

Dec. 3, 1968

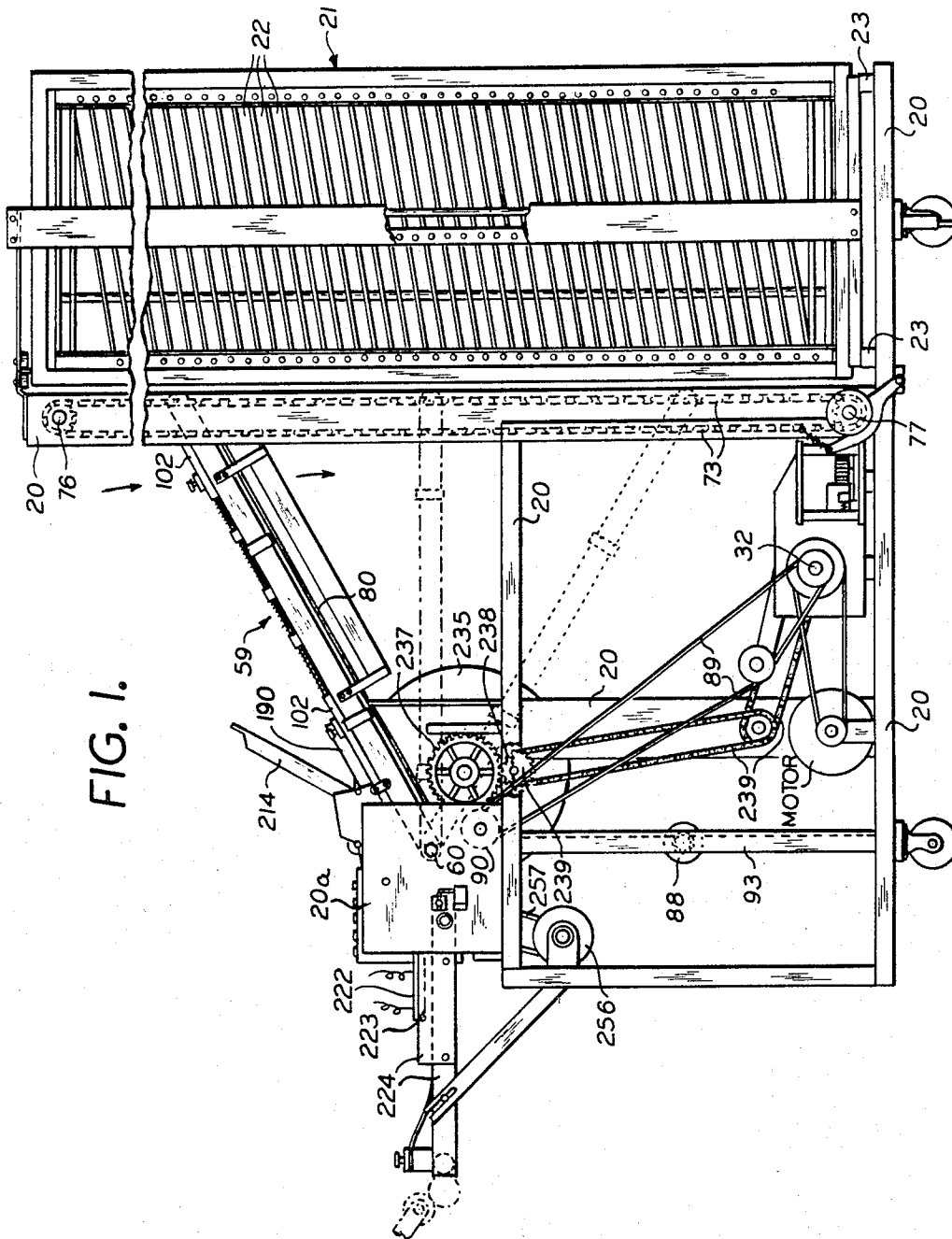
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3,414,256

SHEET SORTER HAVING POCKET INDEXING MEANS

Filed Oct. 12, 1966

10 Sheets-Sheet 1



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SHEET SORTER HAVING POCKET INDEXING MEANS

Filed Oct. 12, 1966

10 Sheets-Sheet 2

FIG. 2.

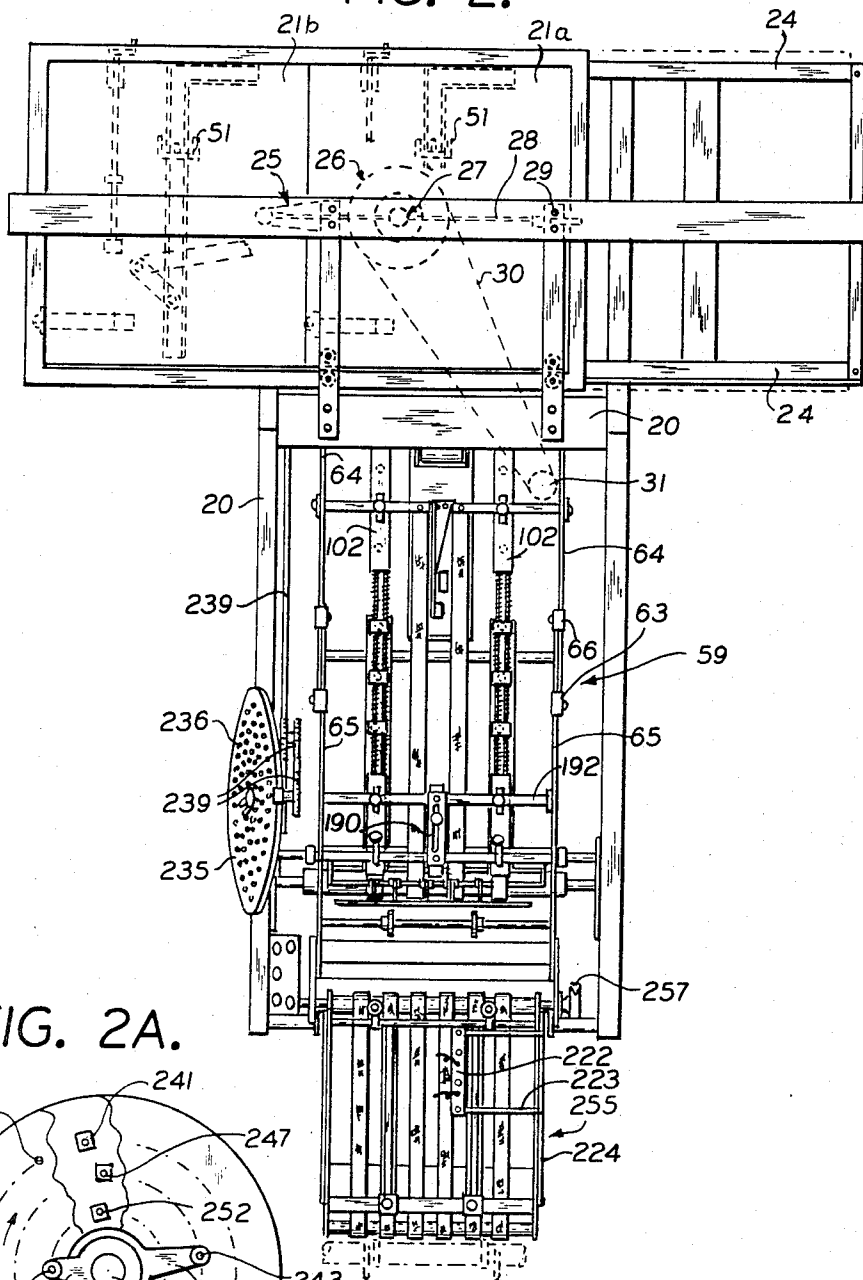
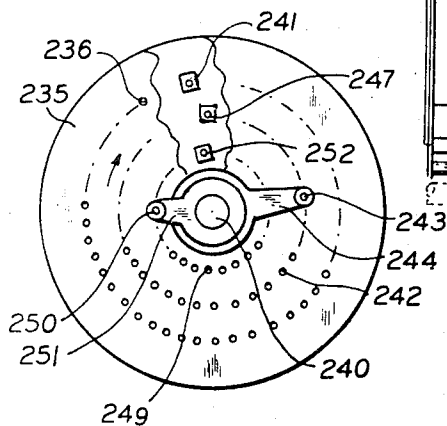


FIG. 2A.



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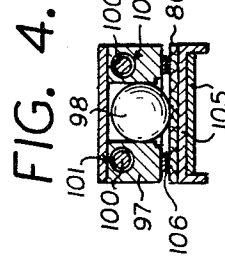
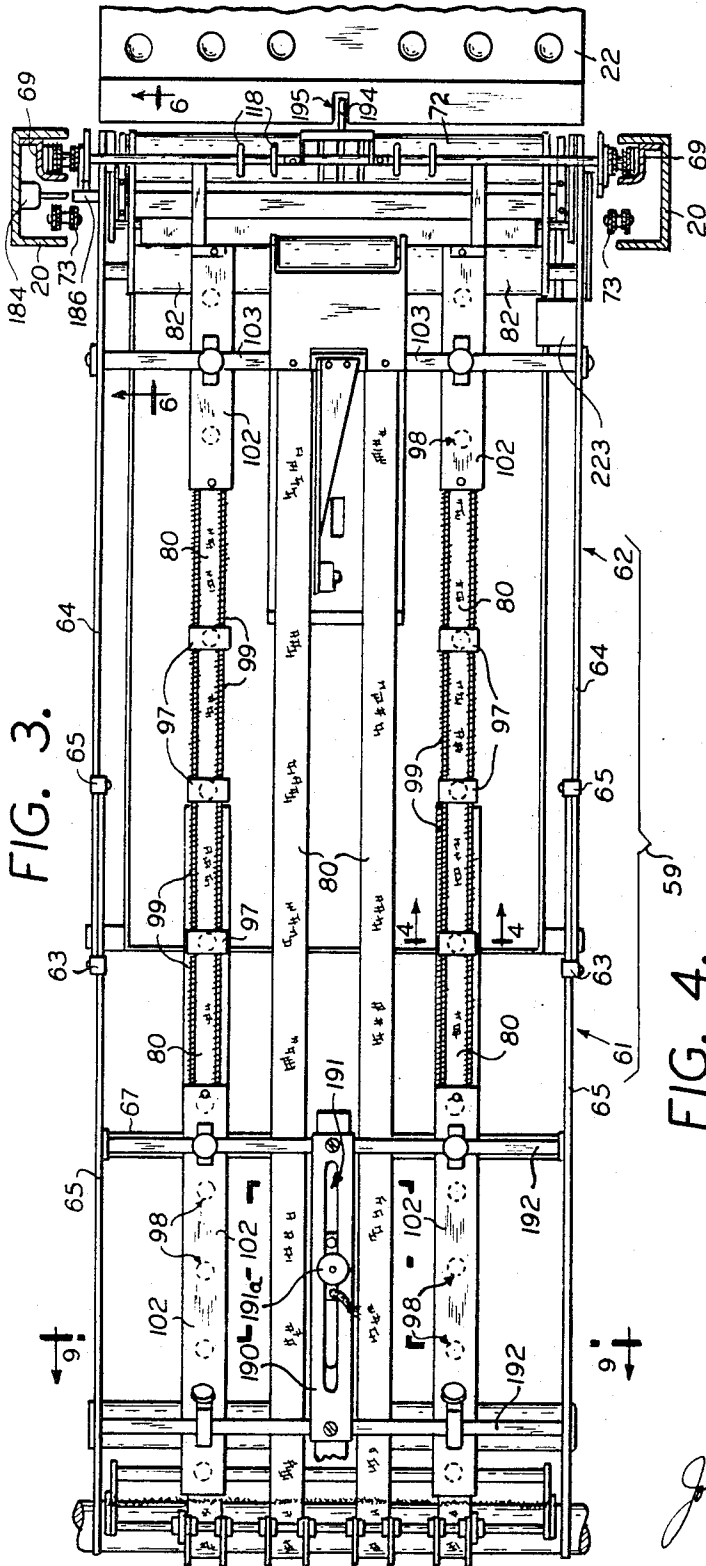
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SHEET SORTER HAVING POCKET INDEXING MEANS

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10 Sheets-Sheet 3



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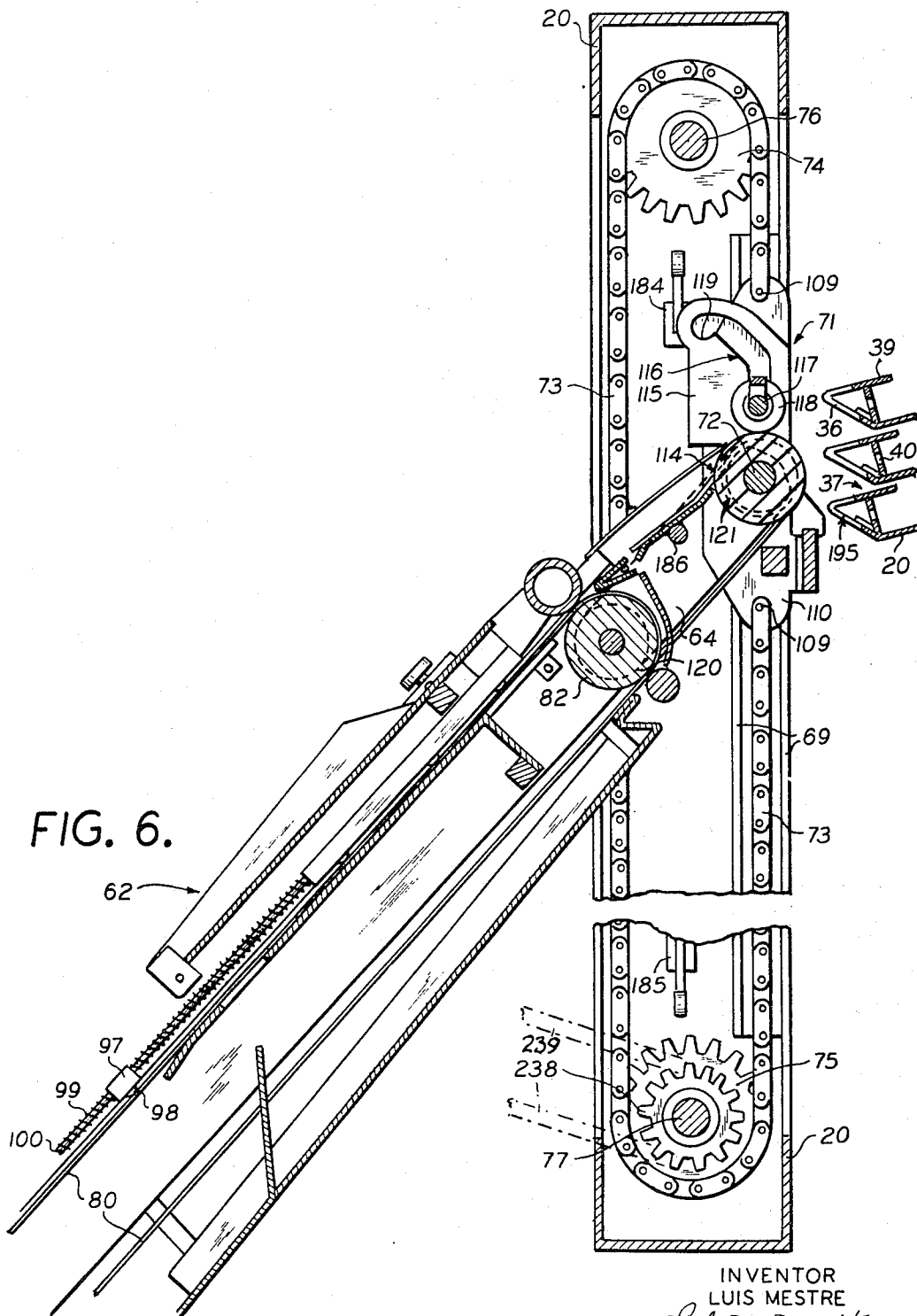
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SHEET SORTER HAVING POCKET INDEXING MEANS

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10 Sheets-Sheet 5



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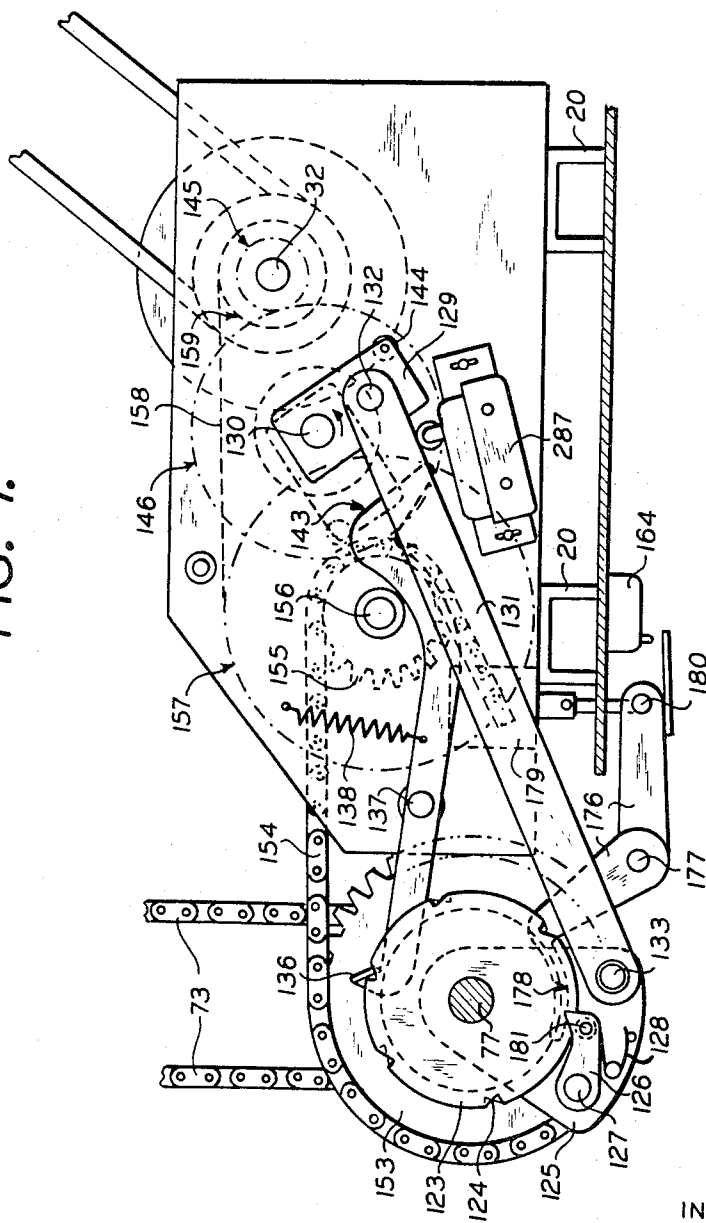
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FIG. 7.



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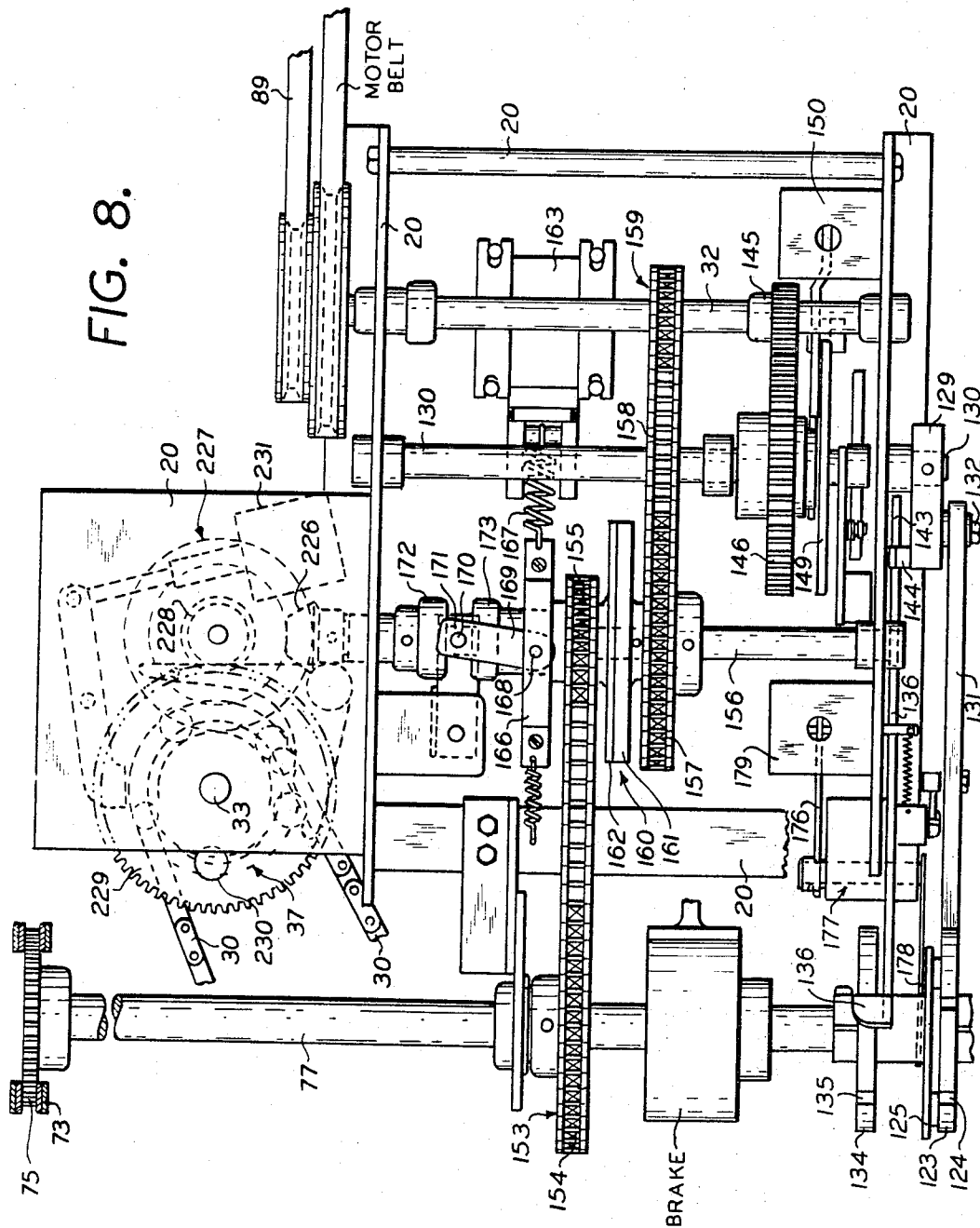
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SHEET SORTER HAVING POCKET INDEXING MEANS

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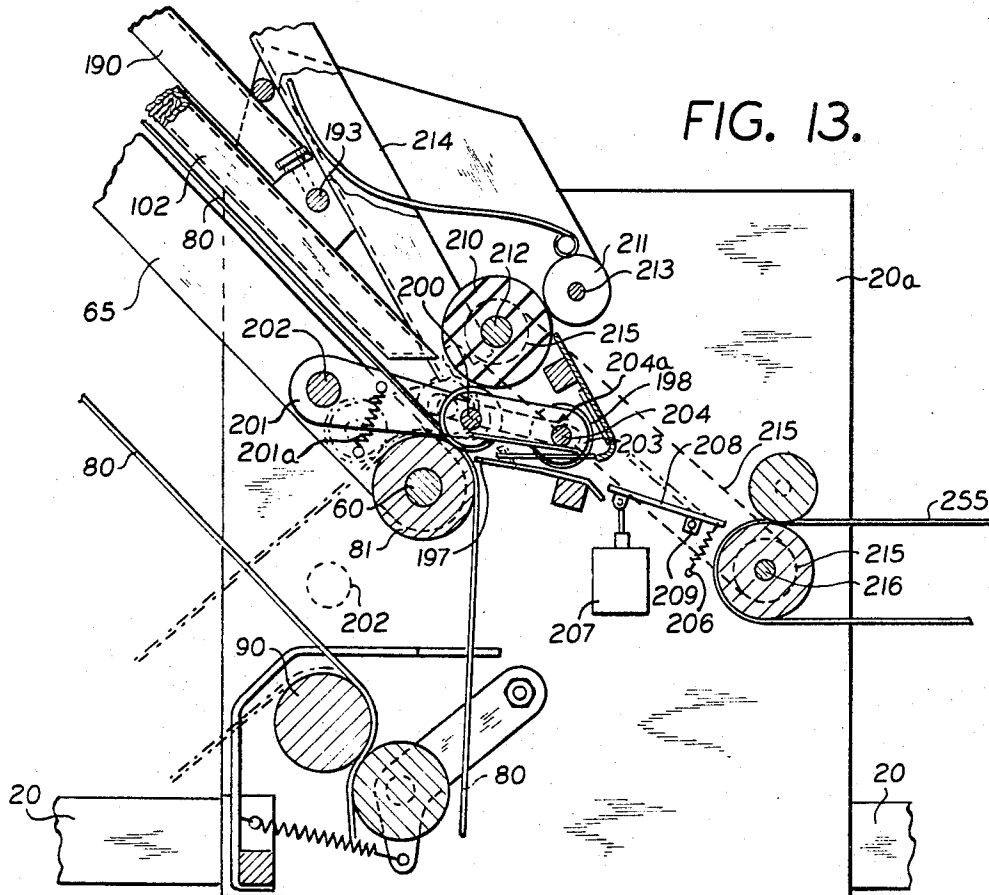


FIG. 13.

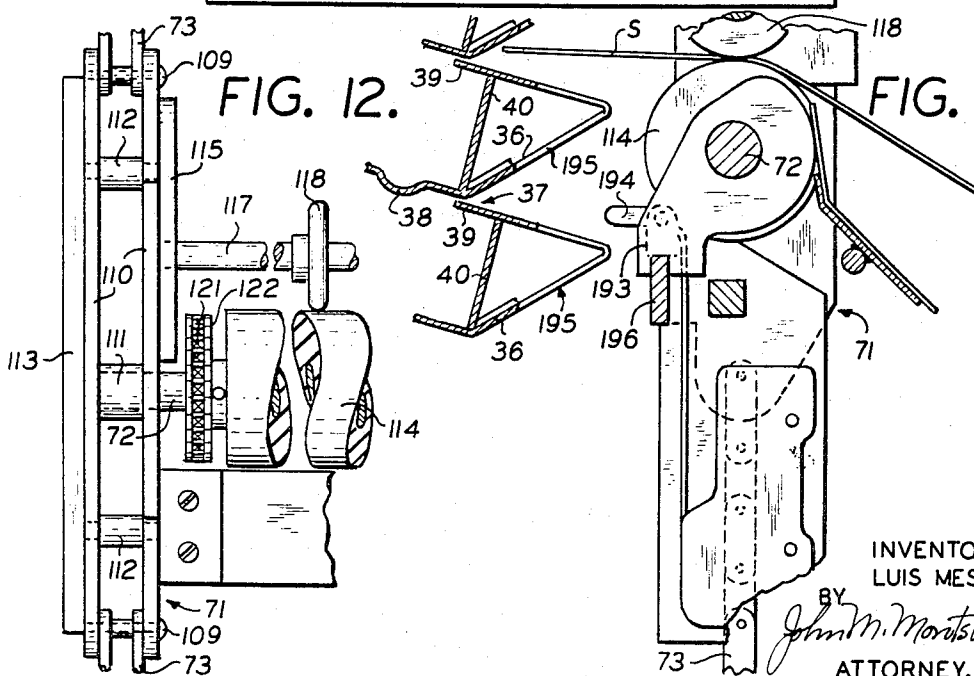


FIG. 12.

FIG. 11.

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10 Sheets-Sheet 10

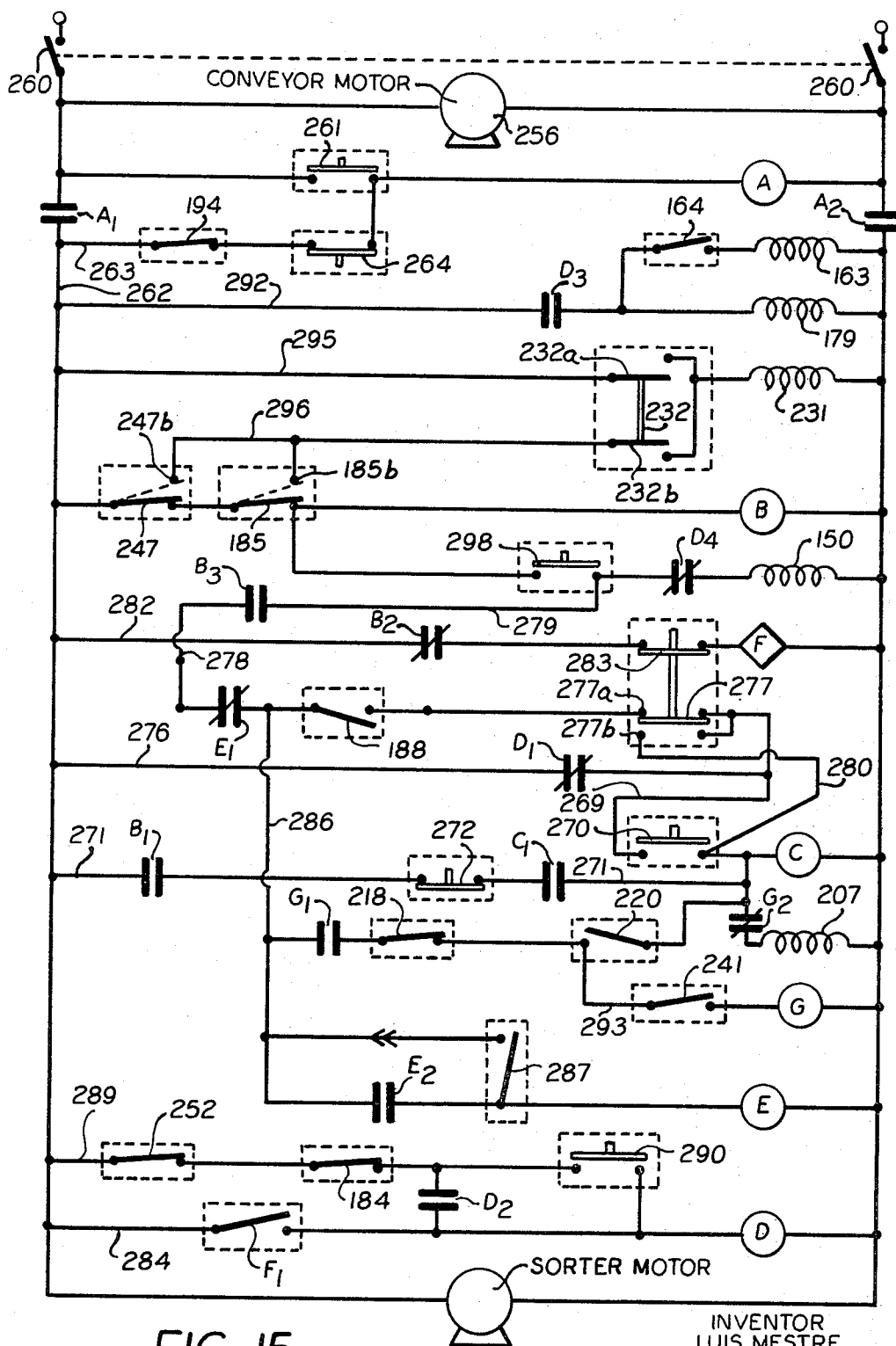


FIG. 15.

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## SHEET SORTER HAVING POCKET INDEXING MEANS

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18 Claims. (Cl. 270—58)

### ABSTRACT OF THE DISCLOSURE

A sheet sorter having a column of vertically spaced pockets and a pivoted delivery conveyor. The forward end of the delivery conveyor is indexed between any desired group of successive pockets in the column. Means are provided to control the delivery of more than one sheet to any pocket or to skip delivery of a sheet to any pocket with the skip deflector ahead of the indexing trigger.

The invention relates to a sheet sorter for delivering one sheet to each of a plurality of pockets and having skip means whereby a sheet is not delivered to one or more selected pockets and is designed particularly as an improvement on the sheet sorter of my application S.N. 498,744 filed Oct. 20, 1965, now Patent No. 3,356,362, although it is applicable to sorters of other constructions. It has particular application in the printing of booklets in small quantities where the sorter is spaced on the delivery side of a printing press and as each sheet is printed, it is delivered to its pocket, and successive sheets to each of the pockets. After one page has been printed and sorted, the press has the plate for page 2 inserted therein and the second sheet is delivered by the sorter to each of a plurality or all of the pockets and so on for all the pages of the book. The sorter herein provides a plurality of pockets, such as fifty, in stacked relation and the sheets are delivered successively to each pocket by a conveying means, the delivery end of which is moved or indexed successively opposite each pocket. There are various controls for accomplishing this delivery of a sheet to its pocket as well as various selective controls for skipping a sheet to any one or more pockets so that the pocket lacks one or more of the sheets.

It is an object of the invention to construct a sorter to feed generally a sheet in succession to each of a stack of aligned pockets and provide a skip deflector between the ends of a conveying means whereby one or more selected pockets are skipped and does not receive a sheet.

Another object is to construct a sorter as above with the skip deflector ahead of the trigger means for indexing the pocket to receive a sheet and yet the indexing means is triggered to move to the next pocket.

Another object is to construct a sorter as above which has a proof deflector at the entry end which is also used as a skip deflector whereby a sheet is not inserted in any one or more of the pockets in a stack.

A further object is as in the preceding paragraphs in which the sorter uses a pivoted ramp means with the delivery end of the ramp means being indexed to successive pockets.

Other objects of the invention will be more apparent from the following description when taken in connection with the accompanying drawings illustrating a preferred embodiment thereof in which:

FIG. 1 is a side view of the sorter;

FIG. 2 is a top view of the sorter;

FIG. 2A is a detail view of the programmer;

FIG. 3 is a plan view of the ramp means;

FIG. 4 is an enlarged cross section taken on line 4—4 of FIG. 3;

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FIG. 5 is a view showing a sheet operated trigger for indexing mechanism;

FIG. 6 is an enlarged view of the delivery end of the ramp means and its raising and lowering means;

FIG. 7 is a side view of the ramp operating means;

FIG. 8 is a top view of the ramp operating means;

FIGS. 9 and 10 show details of the ramp endless means;

FIGS. 11 and 12 show details of the delivery end of the ramp means;

FIG. 13 is a view of details of the delivery end of the ramp means.

FIG. 14 shows control switches for the skip means; and FIG. 15 is a circuit diagram.

The sorter includes a frame 20 of suitable form. A pocket stack means 21 having a plurality of pockets is provided which may be fixed to the frame. When the number of the pockets desired becomes large, it is inconvenient to have the height of the pockets to extend much more than over six feet so that fifty pockets for each of the plurality of vertical stacks is a convenient number for each stack of pockets. If the number of pockets provided are to be, for example, one hundred, the capacity of the sorter is increased to fit such situations as when it is desired to have more than fifty of the booklets, books, or the like.

The sorter illustrated is provided with one hundred pockets by having the stack means comprise two stacks 21a, and 21b, or fifty pockets each, adjacent and fixed to each other with the pockets of each stack in vertical arrangement. When one stack of pockets is filled, or any desired portion thereof, the second stack is moved into receiving position and the desired number of pages are delivered into the pockets of the second stack.

The stack means unit could be moved by hand to and from sheet receiving position, however, power means is preferably provided to shift the stack to and from receiving position when the proper number of sheets has been placed in a desired number of pockets in the receiving stack. This can be accomplished in several ways, that illustrated mounts the stack unit on wheels 23, FIG. 1 which engage a stack track 24, FIG. 2, positioned adjacent to or on the floor. A bell crank lever 25 secured to a sprocket or wheel 26 rotatably mounted on the frame on a pivot or shaft 27. The bell crank lever is connected through a link 28 to a pivot 29 carried by the bottom of the stack. The bell crank lever is rotated by suitable means that shown being a chain 30 connected with a sprocket or wheel 31 on a shaft 33 driven by the shaft 156, FIG. 8, as will be described hereinafter. In addition, the power stack shifting means may be automatic as will appear.

Each pocket 22, FIG. 6, has an angular director 36 projecting upwardly from the bottom of the pocket at the receiving end of the pocket which directs the sheet through a narrow slot 37 at the top of the pocket through which the sheet is projected into its pocket. The bottom of each pocket has projections 38 directed downwardly adjacent to the slot to direct a sheet entering the pocket downwardly into the pocket. The projections extend below the slot so that it also obstructs rebound of the sheet back into the slot. In addition, a lip 39 projects inwardly beyond the end 40 of the pocket so that the end of the sheet is trapped from reentry into the slot on any rebound.

Each stack of pockets has adjustable and a removable back stop 51, FIG. 2 to accommodate the pockets for different sizes of sheets.

The sheets are delivered to the pockets by a ramp means 59 having an entry end at the printing press and a delivery end at the stack means. The entry end of the

ramp means is mounted on the frame for pivotal movement such as on a pivot **60** which is carried by the frame at a point spaced from the stack means and is located at a level approximately that of the vertical center of the stack of pockets. The ramp means is constructed so that it extends and contracts longitudinally and is made up of an entry section **61** and a delivery section **62** which are operatively connected together for extension and contraction. When the delivery end of the ramp means is at the top or bottom of the stack of pockets, it is fully extended. As the delivery end moves downwardly from the top, the ramp means contracts until it reaches a mid point after which it gradually extends and reaches maximum extension at or slightly beyond the bottom pocket. The delivery section of the ramp means is suitably connected with or mounted on the entry section for relative longitudinal movement thereon. The connection shown is by clip means **63** at the end of side members **64** which form the sides of the delivery section extend around the edges of side members **65** forming the sides of the entry section. Similarly the ends of side bars **65** have clip means **66** extending around the edges of the side members **64** to contact the outer face of the side members **64**, of the entry section. The inner surfaces of the side members **64** of the delivery section of the ramp means slides along the outer surfaces of the side members **65** of the entry section. The side members **64** are secured together in spaced relation by a cross bar.

Means are provided, FIGS. 3 and 6 to extend and contract the ramp means as it pivots so that the delivery end of the ramp means is always uniformly spaced from the entry slot of each pocket. A convenient means for accomplishing this is a vertical track means **69**, FIG. 3, carried by the frame and may be a part thereof. Preferably, too, the track is adjacent to the stack means.

The delivery end of the ramp means is provided with carriage means including a carriage **71**, FIGS. 11 and 12, on each side of the ramp means. Each carriage is received by the track means and rides therein. Each carriage is connected with the delivery end of the ramp means by a shaft **72**. Each carriage is also connected with chain means one chain **73** being on each side which chains are mounted on an upper sprocket **74** and a lower sprocket **75** rotatably mounted on the frame **20**. The sprockets are carried or secured to shafts **76** and **77** respectively rotation of which drives the chain means and moves the carriage means and the delivery end of the ramp means.

The ramp means is provided with endless means to feed the sheets, delivered in succession to the ramp means at the entry end, along the ramp means and to deliver the sheets at the delivery end where they are projected into the pockets. The means shown constitute a plurality of endless means, shown as four belts **80**, FIGS. 9 and 13, which pass over a roller **81** mounted on the ramp means pivot **60** at the entry end and pass over a roller **82** at the delivery end of the ramp means, that is, carried on the delivery end of the delivery section. Preferably, roller **82** is spaced from the end of the ramp means as will appear. Means are provided to keep these belts taut as well as to permit the belts to accommodate for the extension and contraction of the ramp means. To this end, floating roller means, including rolls **83** are carried by a roll frame means **84** mounted on a free shaft **85** and each end of this shaft is freely movable vertically as the ramp means extends and contracts. A driving roller **90** is carried at the entry end of the ramp means over which the belts pass so that the two spans of the belt means are practically vertical as they pass over the floating roll means. The floating roll means, or its shaft, carries weights **88** to keep the belts taut. The endless belt means is driven in any suitable manner in that it could be a separate motor, however, it is economical to connect it to the main drive shaft **32**, FIG. 1 such as through a belt **89** and a pulley connected with the belt driving roller **90**. Gears **92** on the free shaft **85** each meshing with a rack means **93**, as-

sist in vertically guiding the free shaft **85**, keeping it horizontal and the belts taut. A flange **94** on the rack means engages a collar **95** on the gear **92** to retain the gear in mesh with the rack.

The ramp means is provided with means which presses the sheet of paper moving along the ramp means in driving contact with the endless belt means so that the sheet moves therewith. This pressing means, FIGS. 3 and 4, desirably expands and contracts with the extension and contraction of the ramp means and includes ball cages **97** and **102**, balls **97**, spring means **99** and rods **100** slidable in holes **101**. Two belts are shown as provided with pressing means and these belts are also provided with belt tracks or supports **105**, FIG. 4, which are telescoping to accommodate for extension and contraction of the ramp means. The belt tracks and presser means may be used on the center belts rather than on the outer belts if desired. The ball cages rest on supports **106** secured to the lower elongated ball cage **102** and slidable in the upper cage **102**.

The delivery end of the ramp means **59** is raised and lowered by ramp operating mechanism. This operating mechanism includes indexing means which moves the delivery end in step-by-step motion in one direction for the delivery of a sheet to each pocket and a return operating means which returns the delivery end of the ramp means in the other direction to the other or initial position of the movement. In the construction particularly shown, the indexing means moves the delivery end in steps downwardly and the return operating means moves it upwardly as rapidly as the mass of the ramp means permits in one continuous movement. It is clear that the sorter will function equally well with the indexing means, raising the delivery end of the ramp means so that sheets are fed to the respective pockets on the upward movement of the ramp means and the continuous return movement would be downwardly.

The ramp operating means, FIGS. 6, 11 and 12, includes the pair of spaced sprockets **74** and **75** rotatably mounted on each side of the frame and each chain **73** extending between the sprockets. A carriage **71** is attached to each chain by pins **109** and the carriage desirably are secured together by a brace. Each carriage includes a pair of spaced plates **110** which carries a bearing **111** in which the shaft **72** is mounted. Each carriage is guided by a track **69** formed with the uprights of the frame so that this track also constitutes means for extending and contracting the ramp means. The plates **110** are spaced apart by bushings **112**. A wear plate **113** is secured to the outer surface of the outer plate **110**. A delivery for auxiliary roller **114** is rotatable with the shaft **72** which roller is spaced from the upper belt roller **82**. Each carriage also carries a directing roller mounting plate **115** having a vertical slot **116**, FIG. 6 which receives a shaft **117** carrying a sheet directing roller **118** which engages the top periphery of roller **114** in all positions of the ramp. The slot is elongated to provide a rest notch **119** to retain the shaft of the directing roller away from roller **114** when desired. The roller **114**, FIG. 12, is driven from belt roller **82** by sprockets **120** and **121** secured to the respective roller or its shaft and connected by a chain **122**. Since the sheet directing roller always engages the top periphery of roller **114**, the sheet is always directed horizontally into a pocket by the roller **118**.

Indexing means, FIGS. 7 and 8, is connected with the sprocket shaft **77** and includes a ratchet disk **123** having ratchet notches **124** shown on the periphery of the disk. A pawl carrier **125** is oscillatably mounted on the shaft **77** and carries a pawl **126** on a pawl pivot **127** in a position so that the pawl engages a pawl notch and turns the disk for each oscillation of the pawl carrier. A spring **128** presses the pawl into contact with the pawl disk. The pawl carrier is oscillated, such as by a crank **129** carried by a crank shaft **130**. The crank is connected by a link **131** on a pivot **132** at one end and the other end of the link is

pivotally connected by a pivot 133 carried by the pawl carrier. A non-retract or lock disk 134 is secured to the shaft 77 and has notches 135 in the periphery thereof to be engaged by a lock pawl 136 pivotally mounted on a pin 137 and held against the disk periphery by a spring 137. Means are provided to raise the lock pawl when the crank starts to turn which means includes a cam surface 143 which cam surface is engaged by a roll 144 carried on the crank 129. Starting position is shown in dot-dash lines.

Gears 145, 146, and clutch 149 connect the main shaft 32 with the crank shaft 130 which clutch is of the type which when engaged rotates the shaft and crank for one revolution and then releases so that the one revolution of the crank oscillates the pawl carrier once so that the pawl rides on the periphery of the disk in a clockwise direction of movement of the pawl carrier and then engages a notch 124 so that on the return movement the pawl turns the pawl disk for one notch to turn the shaft 77 and sprockets 75 to move the delivery end of the ramp means to the next pocket. A one revolution clutch is well known. The clutch is engaged by a solenoid 150 under the control of a sheet moving on the ramp means, as will appear hereinafter.

Return operating means is provided for the ramp means to move the delivery end, upon termination of the step-by-step movement, in the return direction, or upwardly in the construction shown, to initial position to again feed a sheet into each of the pockets. This return operating means FIG. 8, includes a sprocket 153 secured to shaft 77, a chain 154, and sprocket 155 freely rotatable on a jack shaft 156 which jack shaft is operatively connected with the main shaft 32 through a friction clutch, 160, sprocket 157, chain 158, and a sprocket 159 secured to the main shaft 32, so that upon engagement of this clutch, sprocket shaft 77 is rotated in a reverse direction. The friction clutch includes a driving clutch plate 161 secured to the shaft 156 and a driven clutch plate 162 secured to sprocket 155 and freely movable on shaft 156. The friction clutch is engaged when the ramp means reaches one of its limits or particularly either a lower limit or the maximum lower limit, and is disengaged when the ramp means reaches its other limit or movement.

The friction clutch is operated to engaged position by suitable means, that particularly shown including a solenoid 163. Energization of this solenoid pulls a clutch operator 166 to the right through a spring 167. Clutch operator 166 is connected by and mounted on a pin 168 on a clutch lever 169 which is pivotally mounted on pivot 170 carried by the frame. A square or cam 171 is turned by the lever 169. The cam lies between a thrust bearing 172 fixed to the shaft 156 and a thrust bearing 173 slidable on the shaft to press driven clutch plate 162 into driving contact with driving clutch plate 161 and thereby rotate sprockets 155, 153, and sprocket shaft 77 in a reverse direction from that of indexing to return the ramp means to initial position.

Pawl lifting means, FIG. 7, are provided to raise the pawl when the ramp means is returned to initial position. This means includes a pawl lift lever 176 mounted on a pivot 177 which lever carries an arcuate lift ear 178 located adjacent to the pawl to engage a lift pin 181 carried thereby. A solenoid 179 is operatively connected with the lever by a pin 180. When the solenoid is energized, the lifting ear moves downwardly against tension of the spring 128 of contact with the pawl disc 123 so that the disc may rotate clockwise upon return movement of the ramp means.

Ramp switch means are provided on the frame to halt the ramp means at its two limits of movement which, however, are safety limit switches when a programmer is provided. The ramp limit switch means includes an upper switch 184, FIG. 6, and a lower limit switch 185 both carried by the frame which is engaged by ramp

means structure such as a limit switch pin 186 carried by the ramp side bar 64. If a programmer is not provided, then preferably at least one limit switch is adjustable such as the lower switch upwardly, so that for a book of less than 50 sheets, the ramp means need not travel the full available movement. If both limit switches are adjustable, then any set of pockets are available. Switch 184 is connected with solenoid 163 and pawl lift solenoid 179 through a relay D and contacts D3 to engage the friction clutch 161, 162, and opening of switch 184 breaks the two circuits 289 and 292, FIG. 15.

Indexing control means, FIG. 5, is provided to control the normal sorting operation of the indexing means which includes a trigger switch 188 having its trigger 189 in the path of each sheet moving along the ramp means. This switch is carried on a bracket 190 secured to cross members 192 carried by side members 65 of the ramp means. The leading edge of the sheet preferably, operates the trigger switch. The switch is electrically connected with the indexing solenoid 150, FIGS. 8 and 15. Switch 188 preferably is adjustably mounted in a slot 191 in a bracket 190, and locked in position by nut 191a, which gives sufficient adjustment of the timing in the operation of the indexing means as will appear. Indexing limit switch 185 breaks the indexing circuit 271 through relay B and contacts B1.

Safety means are provided to stop the movement of the ramp means in the event that a sheet has not sufficiently entered a pocket. This means includes a safety switch 198, FIG. 11, carried by the ramp means centrally thereof and particularly shown as carried by a carriage cross bar 196. It has an operating lever 194. This switch operating lever moves with the ramp means adjacent to the pockets. A slot 195 is provided in the entry end of each pocket for a longer switch operating lever if the sorter has a single stack of pockets. If a sheet projects just a short distance from its pocket, the lever usually will push it completely into the pocket. If, however, a sheet is jammed, the lever opens the safety switch and stops the operation of the sorter. With this safety control, the machine may also be stopped in the event that a sheet coming off of the ramp means fails to enter its entry slot in its pocket whereupon the sheet will fold upon itself and engage the lever of the safety switch to open the switch and stop the sorter. This safety switch is now mounted on stationary roller shaft 117 since usually a sheet buckles upwardly if it does not enter the pocket slot.

Since the ramp means is at different angles at the entry end, it is desirable to have an entry pressure roller means including rollers 197, and 198, FIG. 13, which are rotatably mounted on rods 200 and 204 respectively, roller 200 moving over the surface of the belts 80 passing over roller 81 and roller 198 moving to and over roller 81. Rod 200 is carried by links 201 pivotally mounted on a pivot 212 carried by the ramp side members 65. The entry pressure roller rod 200 has a link 203 on each end thereof receiving the end of the rods 204 and 200 hence movable with pull rod 202. The ends of rod 204 are received in a slot 204a carried by frame plates 20a. A spring 201a pulls the links 201 and roller 197 downwardly.

It is desirable to be able to remove one or more sheets at the entry end of the ramp means to examine the printing on the sheet before sorting begins. A deflector or gate 208, FIG. 13, is pivotally mounted on a rod 209 to tilt into the path of a sheet and direct it between feed rollers 210, and 211 mounted on shafts 212 and 213 respectively and deposit the sheet in a tray 214 where it can be picked up and examined. The roller 210 is driven by a sprocket and chain connection 215 from a shaft 216 of a receiving conveyor 255, which desirably is pivoted on the shaft 216.

In the construction of sorter of the prior application, it was found that when the sheets being sorted were relatively stiff, difficulty was experienced with the skip sheet

passing around the relatively small diameter of belt roller 82. It is for this reason that the skip deflector is now located at the entry end of the ramp means. This new construction also, is simpler in eliminating a separate skip deflector, its solenoid and a separate skip tray. The deflector 208 serves both as a proof deflector and a skip deflector. Also the skip tray on the earlier machine is in an awkward position beneath the ramp means. The skip control means for the deflector includes a skip switch 241 on a programmer 235, to be described, a normally open switch 220 having a switch closing feeler 221, a relay G and its normally closed contacts G2 in series with the deflector solenoid 207. It will be noted that the deflector skip control switch feeler 221 is ahead of the indexing trigger 189 so that when a skip sheet is deflected by the deflector 208, the indexing trigger 189 is not actuated to close the indexing switch 188 and hence other means are provided to index the ramp means to the next pocket. The skip indexing means is a circuit connected with the indexing circuit including the switch 220, a switch 218 having a feeler 219 and relay contacts G1. Both feelers are located in the path of a sheet passing along the sheet receiving conveyor 255. The switches are carried by a suitable bracket 222 mounted on cross bars 223 secured to the frame 224 of conveyor 255.

Preferably, power means are provided to shift the stacks of a two stack unit to and from loading position. A power take-off is provided from shaft 156 through gears 226, 227, 228, 229, to shaft 33. A one revolution clutch 230, which is well known, connects the gear 229 with the sprockets 37 and 26 providing a 1 to 2 ratio for a two stack construction, so that the crank 25 is rotated 180 degrees for each revolution of sprocket 37. A solenoid 231 engages the one revolution clutch which is energized at will or automatically by a switch 232, FIG. 15, as will be described.

A suitable programmer is provided for control of the operation of the sorter. The programmer shown includes a rotary control disc 235, FIG. 2A, having skip control means shown as a pin 236 for a plurality of and preferably for each pocket in one stack. Each pin is conveniently of that known type which when pressed inwardly, stays in until it is pulled outwardly. When the control means includes a switch the pins are switch operators. The disc is driven by a gear 237 and a pinion 238 which is suitably connected by sprockets and chains 239 with the power sprocket shaft 77 for the ramp means so that the control disc makes a step-by-step partial revolution equal to the space between pins 236 or about a full revolution for each full step-by-step or downward cycle. A skip switch 241 is located to be operated by any control pin which has been pushed down to operative position and when it reaches control position for its particular pocket. Closing of this switch conditions a skip circuit for energization of solenoid 207 to shift the deflector 208 into the path of a sheet and deflect it to tray 214.

The programmer also includes a series of holes or sockets 242 at a different radius, one for each pocket. A switch operator or pin 243 is provided for one of the holes and preferably it is mounted on an arm 244 which is freely turnable on the shaft 240 for selection of any hole 242. The switch operator 243 is pulled outwardly whereupon it may be shifted to any other hole 242 where it will engage the programmer operated limit switch 247 secondly which is a down limit switch for the ramp means. With this limit switch on the programmer, limit switch 185 on the frame serves as a safety switch in the event the operator fails to insert switch operator 243 in a hole where it can operate the programmer limit switch 247.

The programmer also includes a third set of holes 249, one for each pocket into which a switch operator or pin 250 may be inserted. This switch operator, preferably also, is carried by an arm 251 freely turnable on the shaft 240. This switch operator is pulled out of

its hole whereupon it may be shifted to another of this series of holes. When the switch operator is in a hole, it will engage and operate up limit switch 252. This limit switch 252 and its operator also serves for zoning for example, for a twenty page book pockets 1 to 20 may be used for one page and then pockets 25 to 50 may be used for a second page so that the pocket stack is zoned in any desired arrangement. Similarly with two stacks each stack may be zoned for 26 or more pockets for a single page.

Since the press structure and the sorter are shown as separate units, the auxiliary conveyor 255 is provided to receive a sheet from the press and deliver it to the sorter. It is convenient to have this conveyor driven by a separate motor 256 connected with shaft 216 by belt 257 and suitable pulleys. This conveyor also serves as the location for the skip switches 218, 220, FIG. 14, which are spaced apart and control a circuit which diverts a sheet from the ramp means into the tray and although this sheet does not engage the trigger 189, an indexing of the ramp means occurs nevertheless as will appear.

The circuit is illustrated in FIG. 15 and includes manual power switches 260 for connecting the circuit with the power lines. Closing of the switches 260 energizes the conveyor motor 256 and drives the belt conveyor 255.

The sorter is started by closing a manual starter switch 261 which energizes relay A and closes its contacts A1 and A2 to energize main circuit wires 262. A holding circuit is provided by a wire 263 and a normally closed stop switch 264 which is connected with the relay A to hold the latter energized. Opening of stop switch 264 stops the sorter motor by deenergizing relay A which opens contacts A1 and A2. The wires 262 are connected with the sorter motor so that the main shaft 32 is driven and the endless belt means 80 of the ramp means are in operation. Energization of the wires 262 also closes a circuit through wire 267, the bottom limit switch 185 on the frame, limit switch 247 on the programmer and relay B. Relay B operates to close contacts B1 and B3, and open contacts B2, the purpose of which will appear hereinafter. If one or more proof sheets are wanted for deposit in the tray 214, in order to learn whether or not the printing is satisfactory, the press is operated to deposit one or more sheets on the conveyor 255 and since the deflector solenoid 207 is not energized, the deflector is held in its raised position by spring 206 to deliver the printed sheets into the tray.

If the proofs are satisfactory, the press is again operated to print, the manual switch 270 is closed which closes a circuit including wire 276, contactors D1, wire 269, switch 270 and deflector relay C. Relay C is shunted by a circuit including normally closed contacts G2 and solenoid 207 which is energized to pull the deflector 208 down to pass the sheets to the ramp means. Relay C closes contacts C1 to close a hold circuit including wire 271, now closed contacts B1, normally closed switch 272 and through contacts C1 and relay C and also through contacts G2 and solenoid 207. The switch 272 may be opened to deenergize solenoid 207 as well as open the circuit for relay C which opens contacts C1 and sheets are delivered into the tray for examination. Closing of switch 272 and starter switch 270 restores sorting. Opening of limit switch 247 by the control disc 235 at the end of a run breaks the circuit at contacts B1.

The sheets are now delivered one at a time in spaced relation to the ramp means and travel to the delivery end thereof. In this passage of a sheet, an indexing circuit is energized through wire 276, through normally closed contacts D1, switch 277, sheet triggered switch 188 on the ramp means, normally closed relay contacts E1, wire 278, now closed contacts B3, wire 279, contacts D4 and indexing solenoid 150. The solenoid releases the one revolution clutch 149 to turn the crank 129 through one revolution to index the delivery end of the ramp means to the

first pocket and the sheet is delivered therein. The second sheet goes through the same cycle and the sheet is delivered into the second pocket and so on.

The downward movement of the ramp means also turns the control disk 236 of the programmer in a clockwise direction and turns the arm 244 therewith. Depending upon the hole 252 in which the switch operator 243 is inserted, which is dependent upon the number of pockets to receive a sheet, the lever is turned until switch operator 243 opens limit switch 247 and relay B deenergized. A delay circuit is provided including wire 282 now closed contacts B2, a hold switch 283, and a relay F. Relay F is a time delay device, that is, it may be a delay relay or it may be a motor driven timer, both of which are known, which delays closing of the contacts of switch F1 for a period long enough to complete the delivery of the last sheet from the ramp means. The delay is a matter of about one-half second. The time delayed switch F1 is in a circuit including wire 284, the switch F1, and relay D to delay energizing of this relay and hence retain the contacts D1 closed in the indexing circuit 276 to complete the delivery. Upon termination of the delay period, switch F1 closes momentarily and relay D is energized which closes a holding circuit through contacts D2. Contacts D1 and D4 are opened to break the indexing circuit through switch 188 and manual indexing switch. Contacts D3 are closed to energize the pawl lift solenoid 179 and close switch 164 and energize the solenoid 163 to return the ramp means to its other, or up, position whereupon limit switch 252 opens to deenergize relay D and halt the ramp means at its up position either top position or below top position depending upon the location of limit switch operator 250.

It is desirable to provide a non-repeat circuit for the sheet trigger switch 188 in the event that a sheet should be stuck underneath the same which would otherwise repeat the indexing. A non-repeat circuit includes a wire 286 connected behind the trigger switch, a non-repeat switch 287, FIG. 7, which is located to be engaged and closed by the crank link 131 about the time that the indexing is half completed. Closing of switch 287 energizes relay E so that contacts E1 in the trigger circuit open and contacts E2 close to provide a shunt hold circuit around switch 287 to maintain relay E energized. It remains energized until trigger switch 188 opens whereupon relay E is deenergized to restore the indexing circuit 276 to operative condition.

Switches 277 and 283 are switches which are manually opened and are used, if it is desired, to put more than one sheet into one pocket. These switches hold out the indexing circuit until the desired number or sheets have been deposited in one pocket whereupon closing of these switches restores the indexing circuit to operative condition and indexing of the ramp means continues. Switch 277 is a double throw switch so that opening the indexing circuit at contact 277a, also closes contacts 277b to energize circuit 280 and continue energizing relay C.

If the operator should fail to put the switch actuator 243 into a hole, the down limit switch 247 will not be opened. If this should occur, then when the ramp means reaches its bottom position, the ramp limit switch 185 on the frame is opened to halt movement of the ramp means. It is clear, however, that without the programmer, control of the downward movement of the ramp means could just as well be achieved by adjusting the position of the switch 185 on the frame in the event all of the pockets are not to receive a sheet or remain at the bottom in the event that all the pockets are to receive a sheet. In the circuit illustrated with a programmer, the limit switch 185 is fixed and serves as a safety switch. Similarly, if a programmer is not provided, the upper switch may be adjustable for zoning, that is, a first page of a twenty page book may be inserted in pockets 1 to 20 with the lower limit switch so positioned and a second page inserted

in pockets 25 to 45 with the upper limit switch so positioned to halt raising of the ramp means at pocket 25.

The ramp means maybe returned to its initial position such as top position by manually closing switch 290 to close the return circuit including wire 289, top limit switch 184, the disk controlled limit switch 252, switch 290, and relay D. This is used generally only when sheets are not being handled for testing operation or if an automatic return is not provided. Energization of the relay D closes holding circuit contacts D2 so that relay D remains energized until up limit switch 184 or 252 is opened as described, which deenergizes relay D to restore the contacts D1, D2, D3, D4 to their initial condition. Energization of the relay D closes contacts D3 in the return circuit 292 to energize the pawl lift solenoid 179, which closes switch 164 and energizes solenoid 163 to engage the friction clutch 161, 162. In order to assure that the pawl 126 is lifted before the friction clutch for the return movement is operated, it is desirable to provide the switch 164 in series with solenoid 163 and closed by the pawl lift lever 176.

At times, it is desired that a sheet not be delivered to one or more pockets. A skip circuit is therefore provided which is controlled from the skip control pins 236. If a pocket is not to receive a sheet, the skip control pin 236 for that pocket on the disk 235 is depressed which is releasably held depressed, so that as the control disk 235 rotates, the pin closes the skip switch 241. When the next sheet passes over conveyor 255, the sheet opens the first feeler switch 218 and closes the second feeler switch 220 to complete a circuit from wire 271, through switch 220, wire 293, skip switch 241, and relay G. Energization of this relay closes contacts G1 but switch 218 is now open. Relay G also opens contacts G2 to deenergize solenoid 207 and spring 206 raises deflector 218, FIG. 6, into the path of a sheet and the sheet is delivered into the tray 214.

This skip sheet does not pass onto the ramp means and trigger switch 188 remains open so that the ramp means is indexed to the next pocket through a shunt circuit. When the tail of the skip sheet passes the first feeler switch 218, it closes, but 220 is still closed so that a circuit is momentarily closed through 218, contacts G1, wire 286, E1, B3, wire 279, contacts D4 to the indexing solenoid 150. Opening of switch 220 when the skip sheet passes restores the circuit which closes contacts G2 and reenergizes the deflector solenoid 207 and switch 241 opens when the programmer is moved with the indexed ramp means.

With a single stack of pockets, the plate is changed on the press and the plate for page 2 is put on the press and the sorting repeated for this page and so on. With a multiple stack as illustrated, the second stack may be moved manually into delivery position and the process repeated for this stack for each page. When both stacks have received their sheets, the first stack is then moved to sheet receiving position, the plate changed on the press, and the process is repeated.

It is desirable to shift the multiple stack by power which is accomplished by a stack circuit including a wire 295, switch 232a, solenoid 231 which engages a one revolution clutch 230 and rotates crank 25 through 180 degrees to shift the stack. Switch 232 has a center position in which the switches 232a is spring opened so that upon release, this switch opens. The shifting of the stack, however, is completed because of the one revolution clutch 230.

If it is desired to have the stack shift automatically, switch 232 is operated so that switch 232b is closed. The switch is constructed to remain in this position and such switches are well known. Switch 232b is connected in a circuit including wire 267, contacts 296a or 296b, a wire 296 which connects a second contact of switches 185 and 247 so that when one of these limit switches is opened, usually switch 247 on the disc 135, the circuit is closed



through the stack solenoid 231 which engages the one revolution clutch 230, FIG. 8, and the stack is automatically shifted to its other position. At the beginning of the upward movement of the ramp means, the switch 247 is released from contacts 247b and switch 247 returns to its normally closed position so that the circuit 276 is ready for indexing into the second stack. At the bottom position of the ramp means for the second stack, the operation repeats to restore the first stack into sheet receiving position. It will be noted that the stack means is shifted automatically solely from the bottom limit switches and not from the upper position of the stack means since it is not necessary to do so in view of the fact that the plate on the press must now be changed when the first stack is restored to delivery position.

The trigger switch 188 is adjustable along the ramp means in the slot 191 in the bracket 190. It is moved nearer the delivery end for long sheets and towards the entry end for shorter sheets. The reason for this is to give a long sheet a little more time to enter its pocket before the next sheet indexes the ramp means. For a short sheet the trigger switch 188 is moved to the lower end of slot 190 so that the sheet closes the trigger switch 188 sooner and an earlier operation of the indexing means. This spaces the indexing signals farther apart between trigger switch 188 and the first feeler switch 218 for a following skip sheet passing to the tray.

It has been mentioned that switch 277 is depressed in order to put one or more additional sheets in any pocket by breaking the indexing circuit. If it is the last pocket which is to receive a plurality of sheets, the opening of a limit switch 185 or 247, deenergizing of relay B and closing of contacts B2 in the timer circuit would present a problem. It is for this reason that operation of the switch 277 to open contact 277a, also closes contacts 277b and keeps the circuit through wire 280 and deflector solenoid 207 energized so long as switch 277 is held depressed. When released switch 283 closes and since relay B is deenergized, and contacts B2 are closed, the timer circuit 282 is closed and timer F begins to function and after its timed delay it momentarily closes switch F1 to energize relay D, close hold contacts D2, and contacts D3 in the ramp return circuit 292. The ramp continues return movement until return limit switch 184 or 252 is opened to break the circuit to relay D. Opening of contacts D1 and D4 in the indexing circuit 276 renders this circuit inoperative during ramp return movement.

With the trigger switch 188 located adjacent to the entry end of the ramp means, the speed of the belts 80 was increased over the earlier sorter by increasing the pulley ratio between drive shaft 32 and drive roller 90. The ramp means 59 and the receiving conveyor 255 constitute conveying means to receive a sheet at the sheet receiving end of the conveying means and normally deliver the sheet to a pocket. The sheet deflector is located between the ends of the conveying means. The construction is applicable to a conveying means in which the delivery end moves successively to the next adjacent pocket and it is not necessary that part of the conveying means pivots.

This invention is presented to fill a need for improvements in a sheet sorter having pocket indexing means. It is understood that various modifications in structure, as well as changes in mode of operation, assembly, and manner of use, may and often do occur to those skilled in the art, especially after benefiting from the teachings of an invention. This disclosure illustrates the preferred means of embodying the invention in useful form.

What is claimed is:

1. A sheet sorter comprising a frame, a drive shaft rotatably mounted on the frame, a plurality of pockets in adjacent successive relation; conveying means having a sheet receiving end and a sheet delivery end adjacent to the pockets to convey a sheet from the sheet receiving end to a pocket, means mounting the delivery end of the conveying means for movement relatively to the pockets; op-

erating mechanism operatively connected between the drive shaft and the conveying means to move the delivery end thereof with respect to the pockets including indexing means successively moving the delivery end in one direction for the distance between pockets to normally direct successive sheets into successive pockets, the indexing means having an indexing solenoid to initiate the indexing movement, return operating means to move the delivery end in the opposite direction, and means to initiate operation of the return operating means; indexing control means connected with the indexing solenoid including a trigger located in the path of a sheet on the conveying means and operated by the sheet, and an indexing circuit having in series a normally closed first multiple sheet switch, a normally open trigger switch operated to closed position by the trigger when engaged by a sheet, and the indexing solenoid, the multiple sheet switch having a normally open second switch which is closed upon opening of the normally closed first switch; a sheet deflector located between the ends of the conveying means and mounted for movement to a deflecting position in the path of a sheet and to a non-deflecting position; deflector operating means connected with the deflector to move and hold the deflector in non-deflecting position including spring means to move the deflector to deflecting position, and a deflector solenoid to move the deflector to non-deflecting position; a deflector solenoid circuit having in series the normally open contacts of an indexing limit control circuit relay and a sorter starting switch means to close and hold closed the deflector solenoid circuit including a normally open manually closed sorter starting switch in series with the deflector solenoid; the second switch of the multiple sheet switch being connected with the deflector solenoid and shunting the starter switch; the trigger being located between the deflector and the delivery end of the conveying means; a limit control means for the return operating means operable upon reaching the limit of the return movement; and an indexing limit control circuit for the indexing means including in series at least one limit control switch, and a limit control circuit relay.

2. A sheet sorter as in claim 1 in which the sorter starting switch means includes contacts of a deflector relay connected in series in the deflector solenoid circuit, and a deflector relay shunting the deflector solenoid, and the manual sorter starting switch being connected in series with the deflector relay and shunting the deflector relay contacts.

3. A sheet sorter as in claim 2 in which the limit control means for the return operating means includes a limit control circuit having in series a return limit switch and a return limit circuit relay having normally closed contacts with said contacts connected in series with the sorter starting switch.

4. A sheet sorter comprising a frame, a drive shaft rotatably mounted on the frame, a plurality of pockets in adjacent successive relation, conveying means having a sheet receiving end and a sheet delivery end to convey a sheet from the sheet receiving end to a pocket, means mounting the delivery end of the conveying means for movement with respect to the pockets; conveyor operating mechanism operatively connected between the drive shaft and the conveying means to move the delivery end thereof with respect to the pockets including indexing means successively moving the delivery end in one direction for the distance between pockets to normally direct successive sheets into successive pockets, return operating means connected between the drive shaft and the conveying means to move the latter in the opposite direction, and means to initiate operation of the return operating means; a sheet deflector located between the ends of the conveying means and mounted for movement to a deflecting position in the path of a sheet and to a non-deflecting position; deflector operating means connected with the deflector to move and hold the deflector in non-deflecting position; a first indexing control means connected with and initiating the actual



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tion of the indexing means after passing the deflector and operated by a sheet on the conveying means; skip means connected with and actuating the deflector operating means including a programmer connected with the conveying means to move therewith and having a first deflector control means for each of a plurality of pockets selectively connectable with the deflector operating means, a second deflector control means connected with the deflector operating means including a feeler located ahead of the sheet deflector in the path of a sheet on the conveying means, and a second indexing control means having a feeler located ahead of the sheet deflector in the path of a sheet on the conveying means and connected with the indexing means to operate the latter, indexing limit control means connected with the indexing means to stop the latter at the end of the indexing movement of the conveying means, and return limit control means connected with the return operating means to stop the latter at the end of the return movement of the conveying means, the second indexing control means being conditioned for actuation by the skip means.

5. A sheet sorter as in claim 4 including proof means connected with the deflector operating means to move the deflector to deflecting position including a manually operated means.

6. A sheet sorter as in claim 4 in which the deflector operating means includes spring means to move the deflector to deflecting position, and a deflecting solenoid to move the deflector to non-deflecting position; a skip relay having normally closed contacts with the contacts in series with the deflector solenoid; the first deflector control means includes a switch operator carried by the programmer, and a normally open first switch which is closed by the programmer switch; the second deflector control means includes a normally open second switch which is closed by a sheet engaging its feeler, the first and second switches being connected in series with the skip relay to energize the same and open its contacts whereby the deflector solenoid is deenergized and the spring means moves the deflector to deflecting position.

7. A sheet sorter as in claim 6 in which the indexing means includes an indexing solenoid, the first indexing control means includes a normally open trigger switch closed by the trigger and connected in series with the indexing solenoid, the second indexing control means includes a normally closed indexing feeler switch which is opened by a sheet on the conveyor engaging its feeler and located ahead of the second deflector control switch, and the second deflector control switch and the second indexing control switch being connected in series with the indexing solenoid and shunting the trigger switch whereby the circuit to the indexing solenoid is closed when the tail of a skip sheet passes the feeler for the second indexing control switch which closes the latter.

8. A sheet sorter as in claim 7 including a manually operated normally closed proof switch connected in series with the deflector solenoid.

9. A sheet sorter as in claim 8 in which the manually operated means for the deflector operating means includes a normally open sorter starting switch connected in series with the deflector relay and the deflector solenoid and shunting the proof switch.

10. A sheet sorter as in claim 9 including a deflector relay shunting the contacts of the skip relay and the deflector solenoid, the deflector relay having normally open contacts connected in series with the proof switch.

11. A sheet sorter as in claim 4 including trigger mounting means carried by the conveying means adjacent to the deflector and adjustably mounting the trigger towards and away from the deflector.

12. A sheet sorter as in claim 4 in which the indexing means includes a pawl disc having notches, a pawl engaging the notches on the pawl disc, and means to oscillate the pawl; a pawl lift means engaging the pawl to disengage

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the pawl from the notches and hold the pawl disengaged; and the return operating means including a return solenoid to initiate operation of the return operating means, and a normally open switch connected in series with the return solenoid and operated to closed position by the pawl lift means.

13. A sheet sorter as in claim 4 in which the conveying means includes a receiving conveyor and a ramp means in end to end alignment and with their adjacent ends spaced from each other, the sheet deflector being located between the spaced adjacent ends of the receiving conveyor and the ramp means, the ramp means having an entry end at the deflector, endless means extending between the ends of the ramp means to transport sheets thereon from the entry end to the delivery end including directing means at the delivery end to direct each sheet into its pocket; means carried by the frame and pivotally mounting the entry end of the ramp means at a point spaced from the pockets, means retaining the delivery end of the ramp means adjacent to the ends of the pockets as the ramp means pivots; the operating mechanism being operatively connected with the ramp means, and the receiving conveyor carrying the deflector control feelers.

14. A sheet sorter as in claim 13 including proof means connected with the deflector operating means to move the deflector to deflecting position including a manually operated means.

15. A sheet sorter as in claim 13 in which the deflector operating means includes spring means to move the deflector to deflecting position, and a deflector solenoid to move the deflector to non-deflecting position; a skip relay having normally closed contacts with the contacts in series with the deflector solenoid; the first deflector control means includes a switch operator carried by the programmer, and a normally open first switch which is closed by the programmer switch operator; the second deflector control means includes a normally open second switch which is closed by a sheet engaging its feeler, the first and second switches being connected in series with the skip relay to energize the same and open its contacts whereby the deflector solenoid is de-energized and the spring means moves the deflector to deflecting position.

16. A sheet sorter as in claim 15 which the indexing means includes an indexing solenoid, the first indexing control means includes a normally open trigger switch closed by the trigger and connected in series with the indexing solenoid, the second indexing control means includes a normally closed indexing feeler switch which is opened by a sheet on the conveyor engaging its feeler located ahead of the second deflector control switch, and the second deflector control switch and the second indexing control switch being connected in series with the indexing solenoid of shunting the trigger switch whereby the circuit to the indexing solenoid is closed when the tail of a skip sheet passes the feeler for the first indexing control switch closes the latter.

17. A sheet sorter as in claim 16 in which the manual means for the deflector operating means includes a normally open sorter starting switch connected in series with the contacts of the deflector relay, and the deflector solenoid and shunting the proof switch.

18. A sheet sorter as in claim 17 including a sorter starting relay shunting the contacts of the skip deflector relay and the deflector solenoid and having normally open contacts connected in series with the proof switch.

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