detector 47, the last two being located farther downstream adjacent the conveyor 16. A caliper 48 may additionally be utilized to check the thickness of each book on the conveyor 16. The caliper 48 is adjusted to provide a defective book indication to the distribution network 26 and the computer 25 when the thickness of the book measured thereby is outside of a predetermined range.

A stitcher 50 binds the assembled books after measurement by the caliper 48. A diverter 52, under control of the programmable controller 27 rejects defective books by removing same from the conveyor 16. A trimmer 54 then cuts the bound books to size and a label printer 56, which may be a second ink jet printer, operated by the computer 25 and a microcomputer 57, prints mailing information on the outside of the completed book. The label printer 56 may also have a detector 58 incorporated therein to determine whether the printer is operated satisfactorily.

Following the label printer 56, additional processing may be performed as desired.

The computer 25 includes a random access memory, or RAM 62 and a central processing unit, or CPU 64. The RAM 62 contains the control program described in later portions of this specification and may additionally store incremental postal rates, as later noted. The RAM 62 also stores various intermediate results of calculations performed by the CPU 64 and information from the magnetic tape reader 36 indicating the makeup of each book to be produced during a production run, the address to which the completed book is to be sent and other information.

An operator console 66 acts as an interface between an operator and the collating system. The computer 25 may also operate printer 68 to inform a user of various operating conditions in the collating system. For example, the computer 25 may operate the printer 68 to print a postage report for the assembled books, as noted more specifically below.

The collating system may include additional elements, such as a replacement book feeder which replaces missing books with a standard book, or other elements as desired. The replacement book feeder is disclosed in Abram et al. U.S. Pat. No. 3,899,165 and in the above-noted Riley et al patent and reference should be made thereto for a full description.

The order in which the books are to be produced is derived from mailing lists provided by the customer so that advantage is taken of discounts offered by the Postal Service. The postage is then calculated and this precalculated indication of total postage and the rate category for each book to be produced is stored on the magnetic tape 37. The current postal rate structure for bulk business mail and the postal bundling requirements, some of which result in discounts for second and third class mailings is as follows:

	2nd Class		3rd Class	
Category	# of Pieces Required	Postal Rate Level	# of Pieces or Weight Required	Postal Rate Level
Carrier Route	6 or more	C (lowest rate)	10 or more pieces	CAR RT (lowest rate) -
5 Digit Zip Code	6 or more	B (intermediate rate)	50 pieces or 10 lbs.	5-DIGIT (intermediate rate)
3 Digit Zip Code	6 or more	A (highest rate)	10 or more pieces	BASIC (highest rate)
SCF	6 or more	A (highest rate)	10 or more pieces	BASIC (highest rate)
Common State	6 or more	A (highest rate)	10 or more pieces	BASIC (highest rate)
Mixed States	left over	A (highest rate)	left over	BASIC (highest rate)

A typical second class piece of mail is a magazine while a typical third class item is a catalog.

In terms of second class mailings, a bundled group of 6 or more pieces to the same carrier route qualifies for the lowest postal level rate C, while a group of six or more pieces bundled together and having the same 5-digit zip code qualifies for an intermediate postal rate level B. The remaining groupings, for example the 3-digit zip code category (referring to the first three digits of the 5-digit zip code) where six or more books are grouped together each having a common 3-digit zip code prefix, qualify for the basic (or highest) postal rate A.

Similarly, for third class mailings, ten or more pieces bundled together by carrier route qualifies for the lowest postal rate level CAR RT, while groupings of 50 or more books, or 10 pounds or more of books, having a common 5-digit zip code qualifies for the intermediate rate 5-DIGIT. The remaining categories qualify for BASIC (or highest) rates, similar to that described with respect to second class.

As noted above, the magnetic tape **37** contains for each book to be produced information as to the makeup of the book in terms of which signatures are to be included therein and information regarding the person and mailing address to which the book is to be sent. This information may be arranged sequentially on the magnetic tape **37** so that the finished books exit the conveyor ready to be bundled into groups which qualify for the postal rate discounts.

This grouping of books can result in substantial postal savings to the customer. However, when a book originally qualifying for a postal discount is found to be defective on the conveyor and is rejected by the diverter **52**, and it is too late to reorder the same book so that it can be grouped with its original grouping, then the reordered book may not qualify for the discount. Accordingly, the precalculated indication of postage required may become erroneous.

Furthermore, a defective book which cannot be reordered so that it is still grouped with its original grouping of books may cause the entire original grouping to drop below the minimum level necessary to quality at a particular postal rate. For example, if a defective book in a second class mailing was originally grouped with five other books all addressed to the same 5-digit zip code and if the defective book could not be reordered to maintain its grouping with the remaining five books, then all six of the books (i.e. the defective book plus the five other books with which it was grouped), cannot qualify for postal rate level B instead must be mailed at the higher postal rate level A.

The above problems can be particularly acute where the books are "customized" in the sense that not all of the books produced during a single production run are identical. Customization can result from different signatures being included in some books but not in others, ink-jet printing of specialized messages (such as addressee name) on one or more signatures, insertion of subscription cards in some books but not others or any other manufacturing step which is selectively performed on less than all of the books in a production run so that not all books are alike. In fact, two or more different publications might be produced during the course of a single production run, and hence these books are appropriately considered "customized" as well.

Where a customized book is found to be defective and is rejected, the next book in the collating sequence cannot simply be substituted therefor to make up the deficiency since the two books are most likely not identical. Therefore, the customized book must be reordered.

In order to generate an indication of postage for a defective book which is reordered, the computer **25** is programmed to reorder the defective book at an appropriate point in the original collating sequence to take advantage of postal discount rates. An indication of the increase in postage, if any, for the reordered book is then generated by the computer **25** based upon the point in the collating sequence at which the book was reordered.

Referring also to FIG. **2**, the book reorder and postage revision program stored in the computer **25** is accessed by any one of a number of interrupts generated by the computer **25** of the programmable controller **27**. The computer or controller generates an interrupt whenever a signal is generated by one of the defective book detecting means. For example, if a failure has occurred in an ink jet such that the printer **40** fails to print a satisfactory message on a signature, the computer **25** receives the signal from the detector **41** in the printer **40** and generates the interrupt to cause the computer **25** to reorder the book at an appropriate time and generate an indication of the increase in postage for that piece of mail.

In a similar fashion, an indication of a defective book provided by the detectors **30,43,44,46,47** and a thick/-thin-book indication from the caliper **48** causes an interrupt to be transmitted to the computer **25**.

Referring now to FIGS. **3A** and **3B**, there is illustrated a portion of the programming in the computer **25** which determines the appropriate point in the original sequence to reorder a book found to be defective. The postal information of the defective book is compared with the postal information of the most recent books on the conveyor to determine which parts of the postal information for these books match and the defective book is immediately reordered or is reordered later in the sequence prior to a change in one of the matching parts of the postal information.

The "most recent" book is that book in the process of being assembled which is currently adjacent the first signature feeder box **22**. In other words, the most recent book as seen in FIG. **1** is typically that book which is eventually assembled on the station **18**.

As seen in FIG. **3A**, following the receipt of a defective book interrupt generated as previously noted, a block **80** determines the version of the defective book. As previously noted, each book may be different from or the same as other books in the production run depending upon the makeup of the book in terms of which signatures are fed to the appropriate station on the conveyor. As previously noted, this book makeup information is initially stored on the magnetic tape **36**. During production the information for each book is read into the RAM **62** of the computer **25** in a fashion identical to that disclosed in connection with FIGS. **10** and **11** of the Riley et al patent. For purposes of discussion in this application, it will be assumed that the version may be any one of N versions to be produced by the collating and binding system.

A block **82** then compares the 3-digit carrier route and 5-digit zip code designations of the defective book with the same information of the most recent book being assembled on the conveyor. If the carrier routes and zip codes of these books are the same, then a block **86** stores the book information for the defective book in

the RAM 62 so that this book is assembled immediately following the most recent book. The defective book is therefore reordered so that it can be grouped with the other books having the same carrier route and zip code mailing information.

In the event that the carrier route and zip code information are not identical, then a block 88 compares only the 5-digit zip code of the defective book with the most recent book zip code. If it is found that the 5-digit zip codes are identical, a block 92 causes version X to be reordered immediately preceding the first book having a zip code different than the zip code of the books currently being assembled. Following the block 92, control passes to a block 120 in FIG. 4 where the indication of increase in postage for the defective book is generated. This is necessary since the book can no longer be grouped with other books having the same carrier route and zip code information, and hence this book cannot be mailed at postal rate C (for second class) or at the CAR RT rate (for third class mail). Instead this book must be shipped at postal level B, if second class or at the 5-DIGIT rate, if third class.

If the 5-digit zip codes of the defective and most recent books are not the same, a block 94 compares the first three digits of the zip codes of these books to determine whether the books should be grouped in the 3-digit category. If these first three digits are identical, a block 98 causing version X to be reordered immediately preceding a change in the first three digits of the current zip code.

Following the block 98, control passes to a block 130, FIG. 5, which generates the indication of postage increase, if any, for this book. This is necessary since this book now qualifies for the highest postal rate whereas it previously may have qualified for a lesser rate.

If it is determined that the first three digits of the zip code are not the same, then a block 100 determines the sectional center facility, or SCF, of the defective book and the most recent book. This is accomplished by utilizing the zip code information for each book to access a lookup table containing SCF identifications. A block 102 then compares the SCF designations for the defective book and most recent book. If the SCF designations are identical, a block 104 causes version X to be reordered immediately preceding a change in the SCF from that associated with the books currently being produced.

If it is found that the designations are not identical, a block 106 compares the state information of the defective book with that of the most recent book. If the books are to be mailed to the same state, a block 108 causes version X to be reordered immediately preceding a change in such state.

If the block 106 determines that the books are not to be mailed to the same state, then the book is to be grouped with books from other states, and hence version X is reordered at a later point in the sequence such as at the end of the production run.

Control from each of the blocks 104,108,110 passes to the block 130, FIG. 5, previously mentioned.

It should be noted that a change in 5-digit zip code, 3-digit zip code, SCF or state may be indicated by flags contained within the mailing information stored on the magnetic tape and placed in the RAM 62 or may be accomplished by other means, as desired.

The net result of the program shown in FIGS. 3A and 3B is to cause the original collating sequence to be changed to a revised sequence due to the reordering of defective books. Control then passes to the postage revision program shown in FIGS. 4 and 5.

It should be noted that the point at which the defective book is reordered may be determined in accordance with a comparison of the postal information of the defective book with another book on the conveyor not the most recent book. For example, assume that there are 23 signature feeders positioned adjacent the conveyor at positions 1–11 and 13–24 such that position 1 is occupied by the box currently feeding to the most recent book and, position 24 is occupied by the last box to feed signatures to the conveyor stations. Also assume that an ink jet printer occupies position 12 and that a series of customized books are to be produced wherein the customization is due solely to the message printed by the ink jet printer (i.e. all books have the same signature makeup). If a detector downstream of the jet ink printer determines that no signature was fed by one or more of the boxes at positions 13–24 where a signature should have been fed, then the postal information of the defective book is compared against that of the book adjacent the box at position 11. If the zip code and carrier route designations of these two books match, then the message for the defective book is applied on the book currently adjacent position 11 so that the defective book is reordered. This is possible since each book will eventually have the same signatures contained therein. The customized messages for the remaining books in the production sequence are applied on later books after the message for the defective book has been printed.

On the other hand, if the carrier route and zip code designations for the defective book and the book adjacent position 11 are not both the same, the postal information of the defective book might be compared against that of all or only some of the books adjacent positions 1–10 to determine the optimal reorder time.

Referring now to FIG. 4, following the block 92 of FIG. 3A, the block 120 determines whether the defective book was originally classified in lowest postal level C or CAR RT. In other words, the block 120 determines whether the defective book which was originally classified with either more than six (if second class) or ten (if third class) other books having the same carrier route and zip code designations. If this is not the case, then the book was originally classified in the intermediate postal level B or the 5-DIGIT classification and hence no adjustment to postage need be made. Accordingly, control passes through a block 121 to a block 122 if the run is not yet complete where control pauses until the next defective book interrupt is received.

If it is determined that the defective book was originally classified in postal level C or in the CAR RT classification, then a block 124 checks to determine whether the defective book was previously reordered and classified in either postal level B or the 5-DIGIT classification. This is accomplished by checking a flag in the RAM 62, as noted more specifically below. If this is the case, then the defective book was originally classified in the lowest postal rate classification, and subsequently was reordered in the intermediate postal rate classification and the indication of postage increase already generated. Accordingly, no further postage revision is required and hence control passes to the block 121.

If the block 124 determines the defective book has not been previously reordered and that it has been reclassified in the intermediate postal level, then a postal change counter designated "C-to-B" for version X is

incremented, such counter being contained within the RAM 62 shown in FIG. 1. There is a different "C-to-B" counter for each version to be produced in the run.

Following the block 126, a block 128 sets a flag in the RAM 62 indicating that the defective book has been reordered. This information is important since it may occur that the reordered book itself may later be found to be defective, in which case block 124 is again encountered to check the status of this flag.

Referring now to FIGS. 5A and 5B, immediately following the blocks 98,104,108,110 in FIG. 3, the block 130 checks to determine whether the defective book was originally classified in the lowest postal rate level. If this is the case, then a block 132 checks to determine whether the defective book was previously reordered and classified in postal level B or in the 5-DIGIT classification. This is accomplished, similar to the block 124 described in FIG. 4 by checking the reorder flag for the defective book in the RAM 62. If this is not the case, then a postal change counter designated "C-to-A" in the RAM 62 is incremented since the defective book originally qualified for the lowest postal rates, but could not be ordered in time to quality for either the lowest or intermediate rates.

Following the block 134, control passes to a block 136, FIG. 5B, which sets the reorder flag for the defective book. A block 138 then checks to determine whether the entire production run has been completed, and if this is not the case then control pauses at a block 140 until the next defective book interrupt is received.

On the other hand, if the block 138 determines that the run has been completed, a block 142 prints a postage report, to be described in greater detail in later portions of the specification.

If the block 132, FIG. 5A, determines that the defective book had previously been reordered at the intermediate postal rate level, then a block 144 checks to determine whether the defective book and the reordered book are both classified in the highest postal rate classification. In other words, this block checks to determine whether the book is being reordered at the highest postal rate, when it was previously reordered also at the highest postal rate. If this is the case, then no adjustment to postage need be made and control passes directly to the block 136 previously described.

On the other hand, if the block 144 determines that the defective book was classified in the intermediate postal rate level and is now being reordered in the highest postal rate level, then a block 146 decrements the "C-to-B" postal change counter for version X and a block 148 increments the "C-to-A" postal change counter for version X. This is necessary since the book has been twice reordered, each time at a higher rate, i.e. the book originally qualified for the lowest postal rates, then was reordered at the intermediate postal rate and finally was reordered at the highest postal rate. Accordingly, the bookkeeping is kept accurate by simply noting that the book is subject to an incremental increase in postage from the lowest to the highest rates and by deleting the incremental increase from the lowest to the intermediate rates. Following the block 148, control passes to the block 136 previously described.

Referring again to FIG. 5A, if the block 130 determines that the defective book originally did not qualify for the lowest postal rate, then a block 150 checks to determine whether the defective book was previously reordered at the intermediate postal rate level. If this is not the case, then no adjustment to postage need be made since the defective book originally was classified in the highest postal rate level and is reordered at the same level.

On the other hand, if the block 150 determines that the book had been previously reordered at the intermediate postal rate level, then a block 152 checks to determine whether the defective book had been previously reordered and classified in the highest postal rate level. If this is the case, then again no adjustment to postage indication need be made since the book had previously been calculated in the highest postal rate level and will again be ordered at this level.

On the other hand, if the block 152 determines that the book had not been previously reordered and classified in the highest postal rate level, then a block 154 increments a "B-to-A" postal change counter in the RAM 62 for version X since the defective book orginally qualified for the intermediate postal rates while the reorder book cannot so qualify.

Control from the block 154 then passes to the block 136 previously described.

Referring now to FIG. 6, there is illustrated a flow diagram of steps for calculating an indication of the increase in postage due to the reordering of defective books. The flow diagram of FIG. 6 is described under the assumption that the steps are, in the preferred embodiment, implemented in the computer 25, it being understood that such steps may be performed manually, if desired.

A block 160 loads a table of postage rates into memory locations in the RAM 62. Generally, the table is segregated according to version and according to the incremental postage rate for each change between postage rate levels. For example, for version X, three figures are stored representing the dollar increase for a change in classification for a book between the lowest and intermediate postage levels, the lowest and highest postage levels and the intermediate and highest postage levels. These rates are, of course, determined by the U.S. Postal Service.

Following the block 160, the blocks 80–152, shown in FIGS. 3–5, reorder the defective book and generate an indication of the increase in postage for the reordered book. A block 162 then performs a lookup procedure in the table of postage rates and the version X postal change counters and multiplies the contents of each version X counter by the appropriate increase in postage stored in the table. The block 162 then generates three postal adjustments which are added to the previously calculated postal bill for version X by a block 164.

A block 166 then causes the printer 68, FIG. 1, to print out the adjusted postal level for version X. A block 168 then repeats the steps of blocks 162–166 for the remaining versions of the production run.

The programming in the computer can be modified to calculate the extra postage required when a defective book causes an entire group of books to change postal rate level. In such a case, it is necessary to provide on the magnetic tape not only a precalculated indication of the total postage required, but also the number of pieces of each version to be mailed according to postal rate level classification. At the end of the production run, the information stored in the postal change counters can be combined with this additional information to derive an indication of total postage.

Moreover, the programming can be modified to eliminate the need for a precalculated indication of postage. In such a case, the final indication of postage would be

generated after the production run, based upon the sequence in which the nondefective books were produced.

I claim:

1. A method of operating a collating system, comprising

producing a series of books in an original sequence, such original sequence being determined in accordance with postal information relative to such books;

checking for a defective book;

generating a signal when a defective book is detected;

reordering the defective book in response to the generated signal at a point in the original sequence determined in accordance with the postal information relative to the rejected book and another book to produce the series of books in a revised sequence; and

deriving an indication of postage for the nondefective produced books in accordance with the revised sequence.

2. The method of claim 1, wherein the step of producing is carried out on a conveyor and wherein the point in the original sequence at which the defective book is reordered is determined by comparing the postal information of the defective book with the postal information of a book on the conveyor.

3. The method of claim 1, wherein the point in the original sequence at which the defective book is reordered is determined by comparing the postal information relative to the defective book with the postal information relative to the most recent book being produced.

4. The method of claim 1, wherein the step of deriving includes the steps of calculating the postage required for the books if produced in the original sequence and revising the calculated postage in dependence upon the revised sequence.

5. The method of claim 4, wherein the step of revising includes the steps of generating an indication of the increase of postage for each reordered book and adding to the calculated postage the increase in postage for such reordered books.

6. The method of claim 1, wherein the step of reordering includes the steps of comparing the postal information of the defective book with that of the most recent book being produced, determining which parts of the postal information of the defective and most recent books match and reordering the defective book at a point in the original sequence prior to a change in one of the matching parts of the postal information for books to be produced.

7. The method of claim 1, wherein the postal information includes designations of 5-digit zip code and carrier route, and wherein the step of reordering includes the steps of comparing the postal information of the rejected book with that of the most recent book being produced to determine whether any of such informatiokn matches and immediately reordering the defective book only if the carrier route and 5-digit zip code designations of both books match.

8. The method of claim 7, wherein the step of reordering includes the further step of reordering the defective book immediately preceding a change in 5-digit zip code for books to be produced if the 5-digit zip code of the defective book matches that of the most recent book being built but the carrier route designations do not match.

9. The method of claim 7, wherein the step of deriving includes the steps of calculating the postage required for the books is produced in the original sequence, generating an indication of the increase in postage for a defective book if such book is not immediately reordered and adding to the calculated postage the increase in postage to derive the indication of postage.

10. The method of claim 7, wherein the step of reordering includes the further step of reordering the defective book immediately preceding a change in the first three digits of the zip code for books to be produced if neither the 5-digit zip code nor the carrier route designation of the defective book matches that of the most recent book being built but the first three digits of the zip code match.

11. The method of claim 10, wherein the step of deriving includes the step of calculating the postage required for the books assuming such books are produced in the original sequence, generating an indication of the increasing in postage for the reordered book over the calculated postage required for the defective book and adding the increase in postage to the calculated postage.

12. A collating system, comprising:

means for producing a series of books in an original sequence, such original sequence being determined in accordance with postal information relative to such books;

means for detecting a defective book;

means responsive to the detecting means for generating a signal when a defective book is detected;

means for reordering the defective book in response to the generated signal at a point in the original sequence determined in accordance with the postal information relative to the rejected book and another book to produce the series of books in a revised sequence; and

means for deriving an indication of postage for the non-defective produced books in accordance with the revised sequence.

13. The collating system of claim 12, wherein the producing means includes a conveyor and wherein the reordering means includes means for comparing the postal information of the defective book with the postal information of a book on the conveyor to determine the point in the original sequence at which the defective book is reordered.

14. The collating system of claim 12, wherein the reordering means includes means for comparing zip code and carrier route designations of the defective book with zip code and carrier route designations of the most recent book being produced to determine the point at which the defective book is reordered.

15. The collating system of claim 12, wherein the deriving means includes means for providing a precalculated indication of the postage required for the books if produced in the original sequence and means for revising the precalculated indication in dependence upon the revised sequence.

16. The collating system of claim 15, wherein the revising means includes means for developing an indication of the increase in postage for each reordered book and means for adding the increase in postage to the precalculated indication of postage.

17. The collating system of claim 12, wherein the reordering means includes means for comparing the postal information of the rejected book with that of the most recent book being built, means for determining which parts of the postal information of the defective

and most recent books match and means for reordering the defective book at a time prior to a change in one of the matching parts of the postal information for books to be produced.

18. The collating system of claim 12, wherein the postal information includes designations of zip code and carrier route, and wherein the reordering means includes means for comparing the postal information of the rejected book with that of the most recent book being produced to determine whether any of such information matches and first means for immediately reordering the defective book only if the carrier route and zip code designations of both books match.

19. The collating system of claim 18, wherein the reordering means further includes second means for reordering the defective book immediately preceding a change in zip code for books to be produced if the zip code of the defective book matches that of the most recent book being built but the carrier route designations do not match.

20. The collating system of claim 18, wherein the deriving means includes means for providing a precalculated indication of postage required for the books assuming such books are produced in the original sequence, means for developing an indication of the increase in postage due to reordering of a defective book and means for adding the increase in postage to the precalculated indication of postage.

21. The collating system of claim 18, wherein the reordering means further includes second means for reordering the defective book immediately preceding a change in the first three digits of the zip code for books to be produced if only the first three digits of the zip code of the defective book matches the first three digits of the zip code of the most recent book.

22. The collating system of claim 21, wherein the deriving means includes means for providing a precalculated indication of postage required for the books assuming such books are produced in the original sequence, means for developing an indication of the increase in postage for the reordered book over the precalculated indication of postage for the defective book and means for adding the indication of the increase in postage to the precalculated indication of postage.

23. A collating system comprising:

A plurality of signature feeders for delivering signatures to a plurality of stations along a conveyor;

means controlling the signature feeders for progressively building different groups of signatures on the conveyor to thereby build a series of books in an original sequence;

means for providing a precalculated indication of the postage required for the books being built on the conveyor;

means disposed along the conveyor for detecting a defective book;

means responsive to the detecting means for rejecting the defective book;

means for reordering the rejected book at a point in the sequence determined in accordance with a comparison of the postal information of the rejected book with the postal information of a book on the conveyor; and

means for revising the precalculated indication of the postage required in accordance with the point in the sequence at which the rejected book is reordered.

24. The collating system of claim 23, wherein the postal information includes a carrier route designation, a zip code designation and a postal rate category for each book, the postal rate categories comprising lowest, intermediate and highest rate categories, and wherein the revising means includes means for determining the postal rate category for the rejected book and means responsive to the determining means for increasing the precalculated indication of postage by a particular amount if the rejected book had been classified in the lowest postal rate category and is reordered at a point in the sequence such that it can be grouped with other books having the same zip code but not the same carrier route designation.

25. The collating system of claim 23, wherein the postal information includes a carrier route designation, a zip code designation and a postal rate category for each book, the postal rate categories comprising lowest, intermediate and highest rate categories, and wherein the revising means includes means for determining the postal rate category for the rejected book and means responsive to the determining means for increasing the precalculated indication of postage by a particular amount if the rejected book had been classified in the lowest postal rate category and is reordered at a point in the sequence such that it is grouped with other books not having the same zip code and carrier route designations.

26. The collating system of claim 23, wherein the postal information includes a carrier route designation, a zip code designation and a postal rate category for each book, the postal rate categories, comprising lowest, intermediate and highest rate categories, and wherein the revising means includes means for determining the postal rate category for the rejected book and means responsive to the determining means for increasing the precalculated indication of postage by a particular amount if the rejected book had been classified in the intermediate postal rate category and is reordered at a point in the sequence such that it is grouped with other books not having the same zip code and carrier route designations.

27. A collating system, comprising:

a plurality of signature feeders for delivering signatures to stations along a conveyor;

means coupled to the signature feeders for individually controlling the signature feeders to build a series of customized books in a particular sequence, such particular sequence being determined in accordance with postal information relative to each book to be built so that the books are produced in an order which permits groups of books having common postal information to be bundled together and thereby receive a postal discount;

means adjacent the conveyor for detecting a defective book;

means responsive to the detecting means for reordering the defective book at a point in the particular sequence dependent upon a comparison of the postal information relative to the defective book and the most recent book being built on the conveyor; and

means for deriving an indication of the difference in postage, if any, for the reordered book over the defective book.

28. The collating system of claim 27, wherein the postal information includes a carrier route designation, a zip code designation and a postal rate category for

each book, the postal rate categories comprising lowest, intermediate and highest rate categories and wherein the deriving means includes means for determining the postal rate category for the rejected book and means responsive to the determining means for generating an indication of a particular postage difference if the rejected book had been classified in the lowest postal rate category and is reordered at a point in the sequence such that it can be grouped with other books having the same zip code but not the same carrier route designation.

29. The collating system of claim 27, wherein the postal information includes a carrier route designation, a zip code designation and a postal rate category for each book, the postal rate categories comprising lowest, intermediate and highest rate categories and wherein the deriving means includes means for determining the postal rate category for the rejected book and means responsive to the determining means for generating an indication of a particular postage difference if the rejected book had been classified in the lowest postal rate category and is reordered at a point in the sequence such that it is grouped with other books not having the same zip code and carrier route designations.

30. The collating system of claim 27, wherein the postal information includes a carrier route designation, a zip code designation and a postal rate category for each book, the postal rate categories comprising lowest, intermediate and highest rate categories and wherein the deriving means includes means for determining the postal rate category for the rejected book and means responsive to the determining means for generating an indication of a particular postage difference if the rejected book had been classified in the intermediate postal rate category and is reordered at a point in the sequence such that it is grouped with other books not having the same zip code and carrier route designations.

31. The collating system of claim 27, wherein the series of customized books includes a plurality of versions of such books and wherein the deriving means includes means for generating an indication of the difference in postage for each version.

32. The collating system of claim 31, wherein the developing means includes means for storing in a table an indication of the increase in postage for each version.

33. A collating system, comprising:

a plurality of signature feeders for delivering signatures to stations along a conveyor;

means coupled to the signature feeders for individually controlling same to build customized books in a particular sequence, such particular sequence being determined in accordance with postal information including carrier route and zip code designations relative to each book so that groups of books having common postal information can be bundled together and receive a postal discount;

means for providing a precalculated indication of postage required for the books if produced in the original sequence;

means for detecting a defective book on the conveyor;

first means responsive to the detecting means for immediately reordering the defective book if the carrier route and zip code designations of the defective book are the same as the carrier route and zip code designations of the most recent book being produced;

second means responsive to the detecting means for reordering the defective book at a subsequent point in the particular sequence if the carrier route designation of the defective and most recent books do not match; and

means responsive to the second means for revising the precalculated indication of postage by an amount dependent upon the point in the particular sequence at which the defective book is reordered.

34. The collating system of claim 33, wherein the second means includes means for determining whether the zip code designations of the defective and most recent books are the same and third means responsive to the determining means for reordering the defective book immediately prior to a change in zip code designation for books to be produced if the zip codes of the defective and most recent books are determined to be the same.

35. The collating system of claim 34, wherein the second means includes fourth means responsive to the determining means for reordering the defective book after the zip code designation for books to be produced has changed from that of the most recent book if the zip codes of the defective and most recent books are found to not be the same.

36. The collating system of claim 33, wherein the revising means includes means for indicating whether the rejected book was to have been grouped in the original sequence with at least a predetermined number of other books having the same carrier route and zip code designations, means for determining whether the rejected book is reordered so that it can be grouped with other books having the same zip code but not the same carrier route and means responsive to the indicating means and the determining means for increasing the precalculated indication of postage by a particular amount.

37. The collating system of claim 33, wherein the revising means includes means for indicating whether the rejected book was to have been grouped in the original sequence with at least a predetermined number of other books having the same carrier route and zip code designations, means for determining whether the rejected book is reordered so that it cannot be grouped with other books having either the same carrier route or zip code designations and means responsive to the indicating means and the determining means for increasing the precalculated indication of postage by a particular amount.

38. The collating system of claim 33, wherein the revising means includes means for indicating whether the rejected book was to have been grouped in the original sequence with at least a predetermined number of other books having the same zip code but not the same carrier route, means for determining whether the rejected book is reordered so that it cannot be grouped with other books having either the same carrier route or zip code designations and means responsive to the indicating means and the determining means for increasing the precalculated indication of postage by a particular amount.

39. A collating system, comprising:

a plurality of signature feeders for delivering signatures to stations along a conveyor;

means coupled to the signature feeders for individually controlling same to build customized books in a particular sequence, such particular sequence being determined in accordance with postal infor-

mation including carrier route and zip code designations relative to each book so that groups of books having common postal information can be bundled together and receive a postal discount;

means for detecting a defective book on the conveyor;

first means responsive to the detecting means for immediately reordering the defective book if the carrier route and zip code designations of the defective book are the same as the carrier route and zip code designations of the most recent book being produced;

second means responsive to the detecting means for reordering the defective book at a subsequent point in the particular sequence if the carrier route designation of the defective and most recent books do not match; and

means responsive to the first and second means for generating an indication of the postage for the books based upon the point in the particular sequence at which the defective book is reordered.

40. The collating system of claim **39**, wherein the second means includes means for determining whether the zip code designations of the defective and most recent books are the same and third means responsive to the determining means for reordering the defective book immediately prior to a change in zip code designations for books to be produced if the zip codes of the defective and most recent books are determined to be the same.

41. The collating system of claim **40**, wherein the second means includes fourth means responsive to the determining means for reordering the defective book after the zip code designation for books to be produced has changed from that of the most recent book if the zip codes of the defective and most recent books are found to not be the same.

42. A method of operating a collating system, comprising the steps of:

producing a series of books in an original sequence, such original sequence being determined in accordance with postal information relative to such books;

providing an indication of an amount of postage required to mail the books if produced in the original sequence;

checking for a defective book;

generating a signal when a defective book is detected;

reordering the defective book in response to the generated signal;

determining for each reordered book whether an incremental increase in postage is required to mail the books due to the reordering of such book; and

revising the indication of the amount of postage required to mail the books by the incremental increases determined for the reordered books.

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