

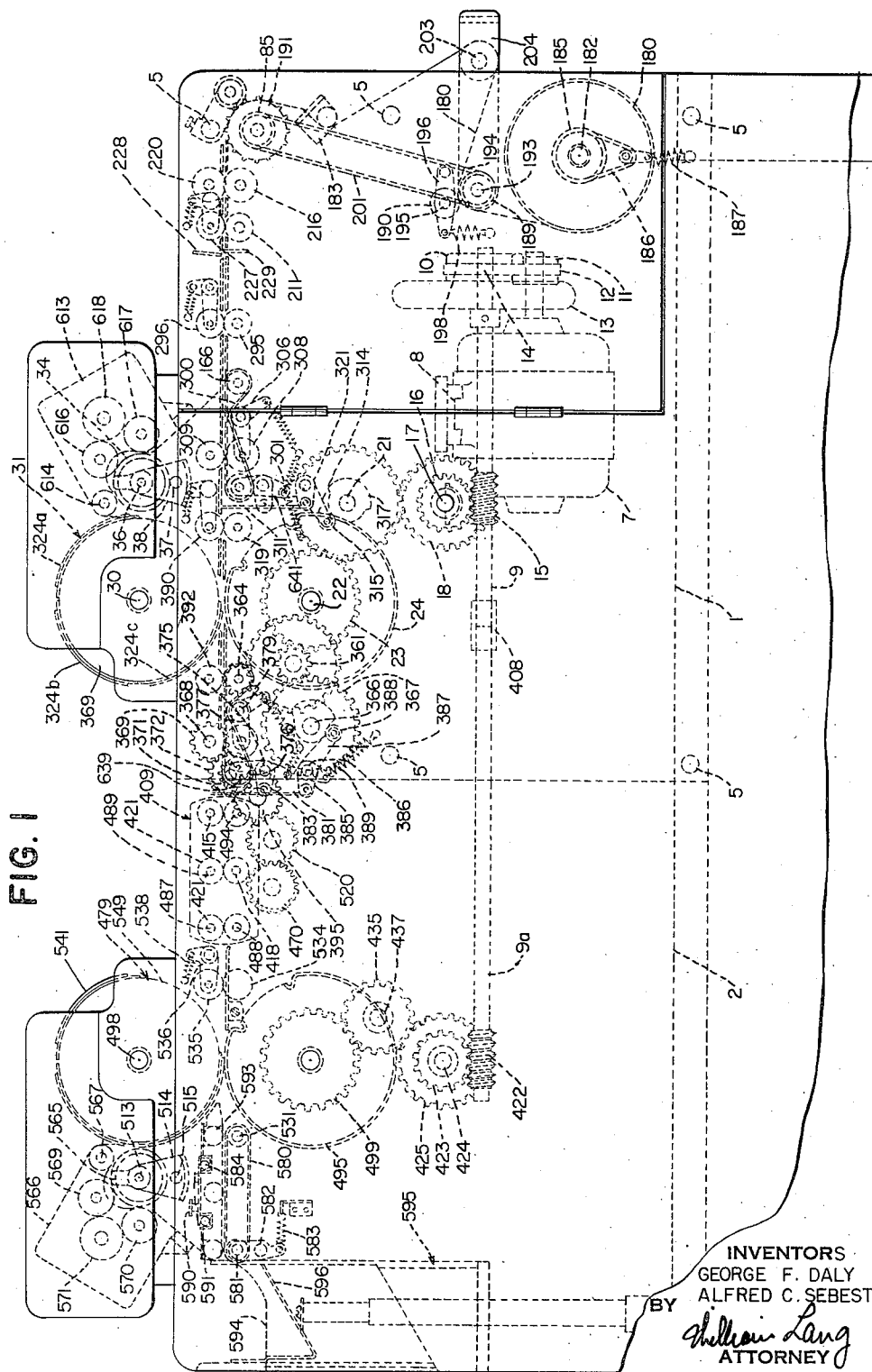
Oct. 9, 1956

G. F. DALY ET AL
SELECTIVE PRINTING MACHINE FOR
PRINTING BOTH SIDES OF A BILL

2,765,735

Filed Dec. 21, 1951

22 Sheets-Sheet 1



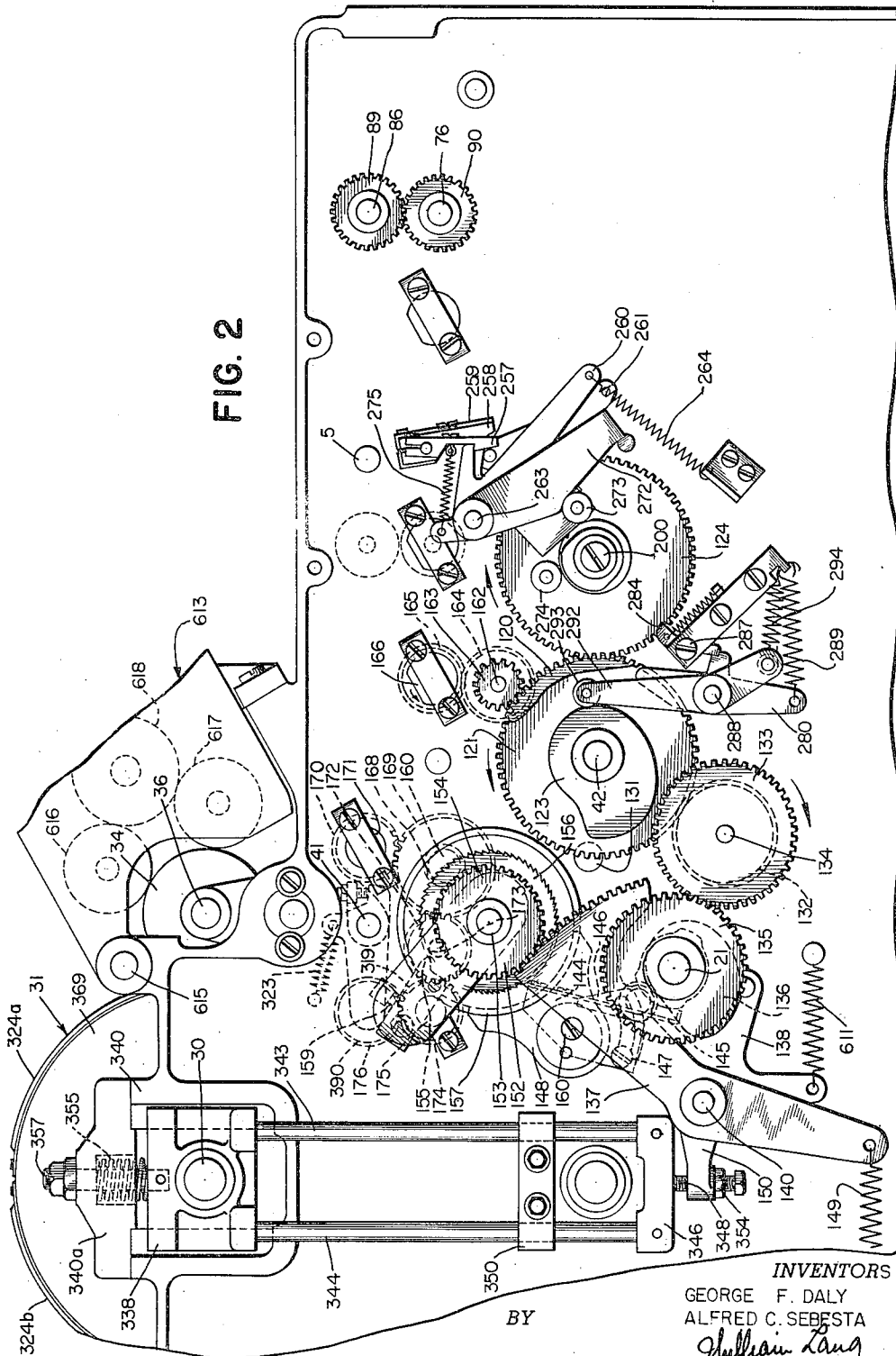
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22 Sheets-Sheet 2



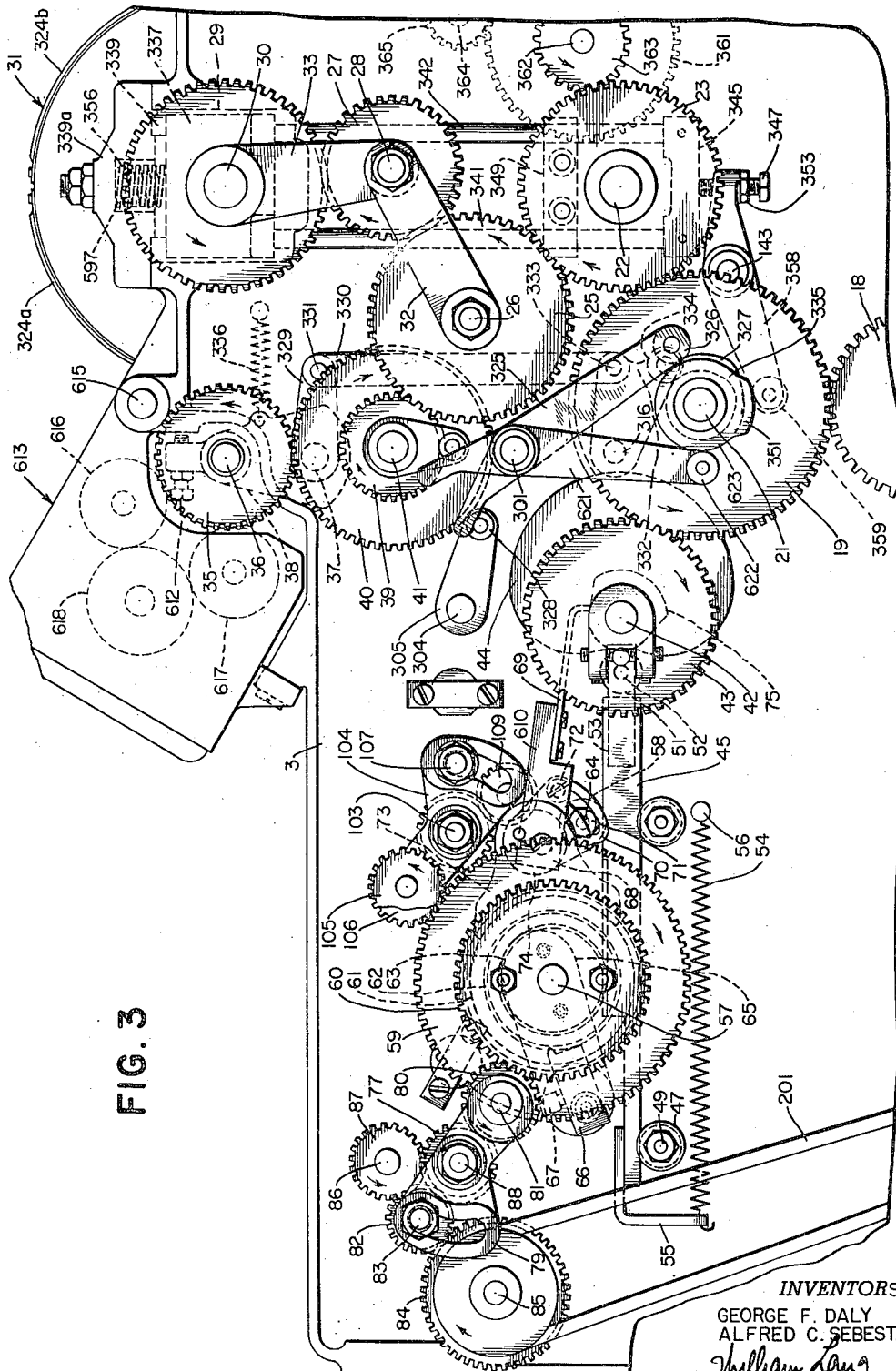
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22 Sheets-Sheet 3



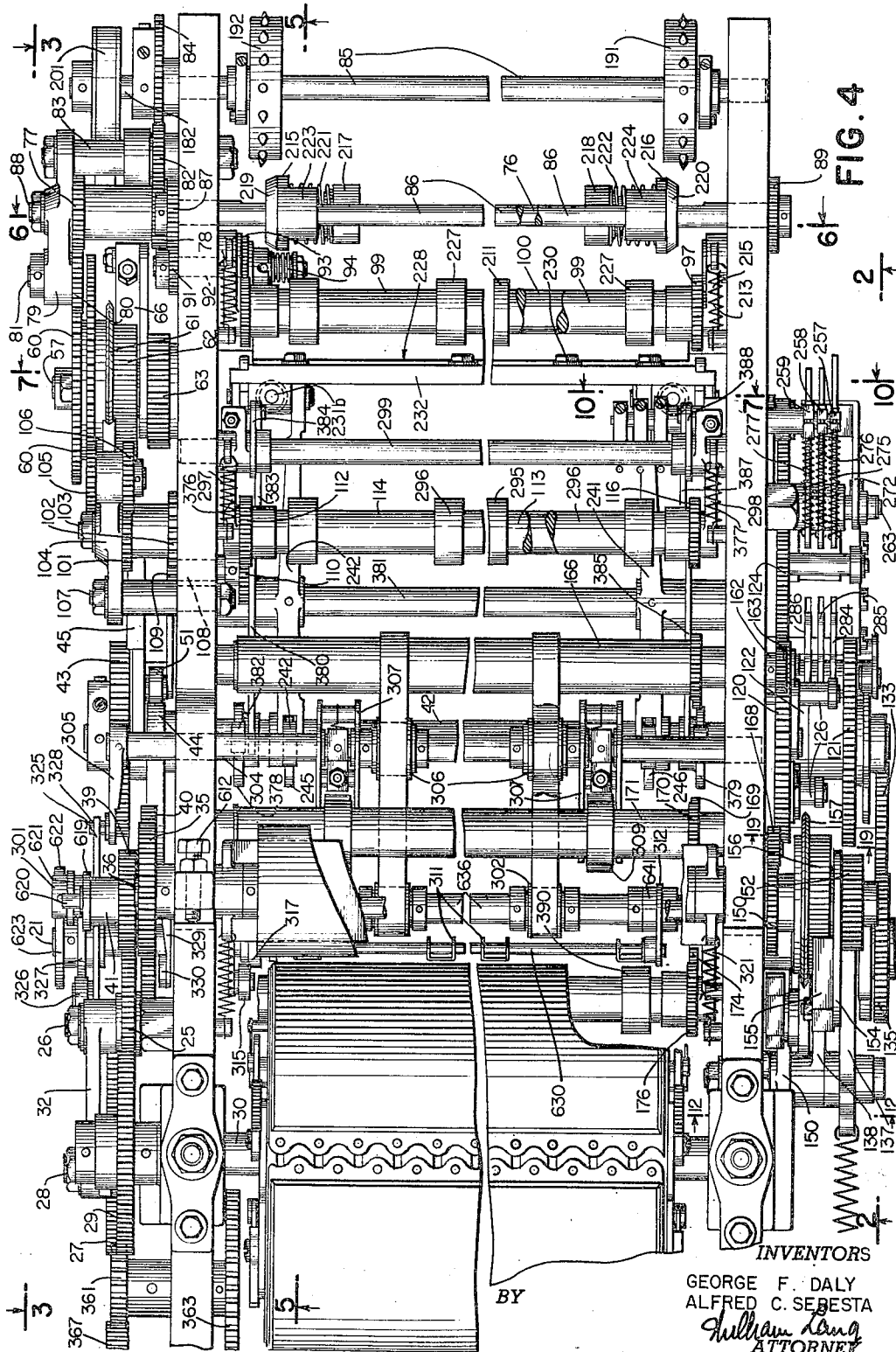
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22 Sheets-Sheet 7



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22 Sheets-Sheet 8

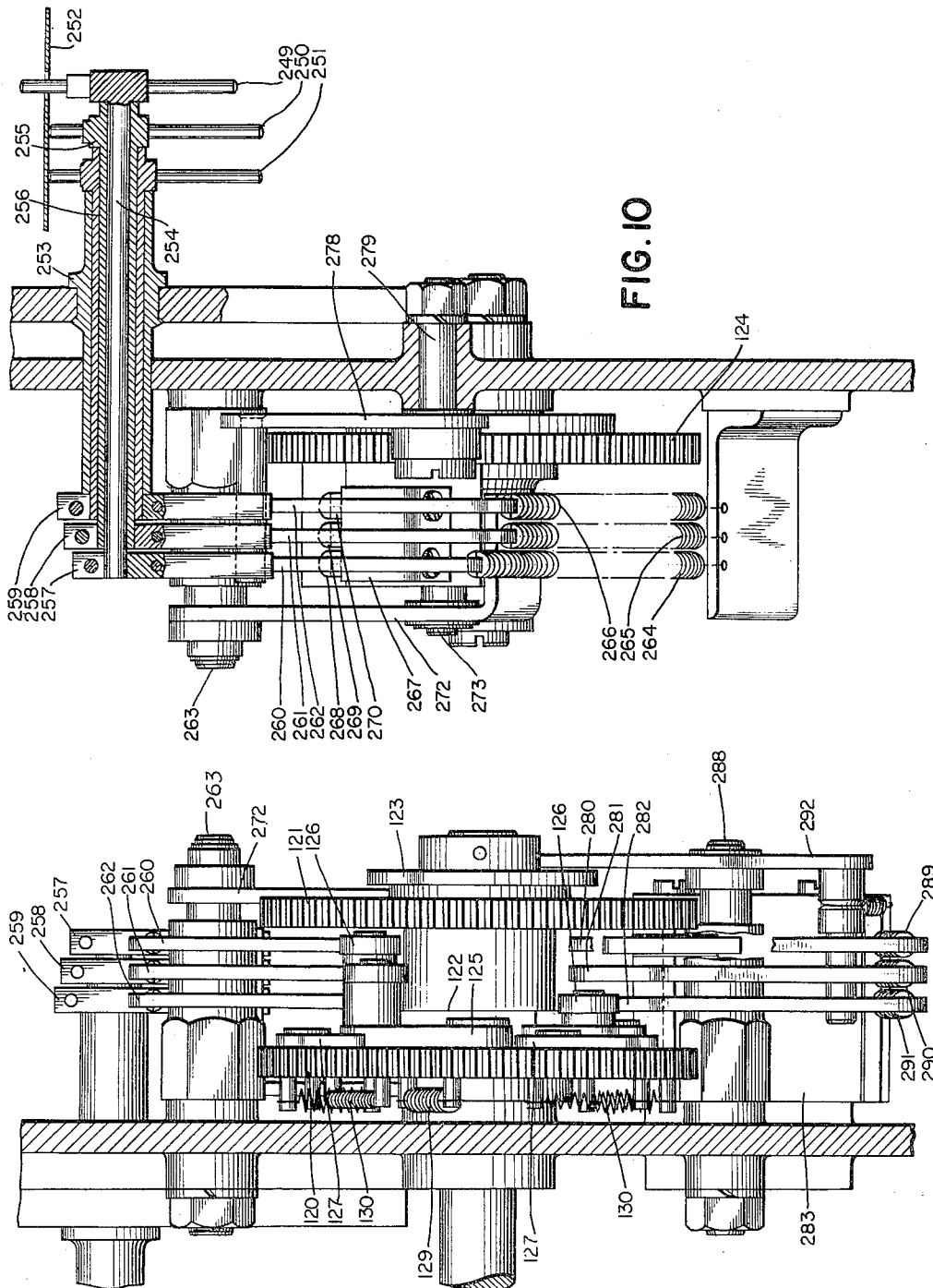


FIG. 9

FIG. 10

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22 Sheets-Sheet 9

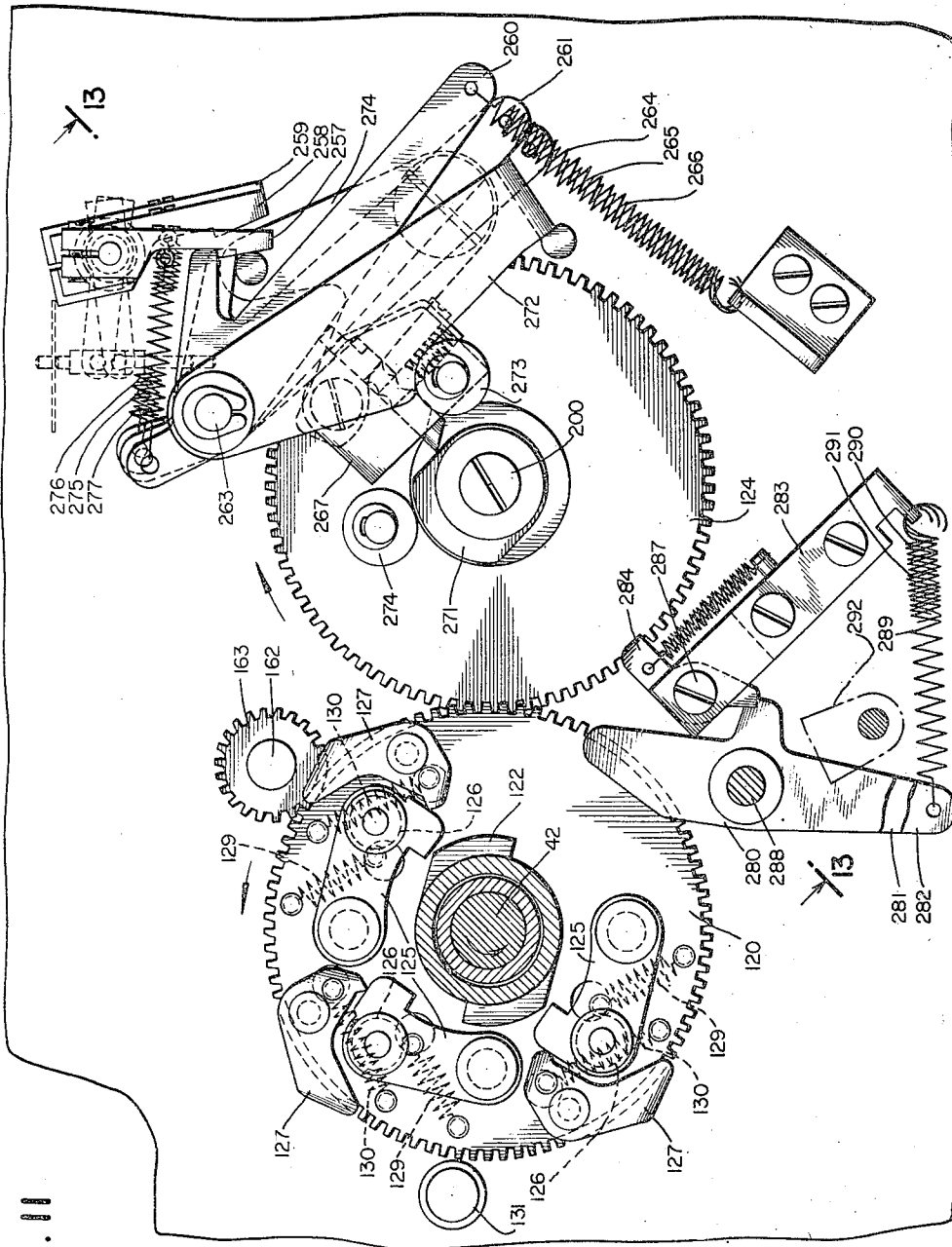


FIG. 11

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FIG. 12

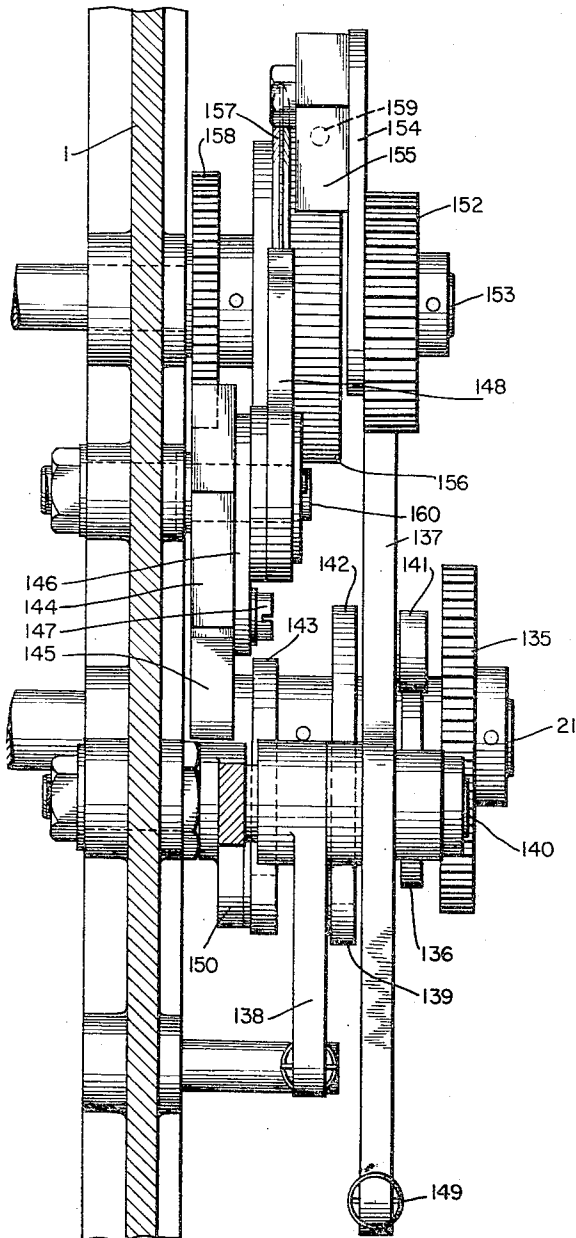


FIG. 14

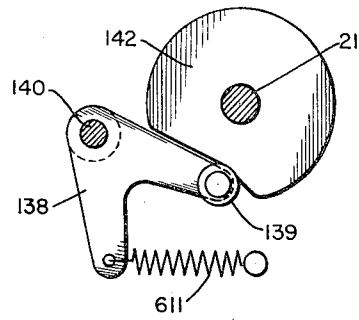


FIG. 15

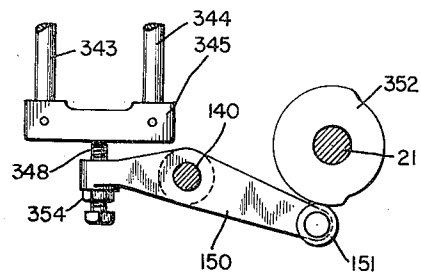
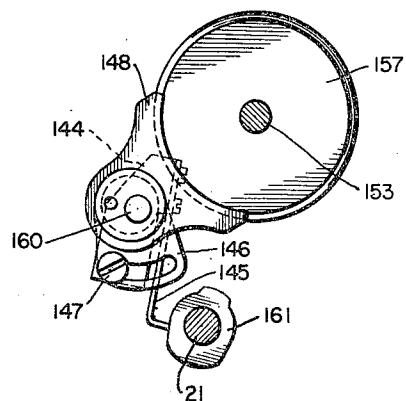


FIG. 16



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FIG. 17

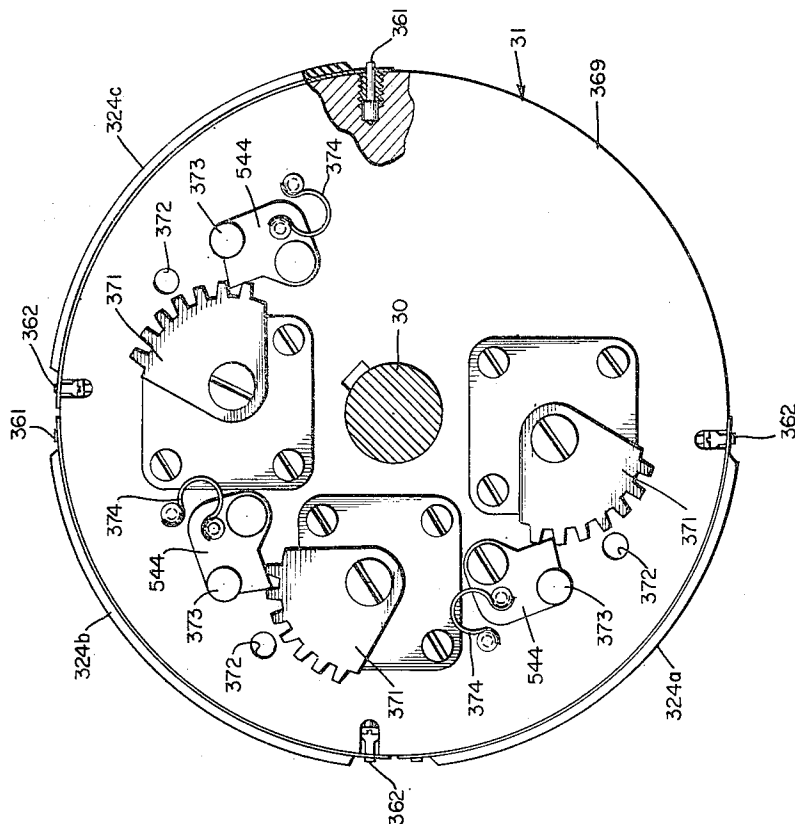
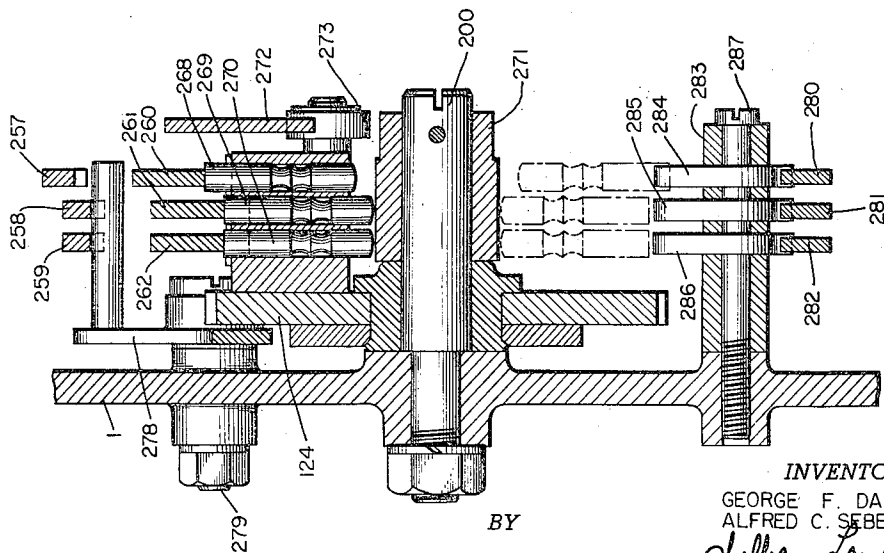


FIG. 13



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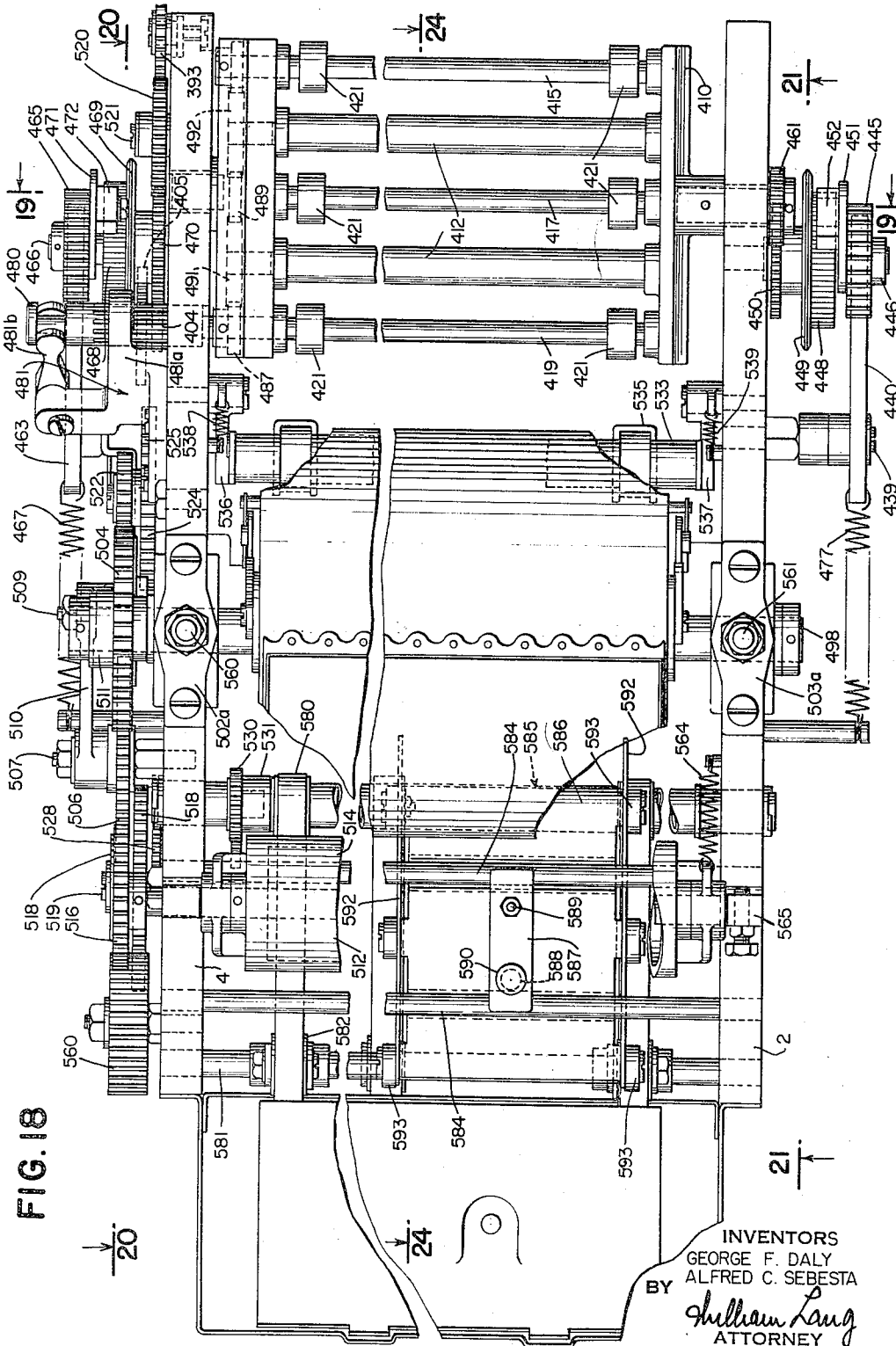
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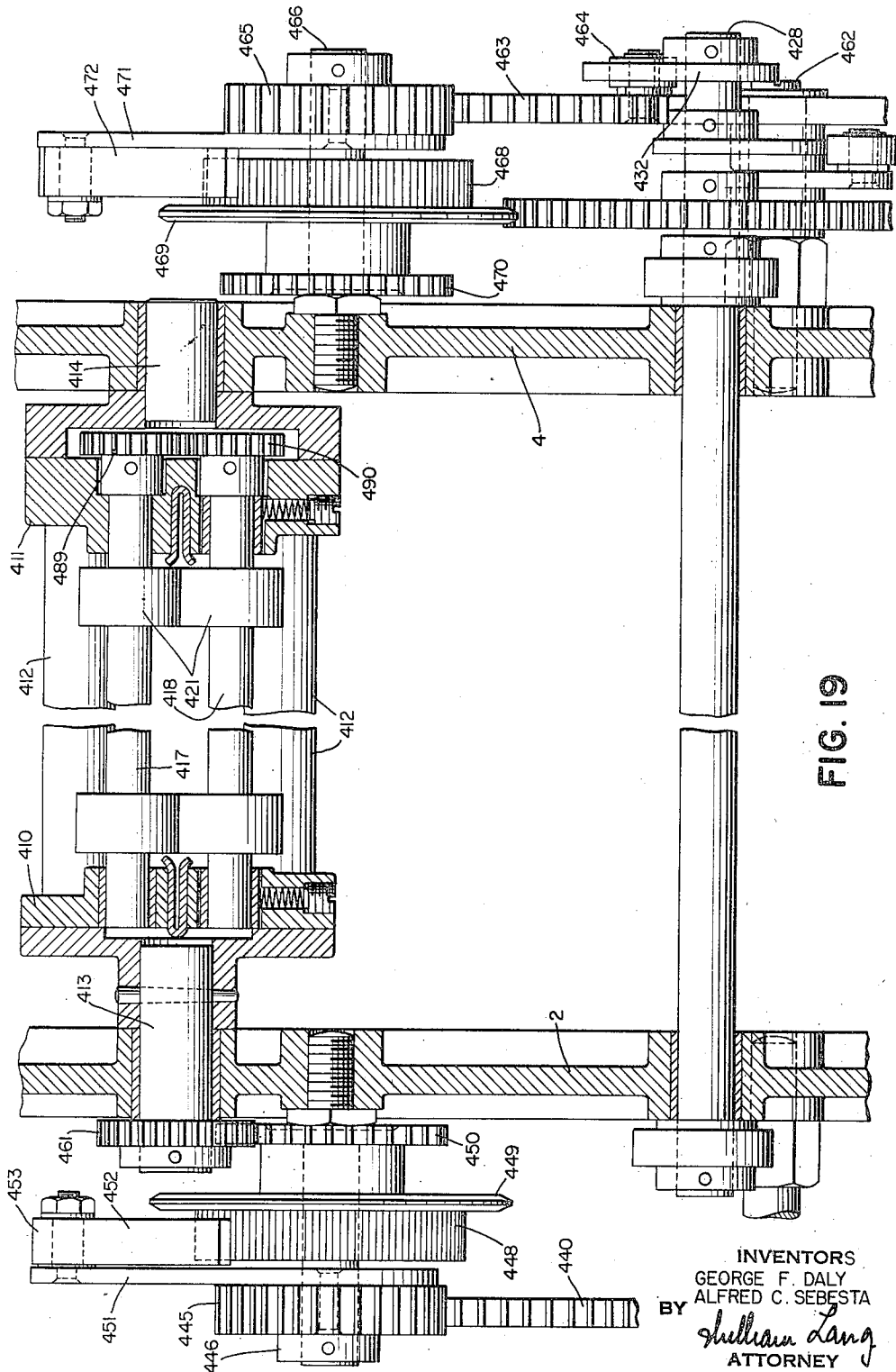


FIG. 19

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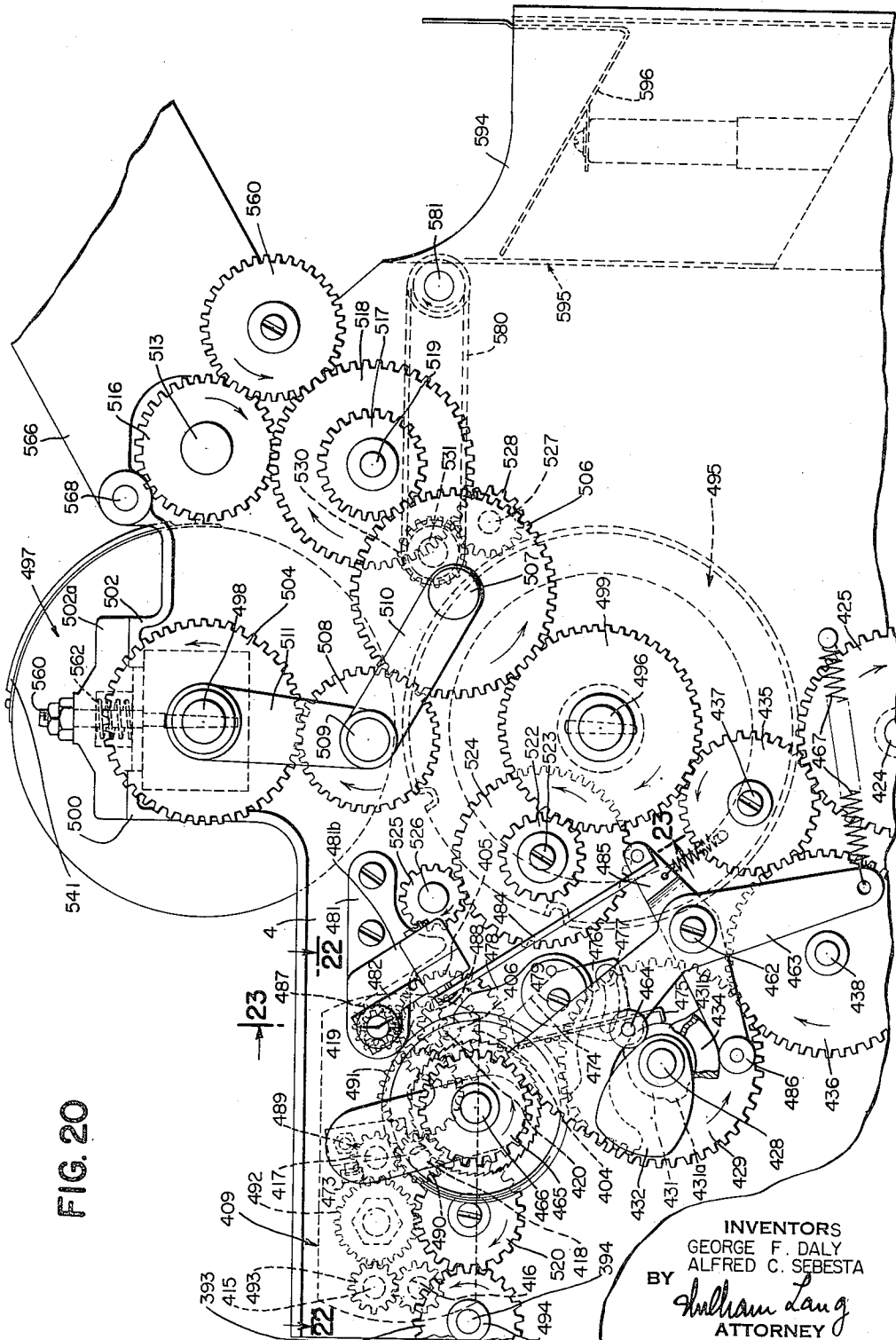
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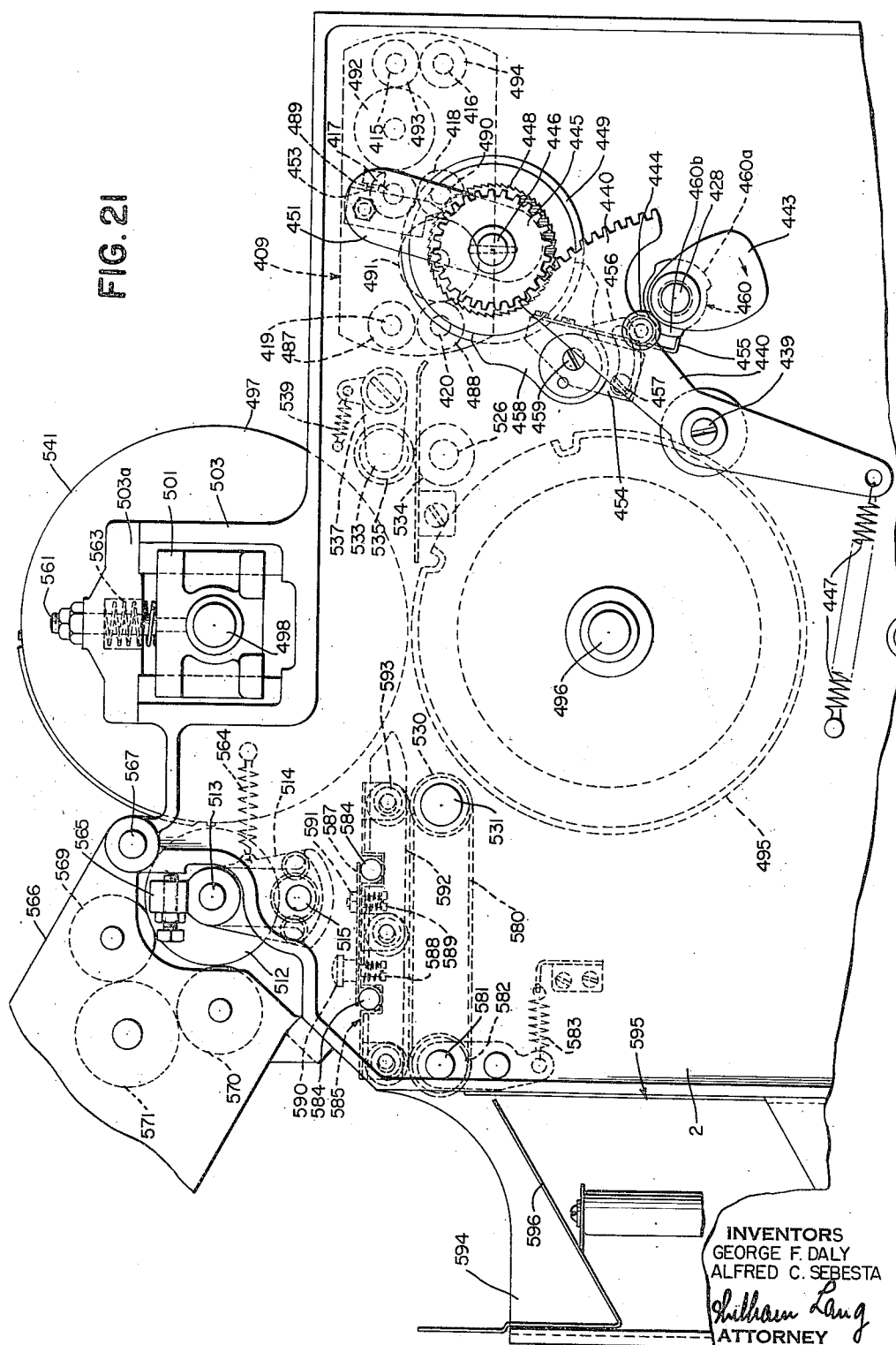
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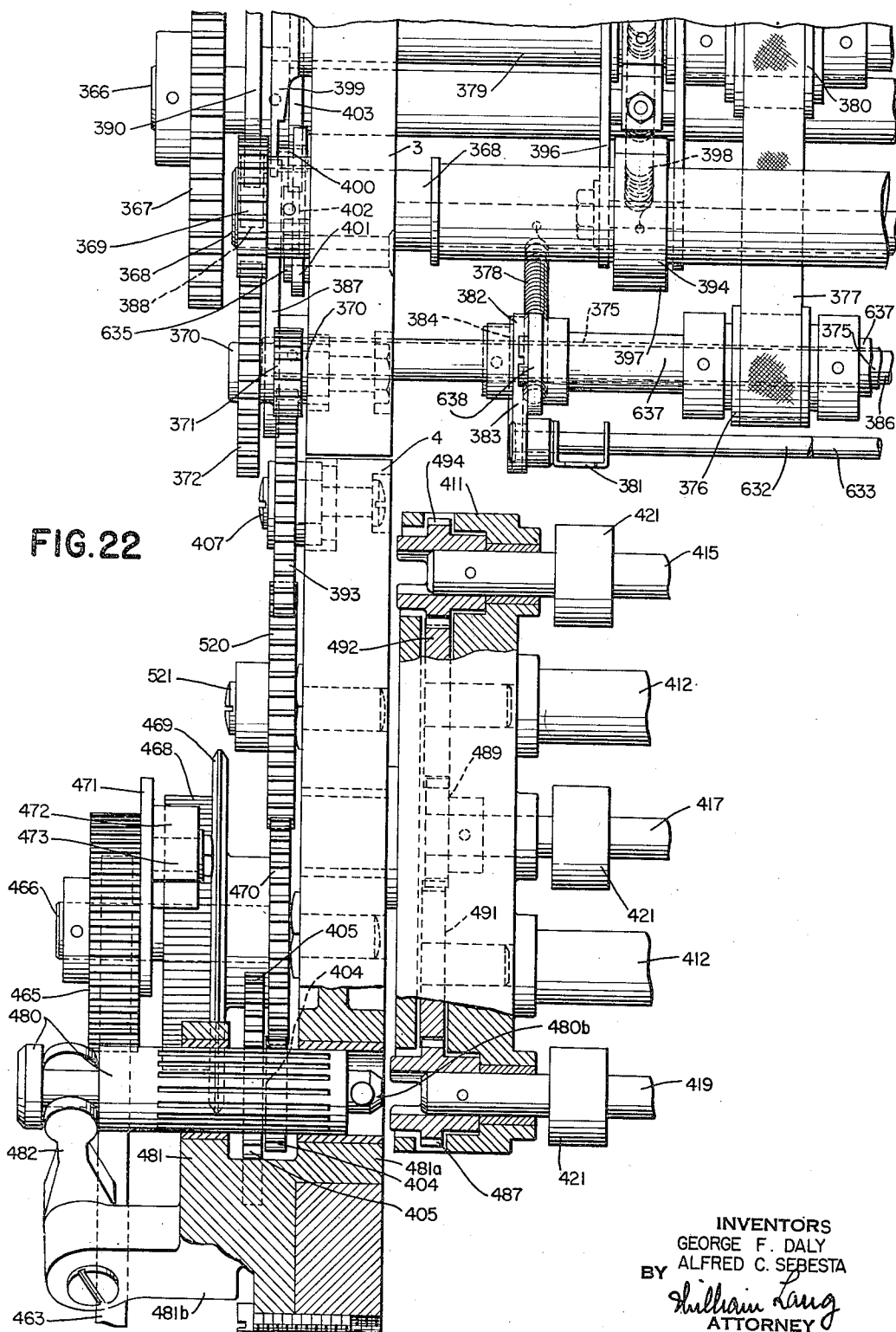
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22 Sheets-Sheet 16



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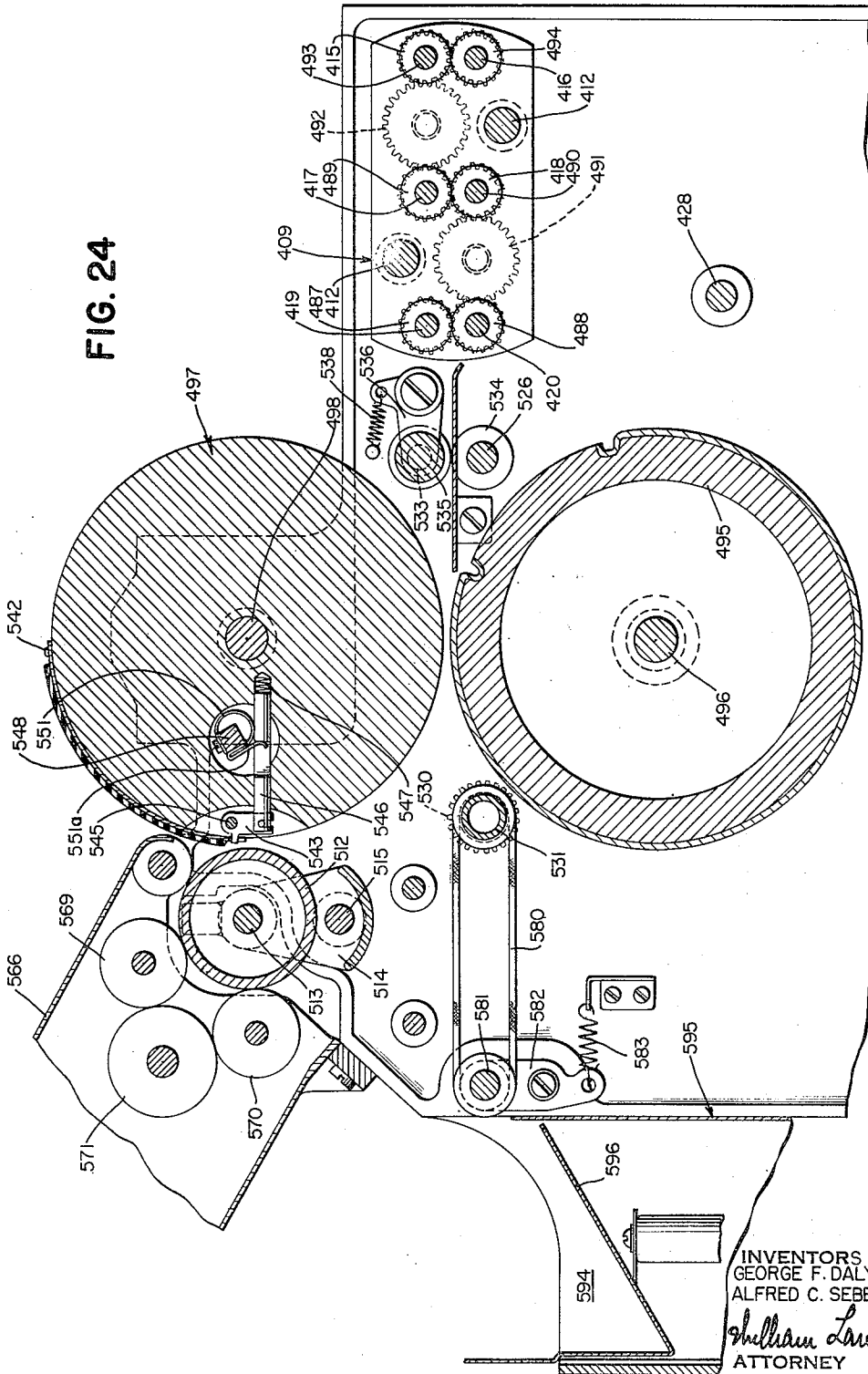
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22 Sheets-Sheet 18

FIG. 24



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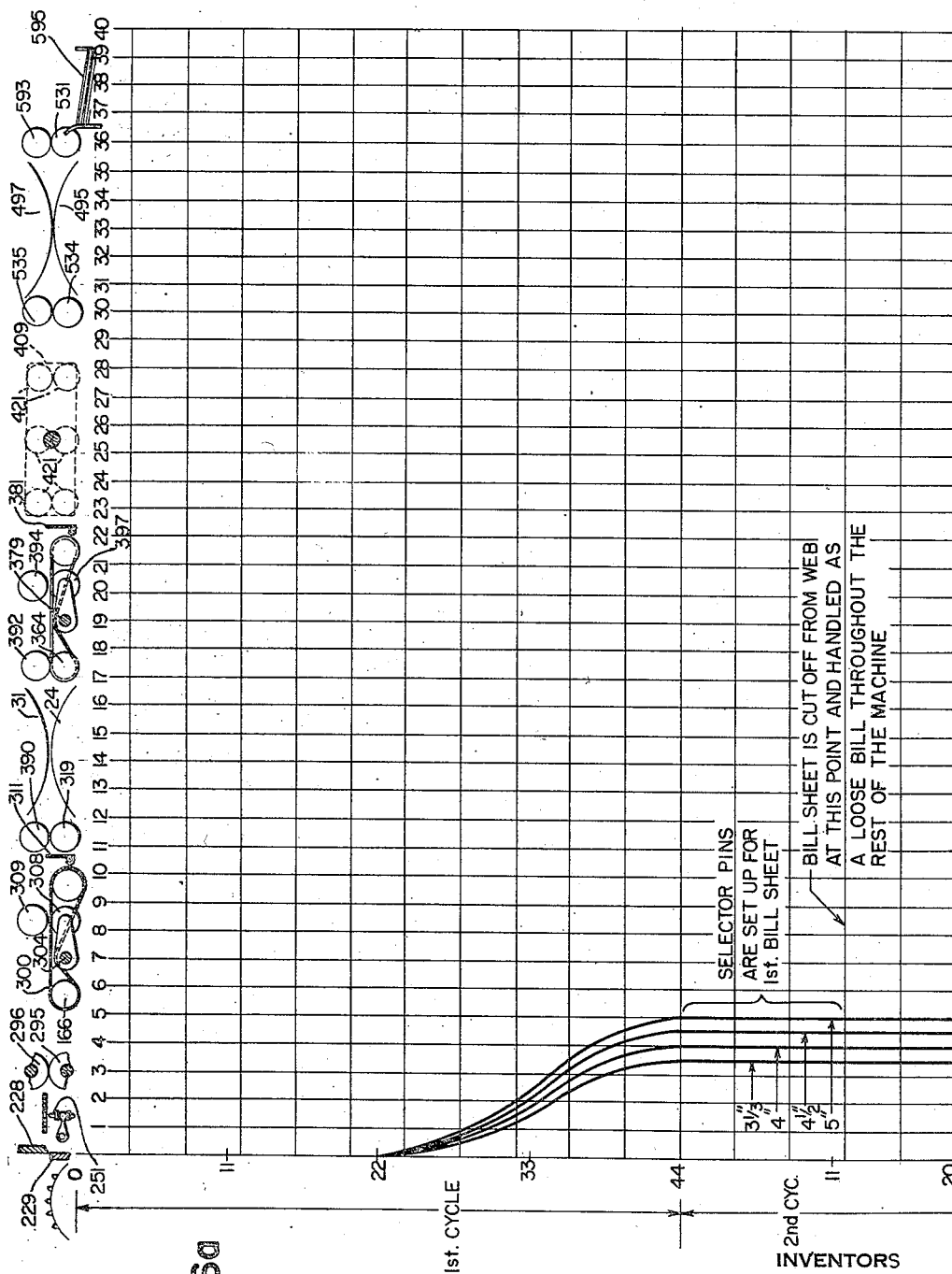
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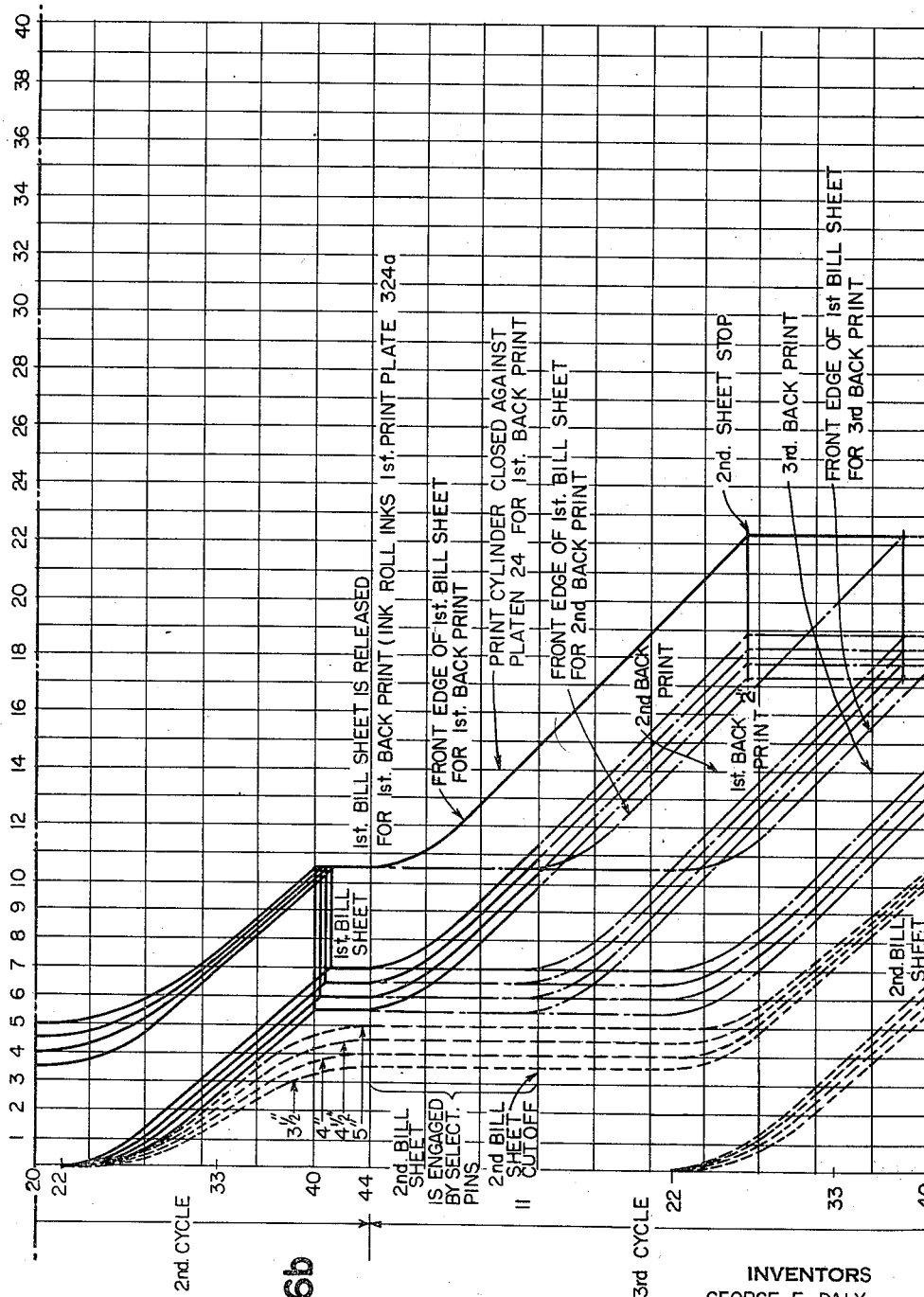
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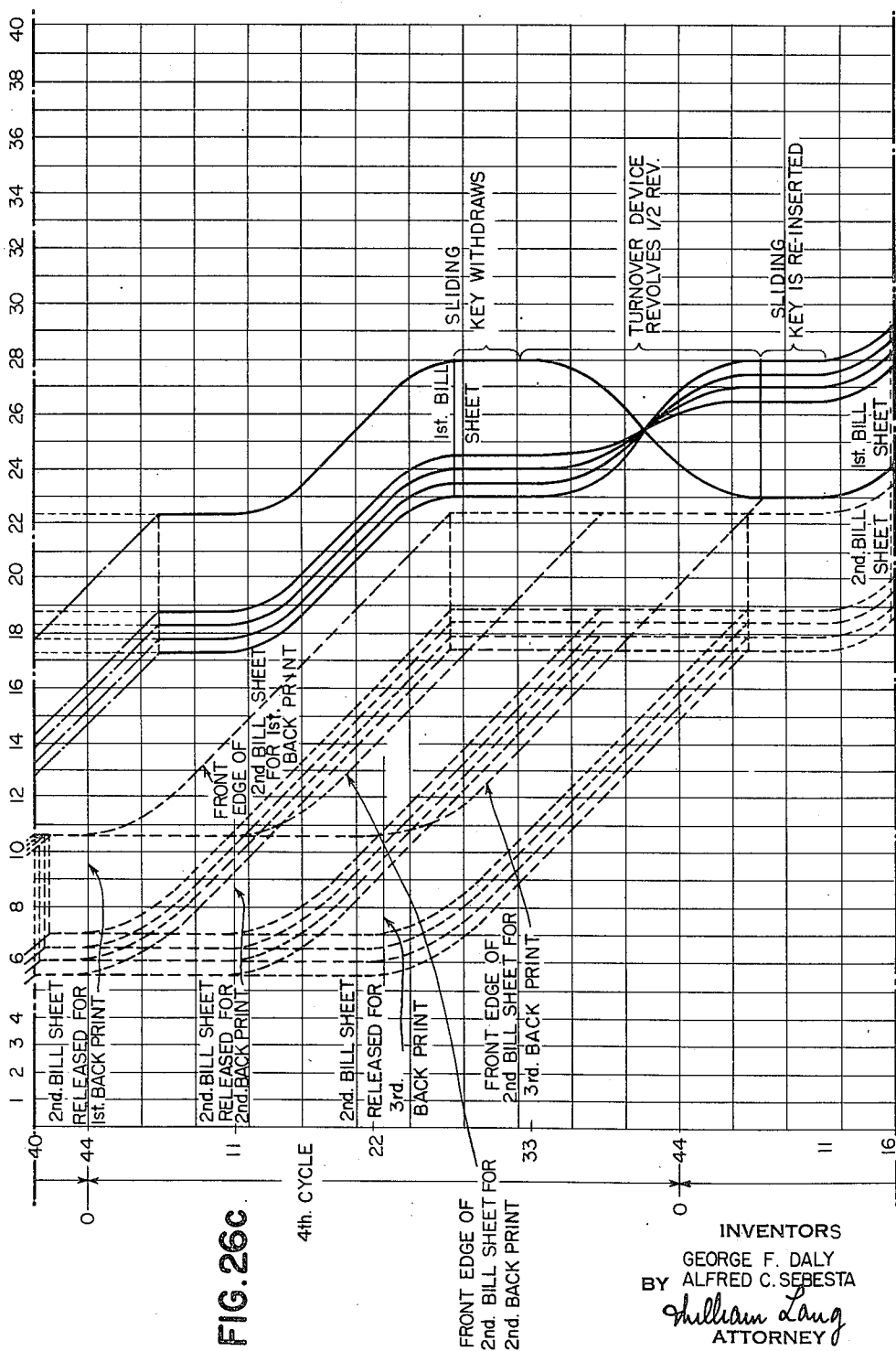
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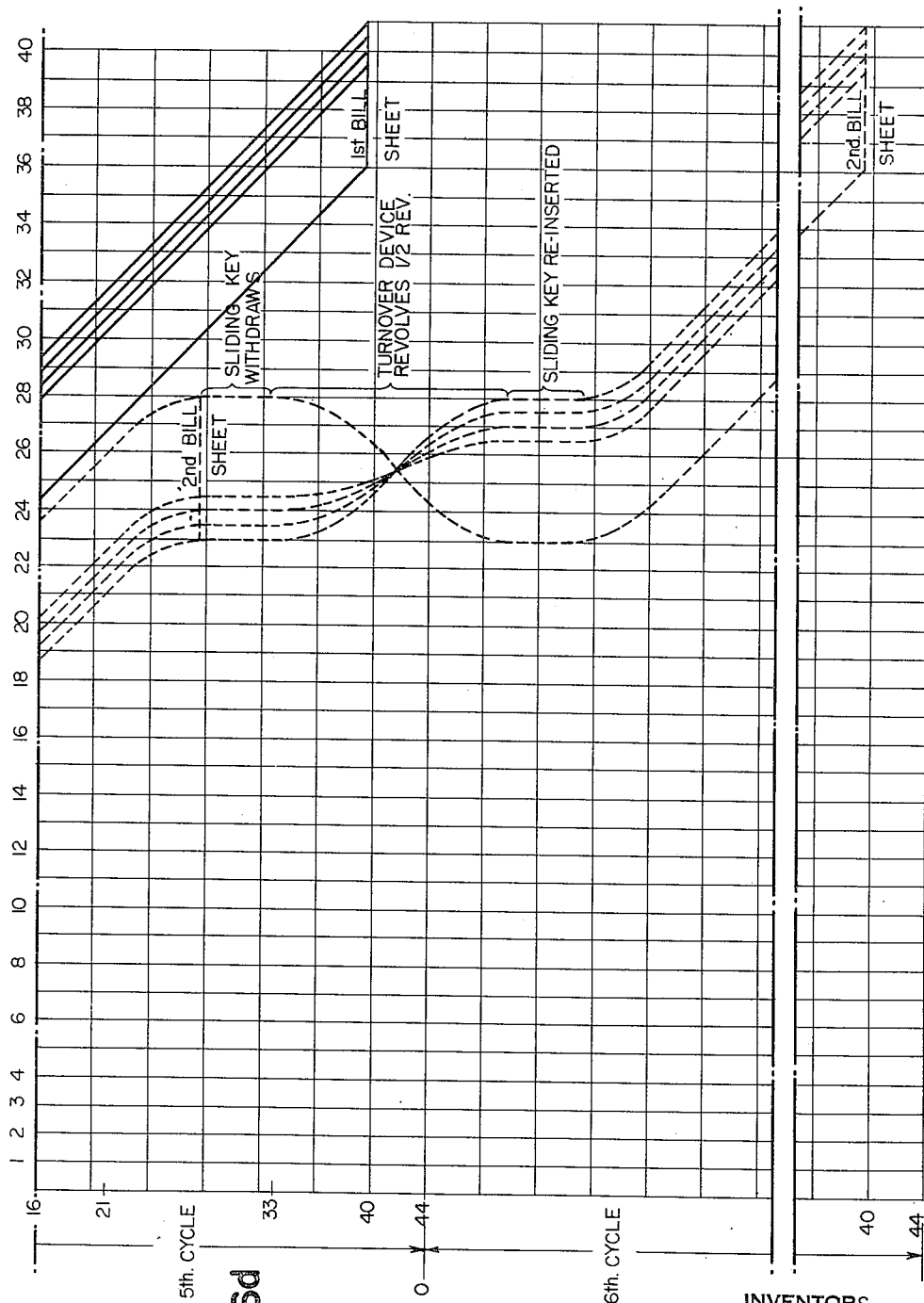


FIG. 26d

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SELECTIVE PRINTING MACHINE FOR PRINTING BOTH SIDES OF A BILL

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Application December 21, 1951, Serial No. 262,758

7 Claims. (Cl. 101—91)

This invention relates to machines for imprinting a choice of rate schedules on one side and a bill form around billing data on the other side of bills, statements, notices, records and the like used by public service, telephone and other companies and which are long and narrow and comprise a main body portion and one or more stubs which may be separated from each other or from the main body portion on scored separation lines.

The principal object of the invention is to provide a novel machine of the character which will cut the sheets to be printed one at a time from a continuous web, imprint a schedule of rates on the back side of said sheets, turn over the backprinted sheets and then imprint the face surface of the sheets with a bill form around previously prepared billing data.

An object of the invention is to provide a novel device for turning over a sheet which has been printed on the back side by one printing mechanism and feeding it to another printing mechanism for faceprinting.

Another object of the invention is to provide a trio of mechanical selection pins to sense print determining indicia on a bill sheet and means under control of the selection pins for calling a trio of printing devices into operation selectively.

Still another object of the invention is to provide a machine for printing matter on the back of a sheet cut from a web and feeding it to a receiving pocket; to provide simple means for eliminating the receiving pocket from the path of a backprinted sheet and attaching a faceprint mechanism to the backprint mechanism; to provide means mounted to the faceprint mechanism for receiving the backprinted sheet and turning it over to feed said sheet to a faceprint printing station.

A further object of the invention is to cut the sheets one at a time from a continuous web, the width of the web approximately forming the length of the sheet, to carry the cut sheets in a continuation of the line of movement of the web to printing position and to selectively print a schedule of rates on the back side of the cut sheets.

Further objects are to provide a machine of simple and substantial construction which will operate automatically to perform various operations required for cutting and printing the sheet; to provide a novel feed for the web to hold it taut and free from wrinkles or creases; to provide improved cutting mechanism to make a clean cut without wrinkling or tearing the web; to provide automatic means for advancing the web to cutting position and cutting a narrow end length sheet therefrom and advancing the sheet from the cutting mechanism in the general direction of movement of the web; to provide a trio of mechanical selection pins for operating a print selection mechanism; to provide a belt conveyor system for advancing the sheet to a printing station where the selected matter is printed on the back of the sheet; to provide another belt conveyor system for advancing the sheet to a means for inverting the sheet; to provide a turnover device for receiving the backprinted sheet, turn-

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ing it over and advancing it to a printing station where the face of the sheet is imprinted with a bill form around previously prepared billing data; to provide a device for receiving the sheet from the faceprinting operation and conveying it to a stacker.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of examples, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a diagrammatic side elevation view of both the backprint and faceprint units assembled showing the path taken by the bill sheets in moving through the machine.

Fig. 2 is a side elevation view with the cover removed looking in the direction of line 2—2 in Fig. 4 and disclosing the driving connections of the feeding and printing devices on one side of the backprint unit.

Fig. 3 is a side elevation view with the cover removed looking in the direction of line 3—3 in Fig. 4 and disclosing the driving connections of the feeding devices on the opposite side of the backprint unit.

Fig. 4 is a plan view of the backprint unit showing the imprinting mechanism and the devices for advancing the bill sheet into the print receiving position.

Fig. 5 is a sectional elevation view taken along line 5—5 of Fig. 4 through the backprint unit showing the guides and feed rollers arranged along the path of the bill sheets to guide them and control their movement to the print cylinder.

Fig. 6 is a vertical sectional view taken along line 6—6 of Fig. 4 illustrating the margin removing mechanism and the cooperating guide roller shaft.

Fig. 7 is a vertical sectional view taken along line 7—7 of Fig. 4 showing the transverse cut-off device for separating each bill sheet from the web.

Fig. 8 is an end view of the backprint unit showing the paper straightening and pin sprocket feeding mechanisms.

Fig. 9 is a vertical sectional view taken along line 9—9 of Fig. 4 showing the selective clutch drive connections.

Fig. 10 is a vertical sectional view taken along line 10—10 of Fig. 4 illustrating the storing and selecting mechanism.

Fig. 11 is a detailed elevation view partly in section of the selective clutch and the storing and selecting mechanisms.

Fig. 12 is a vertical sectional view taken along line 12—12 of Fig. 4 showing the print feeding drive connections.

Fig. 13 is a sectional view taken along line 13—13 of Fig. 11 showing the selector pins in operation for setting up the storing and selecting mechanism.

Fig. 14 is a detailed side elevation view of the detent device for positioning the secondary cam shaft accurately each revolution.

Fig. 15 is a detailed side elevation view of the device for moving the print cylinder to sheet printing position.

Fig. 16 is a detailed side elevation view of the braking device for controlling the backward movement of the print feed mechanisms.

Fig. 17 is a detailed side elevation view partly in section for the backprint cylinder.

Fig. 18 is a plan view of the faceprint unit and the turnover device showing the imprinting mechanism and the devices for advancing the bill sheets through the print receiving position to the stacker.

Fig. 19 is a sectional elevation view taken along line 19—19 of Fig. 18 through the turnover device showing

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the guides and feed rollers to guide the bill sheets into the print receiving station.

Figure 20 is a side elevation view with the cover removed looking in the direction of the line 20—20 in Fig. 18 and disclosing the driving connections of the turnover device and feeding and printing devices on one side of the faceprint unit.

Fig. 21 is a side elevation view with the cover removed looking in the direction of the line 21—21 in Fig. 18 and disclosing the driving connections of the turnover device on the opposite side of the faceprint unit.

Fig. 22 is a detailed plan view with parts broken away of the turnover device looking in the direction of line 22—22 in Fig. 20 and disclosing the driving connections of the devices which feed the bill sheets from the backprint unit to the turnover mechanism.

Fig. 23 is a detailed sectional view taken along line 23—23 of Fig. 20 showing the operation of the sliding key of the turnover device.

Fig. 24 is a sectional elevation taken along line 24—24 of Fig. 18 through the faceprint unit showing the feed rollers, turnover device and feeding devices arranged along the path of the bill sheets to guide them and control their movement through the print receiving station to the stacker.

Fig. 25 is a detailed side elevation view partly in section for the faceprint cylinder.

Figs. 26a, 26b, 26c and 26d when taken together form a timing diagram which can be followed to understand the timing of the various operations of the mechanisms shown herein.

The bill imprinting machine of the present invention is used in conjunction with an alphabetical tabulator to prepare bills of the type commonly used by public service and telephone companies. The bill sheet is short in length varying from 3½" to 5", but comparatively wide varying from 10" to 14". The width is divided into a main body portion and one or more stubs which may be separated from each other or the main body portion on scored separation lines. The information on the stub portions is a duplicate of that on the body portion, one stub usually being kept as a record by the company. The body portion is presented by the customer when paying the bill and this body is sometimes further separated to provide a customer's receipt on payment.

The planned procedure is to prepare billing data on a blank roll of paper or web by feeding it into an alphabetical tabulator where the billing data is printed on the web from punched cards. These data are printed in linear sequence along the web so that the web may be later divided into uniform length bills. Besides printing these data, the tabulator has a small punch unit which punches one of three ¼-inch diameter parallel holes in the left hand area of each successive intended bill from data on the punched tabulating cards. The first hole is punched about ¾" inwardly from the left margin and approximately 2½" down from the top of the intended bill. The second and third holes are punched ⅜" and ¾" to the right of the first hole respectively. Which of these three is punched will later determine which of three rate schedules is to be printed on the back of the bill sheet. Before the paper passes through the tabulator it is punched on both edges with a continuous series of holes spaced ¼" from each edge to provide a driving means for feeding the web during the several printing operations. The punch which punches these marginal holes is an auxiliary attachment to the tabulator.

The web is then transferred to the imprinter which comprises a backprint unit and faceprint unit. The web passes through the backprint unit where the bill sheets are severed from the web and one of three rate schedules is printed thereon. If it is desired to print a bill form around the billing data on the face of the bill sheet, the faceprint unit is assembled to the backprint unit and the

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bill sheet passes into a novel turnover mechanism where it is turned over and fed to the faceprint printing mechanism. Otherwise the backprinted bill sheet is fed to a stacking pocket of a stacker positioned after the printing station of the backprint unit. A more detailed explanation of the operation of the imprinter of the instant invention will be included later in the description of the machine.

Path followed by the bill sheet

In the diagrammatic view, Fig. 1, is shown the path followed by the bill sheet in going from a reel of uncut web in the backprint unit to an individual imprinted bill in the stacker of the faceprint unit. The reel of web 180 is placed in the lower right hand end of the backprint unit and passes through a pair of feed rolls 189 and 190 and beneath a slack idler roll 203. The web next passes through a paper straightener 183 up to a pair of pin sprockets 191 and 192 which engage marginal feed holes on both edges of the web and feed the web to the bill sheet forming mechanism. The web 180 is pushed to the left into engagement with the margin removing mechanism comprising two pairs of rotary shear discs 216, 220 and 215, 219 and continues in its path into engagement with the first set of feed rollers 211 and 227. After leaving the first set of feed rollers, the web continues forward in a straight path between a pair of transverse cutoff blades 228 and 229 and into engagement with the second set of feed rollers 295 and 296 which hold the leading portion of web 180 while a bill length is being severed by the blades. Between the cutoff blades and the second set of feed rollers are located three mechanical pins 249, 250 and 251 which scan the intended bill sheet for the hole controlling the selection of a print plate while the bill sheet is cut from web 180.

After leaving the second set of feed rollers 295 and 296, the cut bill sheet passes on to a belt conveyor comprising a plurality of belts 300 and pulleys 392 and a constantly rotating shaft 166. The bill sheet is advanced until it encounters sheet stops 311. It is held by the stops until the selected peripheral portion of backprint cylinder 31 comes into printing position. As the stops 311 are lowered, print feed rollers 308 and 309 are brought together on the bill sheet to move it forward. The sheet is next drawn between auxiliary feed rollers 319 and 390 and advanced into printing position between platen 24 and print cylinder 31. After leaving the printing position the backprinted bill sheet passes on to a second belt conveyor comprising a plurality of belts 377 and pulleys 376 and a constantly rotating shaft 364. The bill sheet is advanced until it encounters the second sheet stops 381. It is held by the stop until turnover device 409 is in position to receive a bill sheet. As sheet stops 381 are lowered, turnover device entrance rollers 394 and 397 are brought together on the bill sheet to move it forward.

The sheet is next fed into turnover device 409 where it is turned over to prepare it for the faceprinting operation. After leaving the turnover device, feed rollers 534 and 535 advance the bill sheet into printing position between faceprint cylinder 497 and platen 495. After leaving the printing position the faceprinted bill sheet passes on to a third belt conveyor comprising a plurality of belts 580 and pulleys 582 and a constantly rotating shaft 531. The bill sheet is moved to pocket 594 of stacker 595 and rests upon the spring supported stacker plate 596.

Referring to the timing chart, Figs. 26a, b, c and d reveal that each machine cycle is divided into forty-four cycle points and the loose bill sheet travels from the cut-off blades 228 and 229 to the stacker 585 in a period of 215 cycle points, or almost five complete machine cycles. The sheet travel operations diagrammatically represented in Figs. 26a, b, c, and d are related not only to one sheet, but to the five sheets that are at one stage or an-

other in the course of travel from the cutoff blades 228 and 229 to the stacker 595. The timing chart is a composite representation of the happenings along the entire path of the sheet travel.

Framework

Referring to Figs. 1, 4 and 8 of the drawings, the machine of the instant invention is composed of a back print unit and a faceprint unit, each adapted to be used individually or together as a single unit. Two main frames hereinafter called front and rear frames which extend the entire length of both units of the machine are each made up of two sections 1, 2 and 3, 4 respectively. The front and rear frames are tied together by a number of crossbars 5 which protrude a short distance through the sides of the interconnected frames. Supporting legs 6 are fastened to the outside ends of crossbars 5. If only the backprint unit is in use, the mechanisms located between frame sections 1 and 3 are operated. When both the backprint and faceprint units are used together, frame sections 1 and 2 clamp directly together as do frame sections 3 and 4, and the mechanisms between both front and rear frame sections are operated.

The main driving mechanism

The power or driving mechanism used to operate the imprinting, bill forming and various web and sheet feeding devices consists of an electric motor 7, suitably mounted on a small sub-frame 8 extending between the front and rear frame sections 1 and 3 as shown in Figs. 1 and 8. Motor 7 is provided with a small pulley 11, around which is drawn an endless belt 12. Secured to a drive shaft 9 is a drive pulley 10, around which the endless belt 12 is passed. Motor 7 drives shaft 9 through endless belt 12 and the shaft in turn drives the mechanisms which perform the various machine operations mentioned above.

Drive shaft 9 carries a hand wheel 13 at the drive pulley end for manual operation purposes. A ratchet clutch 14 is provided for pulley 10 (Fig. 1) to allow it to be disengaged from shaft 9, thereby preventing motor 7 from turning over when hand wheel 13 is rotated manually.

Attached to drive shaft 9 is a right angle worm gear 15 in mesh with a worm wheel 16 fastened to shaft 17 which rides in frame sections 1 and 3. A spur gear 18 is fixed to a portion of shaft 17 projecting through frame section 3 and meshes with an idler gear 19 which turns freely on a secondary cam shaft 21 to rotate the idler in a clockwise direction (see Fig. 3). Cam shaft 21 extends through and is supported in main frame sections 1 and 3 and is operated at three selective times in the machine operation as explained hereinafter.

Referring to Figs. 3 and 5, a platen 24 is rigidly mounted on a shaft 22 and a backprint cylinder or drum 31 is similarly mounted on a shaft 30. Shaft 22 is mounted for rotation in frame sections 1 and 3 and has a gear 23 fixed to a portion which extends through frame section 3. Shaft 30 is rotated in guide blocks 337 and 338 which are fitted for vertical movement in housings 339 and 340 respectively. A spur gear 29 is secured to shaft 30 on the outside of frame section 3. Idler gear 19 drives platen gear 23 which in turn meshes with an idler gear 25 pivoted on a stud 26 secured to frame section 3. A floating idler gear 27 is pivoted on a floating stub shaft 28 and is maintained in engagement with idler gear 25 and cylinder gear 29 by means of connecting links 32 and 33 each of which is pivoted at one end on stub shaft 28 and on the opposite end to stud 26 and shaft 30 respectively. Idler gear 25 drives print cylinder gear 29 through the floating idler 27.

An ink roll 34 (Fig. 5) is driven from the same train of gears that operate the print cylinder 31 and platen 24. It is already explained that gear 25 is driven by the speed reduction gearing connected to the motor 7. Ink

roll 34 is mounted on a shaft 36 which in turn is secured to a sub-frame 38 pivoted on a shaft 37 which rides in a fixed bearing in frame section 3 and in an eccentric bearing in frame section 1 to permit adjustment of ink roll 34 for an even inking pressure on both ends of print cylinder 31. Shaft 36 extends beyond frame section 3 and has a gear 35 fixed to the end thereof (Fig. 3). Idler gear 25 meshes with a pinion 39 secured to another gear 40 which is loosely pivoted on a rod 41 which is fixed in frame sections 1 and 3 and projects through section 3. Gear 40 meshes with gear 35 to drive ink roll 34. The mechanism for making the ink roll effective is described hereinafter.

A train of rack driven gearing extends across the outside of the rear frame section 3 to reach the drive connections for the web feeding and bill forming mechanisms as shown in Figs. 3 and 4. It is already explained that gear 19 is driven by the speed reduction gearing connected to the motor 7. A constantly driven main cam shaft 42 rides in and extends through frame sections 1 and 3. The shaft 42 carries a spur gear 43 and cams 75 and 44 secured on the outside of frame section 3. Gear 19 meshes with spur gear 43 for driving camshaft 42 in a counterclockwise direction. The main driving mechanism causes camshaft 42 to rotate once during each machine cycle. A rack 45 is guided to operating position by rollers 47, 48 and 58 which are pivoted on studs 49, 50 and 64 respectively projecting from frame section 3. A cam follower or roller 51 is freely mounted on a rod 52 carried by a member 53 telescopically inserted in rack 45 at its cam engaging end. Upon rotation of cam shaft 42, the high point of cam 44 engages roller 51 to effect a lateral displacement of rack 45. A spring 54 extending between an extension 55 of rack 45 and stationary pin 56 urges said rack to a restored position.

Referring again to Fig. 3, gears 59 and 60, brake disk 61 and ratchet wheel 62 are fastened together and rotate freely as a unit on a stud 57 projecting from frame section 3. Gear 63 is loosely mounted on stud 57 and has secured to its face an arm 65 which carries a dog 66. Spring plunger 67 keeps dog 66 in engagement with ratchet wheel 62. The teeth of rack 45 engage gear 63 causing it to be rotated in a clockwise direction when said rack is displaced laterally by cam 44 as it rotates through 180°. Dog 66 moves with gear 63 and engages the first ratchet tooth encountered on wheel 62 causing said wheel 62 and the attached mechanisms, 59, 60 and 61 to be moved clockwise with the gear 63. Gears 59 and 60 are a part of an interchangeable set of gears which are used to vary the size of the bill sheet to be severed from the web 180. By using the two gears 59 and 60 shown in Figs. 3 and 4 or a larger or smaller pair the feed of the web 180 to the bill forming mechanism is controlled to allow a 3½", 4", 4½" or 5" bill sheet to cut off.

As cam 44 moves through the following 180° to complete a machine cycle, spring 54 urges rack 45 to its restored position, thereby causing gear 63 to rotate counterclockwise about stud 57 as viewed in Fig. 3. The teeth of ratchet wheel 62 are so shaped as to enable dog 66 to slip over them without effecting engagement. In order to prevent ratchet wheel 62 from rotating counterclockwise with the gear 63 by force of friction between dog 66 and the ratchet teeth of wheel 62 during the restoring operation of rack 45, a braking device is provided.

A block 610 having an extension rod 69 fastened to the rear thereof is pivoted on stud 68 projecting from frame section 3. Also pivoted on the stud 68 on the outside of block 610 is a plate 70 having an adjusting slot 71 which is engaged by a locking screw 72 seated in the side of block 610. A brake shoe 73, pivoted to plate 70 at 74, is positioned for engagement with brake disk 61 and its position in relation to said disk is regulated by adjustment of plate 70 through slot 71 and screw 72. As the restoring movement of rack 45 com-

mences, the rise of cam 75 engages rod 69 causing block 610 to pivot about stud 68 thereby moving the pivot center of brake shoe 73 closer to disk 61 to effect an engagement between said disk and shoe 73. When rack 45 is completely restored, rod 69 drops from the rise of cam 75 releasing shoe 73 from the aforementioned engagement with disk 61.

Edge stripper shafts 76 and 86 which carry devices for removing the margin from web 130 are supported for rotation in frame sections 1 and 3 (Figs. 4 and 6). Gears 77 and 78 are fastened together and freely mounted on a stud 88 projecting from frame section 3 and a bracket 79 is pivotally mounted thereon beyond gear 77. Shaft 76 is journaled at one end in stud bushing 88a. Idler gear 80 is mounted on a pin 81 supported by one end of bracket 79 (Fig. 3). Gear 60 meshes with gear 89 which in turn transmits clockwise motion to gear 77. Gear 78 meshes with a gear 82 mounted on a stud 83 secured to frame section 3 and provides the drive connection to gear 84 attached to a portion of feed sprocket shaft 85 extending through frame section 3. Bracket 79 contains a slotted portion which is engaged by stud 83 which serves as a stop to limit the length of arc through which bracket 79 may swing about stud 88.

Gear 78 also engages a spur gear 87 (Fig. 6) carried by shaft 86 on the outside frame section 3 to rotate the shaft counterclockwise as viewed in Fig. 3. Gears 89 and 90 are fastened to shafts 86 and 76 respectively and are intermeshed to transmit clockwise motion to shaft 76.

A stub shaft 92 extends through and bears in frame section 3 (Fig. 4). A gear 91 is fixed to shaft 92 on the outside of frame section 3 and is engaged by gear 78 which turns it counterclockwise. Gear 93 is attached to shaft 92 on the inside of frame section 3 and meshes with a gear 95 secured to feed roller shaft 100 to move it in a counterclockwise direction as viewed in Fig. 5. In Fig. 5 it is seen that gear 93 in turn drives feed shaft 99 clockwise through engagement with gear 96 mounted thereon. Gears 97 and 98 are secured to the ends of shafts 99 and 100 respectively near frame section 1 and are intermeshed to maintain said shafts in proper alignment.

Gears 101 and 102 (Fig. 4) are fastened together and freely mounted on a stud 103 extending from frame section 3. A bracket 104 is pivotally mounted on stud 103 beyond gear 101. Gears 105 and 106 are fastened together and freely mounted in one end of bracket 104. The opposite end of bracket 104 is slotted and is engaged by a stud 107, projecting from frame section 3, which serves as a stop to limit the length of arc through which bracket 104 may swing about shaft 103. Gear 59 turns gear 105 in a counterclockwise direction as viewed in Fig. 3, the latter carrying connected gear 106 in the same direction. Gear 106 meshes with gear 101 moving it and gear 102 clockwise. A stub shaft 108 bears in and extends through frame section 3 and has fixed thereto on opposite sides of section 3 gears 109 and 110. Gear 102 meshes with gear 109 moving it and gear 110 counterclockwise. Gear 110 in turn moves gear 111 attached to feed roller shaft 113 to drive it in a counterclockwise direction as viewed in Fig. 5. Gear 111 meshes with gear 112 fixed to shaft 114 to drive it clockwise. Gears 115 and 116 (Fig. 2) are attached to shafts 113 and 114 respectively and are intermeshed to maintain said shafts in proper alignment.

Selective clutch mechanism and drive connections

Referring now to Figs. 2, 9 and 11, main cam shaft 42 carries a gear 120 fixed thereto on the outside of frame section 1. Gear 121, clutch ratchet wheel 122 having two teeth spaced 180° apart and cam 123 are fastened together and freely mounted on shaft 42. Gear 120 is in mesh with a gear 124 which is freely mounted on a stud 200 projecting from frame section 1.

Pivotally mounted on gear 120 at 90-degree intervals 75

are three similar clutch dogs 125, each dog being provided with an engagement roller 126 and independent retaining latch 127. The three dogs differ only in that their rollers 126 are at three different levels for aligning with three cam arms 280, 281 and 282 which are pivotally mounted on a stud 288 projecting from frame section 1. The dogs 125 and latches 127 are maintained in inoperative position by coil springs 129 and 130 respectively which are secured to the under face of gear 120 and to each dog and latch through an opening in gear 120. The fourth quarter of gear 120 has no clutch dog or latch device.

Shaft 42 constantly rotates in a counterclockwise direction as viewed in Fig. 2 carrying gear 120 with it. The releasing of a cam arm 280, 281 or 282 enables said cam arm to engage its corresponding clutch dog 125. The clutch dog which is engaged will pivot in a counterclockwise direction and engage a tooth on ratched wheel 122 causing the ratchet wheel to revolve counterclockwise and carry gear 121 along with it one-half revolution. It is to be noted that latch 127 will hold dog 125 after the camming force of arms 280, 281 or 282 has displaced it. Thus, the clutch mechanism revolves one half revolution for each complete revolution of main cam shaft 42 and may occur at one of three different times during a machine cycle depending upon the set-up of the pin storage mechanism. A latch release roller 131 trips the latch 127 to effect a restoring of clutch dog 125 after each half revolution.

Print feeding drive connections

A train of drive gearing extends from selector clutch gear 121 to the drive connection for the print feed rollers and sheet stop mechanism (see Fig. 2). A pinion 132 and an idler 133 are fastened together and loosely mounted on a stud 134 projecting from frame section 1. Gear 121 meshes with pinion 132 and idler 133 in turn meshes with gear 135 fastened to secondary cam shaft 21 on the outside of frame section 1 to drive said cam shaft in a counterclockwise direction as viewed in Fig. 2. Clutch gear 121 turns one-half revolution while secondary cam shaft 21 turns one complete revolution each machine cycle through the two-to-one ratio transmitted by gears 132 and 133.

From Figs. 2 and 12 it is seen that a stud 140 projecting from frame section 1 carries a sector rack 137, a spring urged detent arm 138 and a lift arm 150 pivoted thereon. Rack 137 is biased toward cam 136, fixed to shaft 21 by a spring 149 and engages said cam through cam follower 141. The teeth of rack 137 engage a gear 152 freely mounted to shaft 153 which extends through frame sections 1 and 3. Gear 152 is driven in a clockwise direction when rack 137 is displaced counterclockwise about stud 140 by cam 136 as it rotates through 180°. As cam 136 moves through the following 180° to complete a machine cycle, spring 149 urges rack 137 to its restored position, thereby causing gear 152 to rotate counterclockwise about shaft 153. Detent arm 138 is biased by spring 611 toward engagement with a detent cam 142 fixed to cam shaft 21 and through cam follower 139 to position said cam shaft accurately each revolution as shown in Fig. 14.

Ratchet wheel 156, brake disk 157 and gear 158 are fastened together and rotate freely as a unit on shaft 153 as shown in Fig. 12. Secured to the face of gear 152 is an arm 154 which carries a dog 155. Spring plunger 159 keeps dog 155 in engagement with ratchet wheel 156. When gear 152 is rotated by rack 137, the dog 155 moves with it and engages the first ratchet tooth encountered on wheel 156 causing said wheel and the attached mechanisms 157 and 158 to be moved clockwise as viewed in Fig. 2. During the restoring operation of rack 137, gear 152 is turned counterclockwise carrying dog 155 with it. The teeth of ratchet wheel 156 are so shaped as to enable dog 155 to slip over them without effecting engagement.

In order to prevent ratchet wheel 156 from rotating counterclockwise with gear 152 by force of friction between dog 155 and the ratchet teeth of wheel 156 during the restoring operation of rack 137, a braking device is provided.

The braking device is outlined in Fig. 2 and shown in detail in Fig. 16. It comprises block 144 having an extension rod 145, plate 146, locking screw 147 seated in block 144 and brake shoe 148. The parts are pivoted on a stud 160 projecting from frame section 1 and assembled in the same manner as previously described for the braking mechanism of disk 61 mounted on frame section 3. As the restoring movement of rack 137 commences, the rise of a cam 161 fixed to cam shaft 21 engages rod 145 causing a displacement of block 144 about stud 160 to effect an engagement between shoe 148 and disk 157.

A stub shaft 162 extends through and bears in frame section 1 (see Figs. 2 and 4). A gear 163 is fixed thereto on the outside of frame section 1 and is engaged by gear 120 to drive shaft 162. Also on shaft 162 on the inside of frame section 1 is a gear 164 which meshes with a gear 165 secured to a conveyor shaft 166. The conveyor shaft rides in frame sections 1 and 3 and is driven in a counterclockwise direction as viewed in Fig. 2.

Referring again to Figs. 2 and 4 a short shaft 167 is mounted in frame section 1 in the same manner as shaft 162 and carries fixed thereto on opposite sides of frame section 1 gears 168 and 169. Gear 168 is engaged by gear 158 to drive shaft 167, and gear 169 meshes with a gear 170 secured to a feed roller shaft 171 riding in frame sections 1 and 3 to rotate it clockwise.

Gear 169 also meshes with an idler gear 172 which is loosely mounted on a stud 173 extending from the inside of frame section 1. Idler 172 transmits motion to a gear 174 attached to an auxiliary feed roller shaft 175 rotating in frame sections 1 and 3. Gear 174 meshes with a gear 176 secured to a cooperating auxiliary feed roller shaft 177 to rotate said shaft in a clockwise direction.

The web feeding mechanism

A reel 179 covered with a roll of tabulated and addressed web 180 is placed in the lower right hand end of the machine as shown in Figs. 1 and 8. Web 180 contains a continuous series of previously punched marginal feed holes on both of its edges. Reel 179 is mounted on stub shafts 181 and 182 which in turn are mounted for rotation in frame sections 1 and 3 respectively. Shafts 181 and 182 engage a hollow portion in the core of reel 179. Shaft 181 is adjustable laterally and spring biased toward reel 179 to allow for removal of a reel when the web has been entirely unwound and for the insertion of another reel of web. Connected to stub shaft 182 outside frame section 3 is a friction brake consisting of a pulley 185 and a leather belt 186 which is wrapped around said pulley. The ends of the leather belt are fastened with springs 187 to a stationary stud 188 projecting from frame section 3. This brake restrains the rotation of the reel 179 slightly against the pull of web 180 to prevent overrunning of the web roll.

The web 180 then passes through a pair of feed rolls 189 and 190 as illustrated in Fig. 1 which draws it off the reel 179 to relieve undue pressure on a pair of feeding pin sprockets 191 and 192 which are fastened to shaft 85 and feed the web in later operations as explained herein-after. Feed roll 189 is fixed to shaft 193 which rides in frame sections 1 and 3. A variable pitch pulley 194 (Fig. 8) is carried by a portion of shaft 193 projecting through frame section 3. A shaft 195 is rotatably mounted between a pair of identical arms 196 pivoted to frame sections 1 and 3, respectively. Feed roll 190 is fixed to shaft 195 and biased toward roll 189 by means of springs 198 secured to frame sections 1 and 3. Feed roll shaft 193 is driven by a belt extending from shaft 85. Endless belt 201 is drawn around pulley 194 and passed over a

pulley 202 secured to shaft 85 on the outside of frame section 3.

A slack idler roll 203 is rotatably mounted between the sides of a swinging frame 204, which pivots about feed roll shaft 193. A cam portion 205 (Fig. 8) of frame 204 engages a side of pulley 194. As frame 204 travels up and down in response to changes in length of the loop of web 180, it cams pulley 194 in and out thereby varying the speed of the rolls 189 and 190. As frame 204 and pulley 194 are drawn by a shortening web loop, the pitch diameter of the pulley 194 is made smaller, causing web 180 to be fed faster thereby compensating for the change of web loop. A lengthening web loop enables the pitch diameter of pulley 194 to be made larger causing web 180 to be fed slower so that a uniform loop is always maintained.

The paper straightener and web feeding pin sprockets

A device is provided for straightening the paper of the web 180 as it is unwound from reel 179. The paper straightener comprises a pair of adjustable flat bars 197a and 197b and guide roller 199 (Fig. 8). Bars 197a and 197b are supported by brackets 183 and 184 which are secured to frame sections 1 and 3 respectively. The bars 197a and 197b are mounted in a manner so as to leave a space between them through which web 180 may pass. Guide roller 199 is journaled in brackets 183 and 184 and bars 197a and 197b are angularly adjusted with respect to roller 199 so that web paper passing over roller 199 and between the bars is straightened. A bend is put in the paper which reverses the curl caused by the web 180 being rolled on reel 179 and leaves the paper straight and flat.

Web 180 then passes over a pair of pin sprockets 191 and 192 fastened to shaft 85 which engages the marginal feed holes on both edges of the web. These sprockets are adjustable along shaft 85 to accommodate different widths of bills and are also adjustable radially so that the information printed on the web by the alphabetical tabulator may be correctly aligned to coincide with the subsequent operations in the imprinter. A bracket 600 is fastened at one end to an upper crossbar 5 located above pin sprockets 191 and 192. Bracket 600 has a notched V edged roller 601 mounted for rotation in the other end. Roller 601 is impressed against support roller 601a in a manner to produce a tear serration of a type common to utility bill forms that require a removable stub. Roller 601 also serves to guide web 180 as pin sprockets 191 and 192 feed web 180 to the margin removing disks.

Margin removing mechanism

Two rotary shear disks 215 and 216 are attached to shaft 76 provided with fixed bearings in both side frames and having gear connections with the driving motor as revealed in Figs. 4 and 6. Disks 215 and 216 are secured to shaft 76 through adjustable collars 217 and 218 respectively. Shaft 86 rides in both side frames and is driven by a gear connection with shaft 76 as already explained. Two disks 219 and 220 which cooperate with disks 215 and 216 respectively are secured to shaft 86 through adjustable hubs 223 and 224. The cooperating disks as shown in Fig. 6 are spring urged into shearing engagement by means of coil springs 221 and 222 respectively positioned between disk 215 and collar 217 and disk 216 and collar 218. The pressure of the springs is regulated by adjusting the position of the collars on shaft 76. Shafts 76 and 86 each have a flat portion 225 and 226 respectively, extending lengthwise of the shafts, for providing a seat for the ends of set screws carried by the adjustable collars. Upon leaving the feeding pin sprockets 191 and 192 the web 180 passes between the aforementioned shearing disks which remove the marginal feed strips from both edges.

The first set of feed rollers

Directly following the shearing disks are mounted the

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cooperating feed roller shafts 99 and 100 also shown in Figs. 4 and 6 which rotate intermittently during machine operation and are driven by friction coupling means as previously described at a slightly higher ratio of speed than pin sprocket shaft 85. Shafts 99 and 100 have fastened thereto a plurality of rollers 227 and 211 respectively which draw the web 180 through the aforementioned rotary shearing disks in a taut condition. The friction coupling enables the rollers to draw the web taut, but the force is not positive enough to tear the feed holes on the pin sprockets 191 and 192.

Shaft 99 is not mounted in fixed bearings in the front and rear frame sections 1 and 3 as is shaft 100. Instead, it is loosely supported at both ends by arms 212 and 213 each of which is pivotally connected to a side frame. Springs 214 and 215 are attached to arms 212 and 213 respectively and anchored to the adjacent frame section, thereby pulling shaft 99 in a counterclockwise direction as viewed in Fig. 1 to press rollers 227 down upon rollers 211. Therefore rollers 227 are free to be raised from contact with rollers 211 allowing the web 180 to be inserted between them for the beginning of machine operation. The web is then carried to the bill sheet forming mechanism where the individual bill sheets are severed from the web.

The bill sheet forming mechanism

The web then passes between a pair of transverse cutoff blades 228 and 229 as illustrated in Figs. 4 and 7 where bill sheets are cut off from the web 180 in 3½", 4", 4½" or 5" sizes by using interchangeable sets of feeding gears as previously explained. Upper blade 228 is made in halves 228a and 228b mounted on a light sliding frame 232 by means of bolts 230. The cutting edges of blade halves 228a and 228b taper up and toward the center where both edges of the blade halves join. The lower blade 229 is straight and solid and mounted on a cross frame 231. Upper blade frame 232 is mounted on arms 232a and 232b which in turn are pivoted to sliding bearings 233 and 234 respectively by means of pins 235 and 236. Springs 237 and 238 are secured to pins extending from the adjacent frame sections and fastened to the bottom or arms 232a and 232b respectively to urge blade 228 toward cutting engagement with lower blade 229. Bearings 233 and 234 slide on guide bars 239 and 240 which are secured to extensions 231a and 231b of cross frame 231.

Upper blade 228 is operated by means of cam arms 241 and 242 (Figs. 4 and 5) which are pivotally mounted on a rod 381 extending between frame sections 1 and 3. Cam arm 241 is bifurcated on one end for engaging a block 243 pivoted on pin 235 and carries a cam follower 241a on the opposite end. Cam arm 242 is similar in construction to cam arm 241 carrying a cam follower 242a and engaging a block 244 pivoted on pin 236. Cam followers 241a and 242a are in contact with cams 245 and 246 respectively fixed to cam shaft 42. When the rise portion of each cam engages its cooperating cam follower, arms 241 and 242 are caused to pivot about their centers and drive blade 228 down for the cutting operation. Coil springs 247 and 248 are wound around guide bars 239 and 240 respectively and press against sliding bearings 233 and 234 to return blade 248 to a normal position after the cutting operation has taken place and the cam followers have fallen off the rise portion of cams 245 and 246. Cams 245 and 246 are shaped so that the cutting operation occurs once every machine cycle.

The selector pins and storage mechanism

Immediately following the cutoff blades on the front of the web line are three mechanical brush pins 249, 250 and 251 (Figs. 4 and 10) which press against the web 180 held down by a plate 252 having three holes in line with pins 249, 250 and 251. These pins are parallel

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with cutoff blades 228 and 229 and engage web 180 while a bill length is being cut off by said cutoff blades. They retract when the bill moves forward but project up against the next bill and as the ¼-inch hole which was punched when web 180 passed through the alphabetical tabulator, is sensed, the corresponding pin projects through it, while the other two are restrained. This pin which passes through the punched hole sets up storing and selecting mechanism for the first print cylinder 31.

Sub-frame 253 extends through frame section 1 supporting within it telescoping tubular shafts 254, 255 and 256 each of which have a supporting arm fastened thereto for holding pins 249, 250 and 251 respectively. Also rigidly secured to each shaft on the outside of frame section 1 is a latch arm 257, 258 and 259 as shown in Fig. 11 urged by springs 275, 276 and 277 to rotate their respective shafts in a clockwise direction, thereby enabling pins 249, 250 and 251 to press on web 180. Springs 275, 276 and 277 are secured to the upper portions of three levers 260, 261 and 262 respectively which are pivotally mounted on a stud 263 projecting from frame section 1 and urged in a clockwise direction as viewed in Fig. 2 about stud 263 as a pivot by springs 264, 265 and 266. The latch arms 257, 258 and 259 are in line with latch points on levers 260, 261 and 262.

Referring again to Figs. 10 and 11, a storage device 267 containing three detent type pins 268, 269 and 270 is mounted on constantly revolving gear 124 which rotates once every machine cycle. Storage device 267 contains a spring pressure ball for each pin which fits into grooves in said pins to hold them in the required position.

A cam 271 (Fig. 13) is also fixed to stud 200. As pins 268, 269 and 270 rotate on gear 124, cam 271 pushes them to a projecting position. As the pins approach levers 260, 261 and 262, the levers are lifted by a bail 272 pivoted on stud 263 (Fig. 10) and operated by a cam arm 273 secured to gear 124. The brush pin which projects through the prior punched hole in web 180 has its latch arm in position to catch and hold up the corresponding lever. For example, in Fig. 10 brush pin 249 has sensed a hole in web 180 and projected through it by pressure of spring 275 and shaft 254 has been rotated clockwise as viewed in Fig. 11 placing latch arm 257 in position to latch lever 260. When lever bail 272 lowers, the lever springs displace the two levers that are not latched in a clockwise direction about stud 263. The two unlatched levers press two of the aforementioned detent pins into their retracted position, leaving the one in line with the latched up lever projecting. This pin remains out while gear 124 revolves one half revolution where it trips a small latch dog in line with it to operate the selective clutch mechanism. Latch arm restoring bail 278 is pivoted on stud 279 projecting from frame section 1 and operated by a cam 274 fixed to the face of gear 124.

A bracket 283 fastened to frame section 1 carries three small latch dogs 284, 285 and 286, Fig. 13, positioned in an upper comb portion and pivoted on common pin 287. These latch dogs are spring urged in a clockwise direction about pin 287 as viewed in Fig. 11 and their lower ends engage latch points on corresponding cam arms 280, 281 and 282. The cam arms are urged in a counterclockwise direction about a stud 288 by springs 289, 290 and 291 which are fastened to the lower portion of bracket 283. When a latch dog is tripped by one of the aforementioned detent type pins 268, 269 and 270, the corresponding cam arm is moved into the path of the engagement roller 126 of the corresponding clutch dog 125 causing the selective clutch mechanism to drive the print feeding devices as previously set forth. Also pivotally mounted on stud 288 (Figs. 2 and 9) is a cam arm restoring bail 292 having a cam follower 293 freely mounted on one end which is held in engagement with cam 123 by means of spring 294. When the high point of cam 123 contacts follower 293, bail 292 rocks in a

clockwise direction about stud 288 to move any displaced cam arm back to a latched position with its corresponding latch dog.

The second set of feed rollers

Directly following brush pins 249, 250 and 251 are located feed rollers 295 and 296 which hold the leading portion of web 180 while a bill length is being cut off by blades 228 and 229 and at the same time scanned by the brush pins 249, 250 and 251. The lower feed rollers 295 (Figs. 4 and 5) are attached to the shaft 113 provided with fixed bearings in both front and rear frames and having gear connections with the driving motor as revealed in Fig. 4. The upper rollers 296 are fastened to rod 114 which is rotatably mounted on support arms 297 and 298. Rod 114 carries gear 112 which is in mesh with gear 111 attached to shaft 113 so that the rollers are intermittently operated as previously explained. The support arms in turn are secured to a shaft 299 having fixed bearings in both front and rear frame sections 1 and 3. Springs 376 and 377 fastened to arms 297 and 298 respectively and anchored to the adjacent frame section constantly urge rollers 296 toward engagement with rollers 295. Rod 114 carrying the upper feed rollers is arranged to be moved as part of a bail suspending the upper rollers above the lower fixed rollers.

The bail comprises support arms 297 and 298 and is operated through linkage by cams 378 and 379 (Fig. 4) secured to main cam shaft 42 inside front and rear frame sections 1 and 3. Rocker arm 380 (Fig. 5) is pivotally mounted near frame section 3 on rod 381. One end of arm 380 carries a cam follower 382 and the opposite end is pivoted to a link 383 (Fig. 5) which in turn is pivoted to an operating arm 384 fixed to shaft 299. Cam follower 382 is maintained in constant engagement with cam 378 through tension of spring 376. The structure linking cam 379 to shaft 299 is similar to that linking cam 378 to shaft 299 and is located to the front of the machine near frame section 1 (Fig. 4). Rocker arm 385 having a cam follower 386 is pivoted on rod 381 and pivotally connected to a link 387 which in turn is pivoted to an operating arm 388 fixed to shaft 299. Spring 377 maintains cam follower 386 in constant engagement with cam 379.

Referring again to Fig. 5, as web 180 is continued on its path by feed rollers 227 and 211, rollers 295 and 296 are opened to allow the leading edge of the web to interpose itself between them. This is brought about by cams 378 and 379 which are so proportioned that at the beginning of each machine cycle a rise on each cam pushes against the cooperating rocker arm to move it clockwise about rod 381. The displaced rocker arms 380 and 385 pull links 383 and 387 respectively downward and to the left causing operating arms 384 and 388 to move in a clockwise direction and separate rollers 295 and 296 by lifting the entire roller holding unit comprising rod 114 and rollers 296. When the proper length of web 180 has interposed itself between the rollers 295 and 296 as has been predetermined by the choice of one of several combinations of gears 59 and 60, cams 378 and 379 present abrupt depressions which allow rocker arms 380 and 385 to rock counterclockwise under tension of springs 376 and 377 respectively and lower feed rollers 296 into contact with the web 180 to press it against the lower feed rollers 295, thereby gripping it between them while a bill length is being cut off by blades 228 and 229. After the cutting operation has taken place, rollers 295 and 296 carry the cut bill sheet onto a constantly revolving belt conveyor with a harmonic acceleration.

The belt conveyor

The belt conveyor comprises five individual endless belts 300 having flat surfaces on top and bottom and a rubber bonded fabric composition as shown in Figs. 4 and 5. Stationary shaft 301 is rigidly fixed in front and

rear frame sections 1 and 3 and projects through section 3. Five pulleys 302 are pivotally mounted on a rod 636, there being one pulley for each conveyor belt 300. The forward ends of belts 300 pass around their corresponding pulleys 302 and extend back over constantly rotating conveyor shaft 166 as revealed in Fig. 5. Arms 640 and 641 are pivotally mounted on shaft 301 and support rod 636 between them. A spring 303 is secured to the lower portion of arms 640 and 641 to urge pulleys 302 in a counterclockwise direction, as viewed in Fig. 1, causing each belt 300 to be maintained in a taut condition. A shaft 304 is mounted for rotation in fixed bearings in frame sections 1 and 3 and projects through section 3. Loosely mounted on shaft 304 are five grooved rollers 306. Each roller receives a corresponding belt 300 in its grooved portion for guiding while the belt is in motion.

Belts 300 are constantly running during machine operation. When a bill sheet is fed by rollers 295 and 296 onto the belt conveyor, it is advanced until it is halted by the sheet stops 311 which obstruct its path of travel. The bill sheet remains against the sheet stop until the stop is lowered as is explained hereinafter.

Sheet stop and backprint feed rollers

The mechanism for stopping a sheet comprises a plurality of sheet stops 311 and a pair of support levers 312 and 313 pivotally mounted on stationary shaft 301 (Figs. 1, 4, 5) and a pair of operating levers 321 and 322 secured to shaft 316 which is mounted for rotation in fixed bearings in both front and rear frame sections 1 and 3. The stop members 311 are connected to support members 630 and 631 extending between the support levers and operating levers respectively. Rigidly fixed to shaft 316 is an arm 314 having a cam follower 315 located on the free end. A spring 318 attached to arm 314 urges the arm in a counterclockwise direction as viewed in Fig. 5 about shaft 316 with cam follower 315 in constant cooperation with a cam 317 fixed on secondary cam shaft 21. The rise of cam 317 pushes arm 314 upward to rock shaft 316 in a clockwise direction and lift stop members 311 into the path of the advancing sheet. The operation of stops 311 is synchronized with the operation for closing cooperating sets of feed rollers 308 and 309 (Fig. 5) because normally when the stops are in effect, the rollers are ineffective, and conversely, when the rollers are made effective, the stops are to be withdrawn as explained hereinafter in connection with the machine timing diagrammatically shown in Figs. 26a, b, c and d.

Referring again to Figs. 4 and 5, feed roller shaft 171 is mounted for rotation in fixed bearings in front and rear frame sections 1 and 3 and is intermittently driven through the selective clutch mechanism as previously explained. A plurality of rollers 309 are fastened to shaft 171. Shaft 304 carries a plurality of bracket devices 307, each having a roller 308 loosely mounted on one end. The opposite end of each bracket has a spring 310 fastened thereto which urges the bracket in a clockwise direction about shaft 304 as viewed in Fig. 5 to bring each roller 308 into close proximity with a cooperating roller 309 on shaft 171.

Fixed to the projecting portion of shaft 304 is an operating arm 305 (Fig. 3) having an offset lug 328 secured to its free end. A cam arm 325 is pivotally mounted on shaft 301 outside frame section 3 and carries a cam follower 326 on its lower end which cooperates with a cam 327 secured to secondary cam shaft 21 outside frame section 3. Lug 328 is maintained in contact with a camming surface on the upper end of arm 325 through tension of bracket springs 310. Cam 327 is proportioned so that it normally rocks arm 325 in a counterclockwise direction as viewed in Fig. 3 to depress operating arm 305 and open rollers 308 and 309.

At the selected time which for each bill sheet has been predetermined by the selector brush pins 249, 250 and

251, the rise on cam 327 moves away from follower 326 and allows closure of the rollers for sheet feeding by springs 310. At the same time that the rollers 308 and 309 are brought together on a bill sheet, an abrupt depression on cam 317 (Fig. 5) allows spring 318 to rock the shaft 316 in a counterclockwise direction to lower sheet stop 311 out of the path of the bill sheet which is now ready to be directed forward by rollers 308 and 309. The bill is fed next between auxiliary feed rollers 319 and 390 with harmonic acceleration.

The auxiliary backprint feed rollers

After the bill sheet passes stop 311, it is drawn between auxiliary feed rollers 319 and 390 (Figs. 4 and 5) which are mounted to shafts 175 and 177 respectively. The shafts are driven by the selective clutch mechanism as shown in Fig. 2 and rotate intermittently during machine operation as previously explained. Shaft 177 is not mounted in fixed bearings in the front and rear frame sections 1 and 3 as is shaft 175. Instead, it is loosely supported at both ends by arms 320 and 321 each of which is pivotally mounted on a fixed rod 41. Springs 322 and 323 (Figs. 2 and 5) are attached to arms 320 and 321 respectively and anchored to the adjacent side frame section pulling shaft 177 in a counterclockwise direction as viewed in Fig. 5 about rod 41 to press rollers 390 down upon rollers 319.

Fixed to the projecting portion of rod 41 is an operating arm 619 (Fig. 3) having an offset lug 620 secured to its free end. A cam arm 621 is pivotally mounted on shaft 301 outside frame section 3 and carries a cam follower 622 on its lower end which cooperates with a cam 623 fastened to secondary cam shaft 21 outside frame section 3. Lug 620 is maintained in contact with a camming surface on the upper end of arm 619 through tension of springs 322 and 323. Cam 623 is proportioned so that it normally rocks arm 621 in a clockwise direction as viewed in Fig. 3 to depress arm 621 and open rollers 390 and 319. When sheet stop 311 is lowered to allow a bill sheet to advance, the rise on cam 623 moves away from follower 622 and allows closure of the rollers by springs 322 and 323. The bill sheets are moved by the rollers 319 and 390 into printing position with the selected peripheral portion of cylinder 31.

The backprint station

Backprint cylinder or drum 31 has three print plates 324a, 324b and 324c secured to the periphery thereof which occupy three quarters of the cylinder surface. The fourth quarter is left blank to allow time to advance the bill sheet and actuate the ink roll 34 when the first selection is made in a cycle. Each of the plates 324a, 324b and 324c corresponds to one of the three holes that may be punched in the bill to indicate which backprint is to be printed on that respective bill. The three clutch dogs 125 placed 90° apart on the selective clutch gear 120 correspond to the three print plates placed 90° apart on backprint cylinder 31 and serve to synchronize the time of operation of a secondary or backprint cycle. This secondary cycle comprises the steps for inking the selected print plate when the bill is carried to printing position and is driven by the secondary cam shaft 21 at a time so that the advancing bill will coincide with one of the print plates 324 of print cylinder 31.

Backprint cylinder 31 is keyed to shaft 30 and for purposes of this invention is composed of cast iron or a material with similar properties as illustrated in Fig. 5. Print plates 324a, 324b and 324c consist of a rubber print face mounted on a thin brass backing. The length of each plate is approximately 5¼" and the width may vary up to the width of the print cylinder 31. The top and bottom edge of each plate is scalloped and perforated with a plurality of holes approximately ⅝ of an

inch in diameter and spaced about ¾ of an inch apart. The holes and scallops of the top edge are staggered between the holes and scallops of the bottom edge so that two plates may be placed edge to edge on the cylinder surface with a minimum of interference and clamping space. The means for clamping each print plate to the cylinder surface are identical.

The perforations in the top edges of the three print plates are penetrated by stationary pins 361 (Fig. 5) which hold the edges to the periphery of cylinder 31, while the perforations in the bottom edges are made secure by adjustable hooks 362 which extend through each perforation and exert stretching pressure on plates 324a, 324b and 324c. The provision of adjustable hooks as a securing means facilitates placing and removing the print plates. For each print plate a row of hooks 362 are spaced across the cylinder, and pivot about a shaft 363 which extends the length of cylinder 31 in a depressed portion of its surface. Pivotaly connected to the base of each hook 362 is a pull rod 364 riding in a slotted portion of cylinder 31 and extending radially of shaft 30. A coil spring 365 is interposed between the free end of each rod 364 and the end of the slotted portion, urging each rod radially outward and maintaining hook 362 in a retracted position. Also, extending the length of cylinder 31 in a hollowed out portion is a square rod 367 for each print plate which is rotatably mounted in fixed bearings in end plates 368 and 369 as revealed in Fig. 17. Fastened on one end to rod 367 is a series of circular springs 370 each having an extension 370a which engages one side of a depression in each pull rod 364. Rod 367 is keyed to a segment 371 on the outside of end plate 369 (Fig. 17). A hole 372 is provided in plate 369 adjacent to segment 371 for receiving an insertable key which meshes with the teeth of segment 371 to rotate it in a counterclockwise direction. At the same time rod 367 moves with segment 371 causing springs 370 to move pull rods 364 in toward the center of the cylinder 31 and springs 365 to be depressed. When the segment is thus tightened, a latch dog 544 pivoted at 373 falls into place by force of a spring 374 to hold the segment in the displaced position. The inward movement of each rod 364 causes each hook 362 to pivot in a counterclockwise direction, as viewed in Fig. 5, about shaft 363 and engage the side of the corresponding perforation on the bottom edge of the print plate 324 to secure the plate to the periphery of cylinder 31.

The first step in mounting a print plate 324 on backprint cylinder 31 comprises slipping the perforations on the bottom edge over the adjustable hooks 362 and then inserting and tightening the stationary pins 361 in the perforations of the top edge. Next the segment 371 is tightened causing hooks 362 to engage the sides of the perforations and exert stretching pressure on the print plate. To release the bottom edge of the print plate, the latch dog 544 is drawn out of engagement with its segment 371 permitting springs 365 to push out the pull rod 364 and effect a clockwise movement of each hook 362 about shaft 363 thereby causing the hooks to relax their pressure on the sides of the perforations. This arrangement of parts permits rapid removal of any of the three print plates 324 and provides means for holding the plates tightly stretched around the periphery of cylinder 31.

Print cylinder shaft 30 is seated in guide blocks 337 and 338 which are fitted for vertical movement in housings 339 and 340 respectively as previously explained and shown in Figs. 2 and 3. Extending downward from each guide block are two push rods. Rods 341 and 342 extend from block 337 and rods 343 and 344 extend from block 338. Each pair of push rods has a base member and a brace which extend between the paired rods. Push rods 341 and 342 are secured in base member 345 and rods 343 and 344 are fixed to base member 346. Braces 349 and 350 maintain the proper distance between the

paired rods. Secondary cam-shaft 21 carries a cam 351 secured outside frame section 3 and a cam 352 fastened outside frame section 1. Referring to Figs. 2 and 15, lift arm 150 is pivotally mounted on stud 140 and carries a cam follower 151 at one end which constantly engages cam 352. Running through the opposite end of arm 150 is a screw 348 which is seated in base member 345. Arm 150 is held firmly on screw 348 by lock nut 354. When follower 151 is riding on the high point of cam 352 block 338 is at the upper limit of vertical travel in housing 340 and print cylinder 31 is kept out of contact with platen 24. When follower 151 moves to the low point of cam 352 arm 150 rocks counterclockwise about stud 140 causing rods 343 and 344 to pull guide block 338 downward, thereby moving print cylinder 31 into contact with platen 24 aided by the pressure of a spring 355 encircling a stud 357 in a recessed portion of a cap 340a of housing 340. Stud 357 serves as a positioner for spring 355 and a stop to limit the downward vertical travel of block 338. The selected plate prints the back face on the cut bill while cylinder 31 is in the lowered position. A lift arm 358 similar to arm 150 and functioning in the same manner supports the push rod structure on the opposite side of the machine as viewed in Fig. 3. Arm 358 is pivotally mounted on a stud 143 and carries a cam follower 359 at one end which constantly engages cam 351. Screw 347 secures the opposite end of arm 358 to base 345 while lock nut 353 holds arm 358 firmly on screw 347. Spring 597 encircles a stud 356 disposed in a recessed portion of a cap 339a of housing 339 and serves to urge block 337 downward to a printing position when follower 359 encounters the low point of cam 351.

Print plate inking mechanism

Mechanism is also provided at the back-printing station for inking the print plate 324a, 324b or 324c which has been selected to print on the back of the advancing bill sheet. Referring again to Fig. 3, ink roll frame shaft 37 has fixed thereto an operating arm 329 which is operable through linkage by a cam 335 fixed to secondary cam shaft 21 on the outside of frame section 3. A reach rod 330 is pivotally connected to operating arm 329 at 331 and a cam engaging member 332 is pivotally connected at 333 to the lower end of said rod. Member 332 is freely mounted on shaft 316 and has a cam follower which is maintained in constant engagement with cam 335 by tension of spring 336 fastened to sub-frame 38. Cam 335 is so proportioned that sub-frame 38 is normally rocked in a counterclockwise direction as viewed in Fig. 3 and ink roll 34 is held at a distance from print cylinder 31 and out of engagement with any print plate. Secondary cam shaft 21 is operated in conjunction with the selective clutch mechanism, as previously explained, and when cam follower 334 reaches the low point on the surface of cam 335, member 332 is rocked clockwise and allows a rod 330 to move downward which in turn moves operating arm 329 and shaft 37 in a clockwise direction. Sub-frame 38 moves with shaft 37 and brings ink roll 34 into contact with the selected print plate 324a, 324b or 324c thereby transferring ink from roll 34 to the selected print plate. Sub-frame 38 is adjusted for spaced relationship with print cylinder 31 by means of a screw 612 situated at the top of sub-frame 38.

An ink pot 613 is pivotally mounted to lugs on frame sections 1 and 3 at 614 and 615 respectively (Figs. 2 and 3). Inking transfer rolls 616, 617 and 618 are mounted for rotation within ink pot 613. Rolls 616 and 617 are positioned to engage ink roll 34 when the ink pot 613 is placed in an operating position as shown in Figs. 2 and 3. Rolls 616 and 617 are driven by friction through engagement with the constantly rotating ink roll 34. Roll 618 is in turn driven by friction through engagement with rolls 616 and 617. It is readily seen that rolls 616 and 617 can be moved to and from engagement with ink roll 34 by rotating ink pot 613 about pivot points

614 and 615. The inking material is placed in the ink pot 613 and is moved by rolls 618, 617 and 616 onto the surface of ink roll 34. This ink pot device is the conventional kind which is in general use on printing machines.

In summary, the bill sheet holes are scanned by the pins 249, 250 and 251 and their selection is stored in the storage device 267 mounted to gear 124. The storage device effects tripping of one of the three clutch dogs 125 in the selective clutch mechanism to activate a train of gears which operates all functions that will properly print the desired one of the three backprint cylinder print plate faces on the bill sheet. When the bill sheet is gripped by the feed rollers 308 and 309, bill sheet stop 311 is lowered permitting the bill sheet to advance. The ink roll 34 is allowed to come in contact with the selected print plate 324a, 324b or 324c and the backprint cylinder 31 and platen 24 come together as the selected print face moves into printing position with respect to the advancing bill sheet which is being fed simultaneously from the auxiliary feed rollers 319 and 390.

If the backprint mechanism is to be used as an individual unit, after a bill sheet passes under the print cylinder 31 it is fed directly into a stacking pocket of a stacker (not shown). However, if it is desired to print material on both the back and front sides of the bill sheet, the stacking pocket is removed and a belt conveyor and sheet stop are added.

Drive connections for the second sheet stop and belt conveyor

In Fig. 3 platen gear 23 is driven from the main drive shaft 9 as previously explained. In mesh with gear 23 is an idler gear 361 which turns freely on a stud 362 projecting from frame section 3. A gear 363 is fastened to idler 361 and is rotated in a counterclockwise direction with the idler. A conveyor shaft 364 is mounted for rotation in frame sections 1 and 3. A gear 365 is secured to conveyor shaft 364 outside frame section 3 and is engaged by gear 363 which rotates it in a clockwise direction, as viewed in Fig. 3, thereby driving conveyor shaft 364 at a constant speed.

Another secondary camshaft 366 (Figs. 1 and 22) is journaled in frame sections 1 and 3 and projects through section 3. This camshaft controls the operation of the second sheet stop and a set of feed rollers for feeding the advancing bill sheet to a turnover device described hereinafter. A gear 367 is secured to the projecting portion of camshaft 366. Idler gear 361 also meshes with gear 367 to drive camshaft 366 in a counterclockwise direction as viewed in Fig. 1. A feed roller shaft 368 is mounted for rotation in frame sections 1 and 3 and has a gear 369 secured thereto outside frame section 3. Gears 371 and 372 (Fig. 22) are fastened together and freely mounted on a stud 370 projecting from frame section 3. A train of rack-driven gearing extends across the outside of rear frame section 4 of the faceprint unit to reach gear 371. Gear 372 meshes with gear 369 to intermittently drive feed roller shaft 368 in a clockwise direction, as viewed in Fig. 1, and hereinafter explained in connection with the driving mechanism for the faceprint unit.

The second belt conveyor

The second belt conveyor is similar in construction to the belt conveyor for advancing a bill sheet to the back-printing station, which has already been described in detail. A stationary shaft 375 is rigidly fixed in front and rear frame sections 1 and 3 and projects through section 3 (Figs. 1 and 22). Five tension pulleys 376 are pivotally mounted on a rod 637. An endless belt 377 is passed around a pulley 376 and extends back over constantly rotating conveyor shaft 364, as revealed in Fig. 1. Arms 638 and 639 are pivotally mounted on shaft 375 and support rod 637 between them. A spring 378 is secured

to the lower portion of arms 638 and 639 to urge pulleys 376 in a counterclockwise direction, as viewed in Fig. 1, causing each belt 377 to be maintained in a taut condition. A shaft 379 is mounted for rotation in fixed bearings in frame sections 1 and 3 and projects through section 3. Loosely mounted on shaft 379 are five grooved rollers 380. Each roller 380 receives a corresponding belt 377 in its grooved portion for guiding while the belt is in motion. A feed roll 392 (Fig. 1) is journaled in frame sections 1 and 3 and turns clockwise through frictional engagement with conveyor belts 377. The bill sheets discharged from the backprinting station are thus held on the conveyor belts.

Belts 377 are constantly running during machine operation. When a bill sheet is discharged from the backprinting station onto the belt conveyor, it is advanced until it is halted by sheet stops 381 which obstruct its path of travel. The bill sheet remains against the sheet stops until the stops are lowered, as is explained hereinafter.

Second sheet stop and turnover device entrance rollers

The mechanism for stopping a sheet comprises a plurality of sheet stops 381 and a pair of support levers 382 and 383 pivotally mounted on stationary shaft 375 (Figs. 1 and 22) and a pair of operating levers 384 and 385 secured to a shaft 386 which is mounted for rotation in fixed bearings in both front and rear frame sections 1 and 3. The stop members 381 are connected to support members 632 and 633 extending between the support levers and operating levers respectively. Rigidly fixed to shaft 386 is an arm 387 having a cam follower 388 located at the free end. A spring 389 attached to arm 387 urges the arm in a counterclockwise direction as viewed in Fig. 1 about shaft 386 with cam follower 388 in constant cooperation with a cam 390 fixed on secondary camshaft 366. The rise of cam 390 pushes arm 387 downward to rock shaft 386 in a clockwise direction and lift stop member 391 into the path of the advancing sheet. The operation of stops 381 is synchronized with the operation for closing cooperating sets of feed rollers 394 and 397 (Fig. 22) because normally when the stop is in effect, the rollers are ineffective, and conversely, when the rollers are made effective, the stops are to be withdrawn as explained hereinafter.

Referring again to Figs. 1 and 22, feed roller shaft 368 is mounted for rotation in fixed bearings in front and rear frame sections 1 and 3 and is driven through a train of gearing from the faceprint unit as explained hereinafter. A plurality of rollers 394 are fastened to shaft 368. Shaft 379 carries a plurality of bracket devices 396 each having a roller 397 loosely mounted on one end. The opposite end of each bracket has a spring 398 fastened thereto which urges the bracket in a clockwise direction about shaft 379, as viewed in Fig. 1, to bring each roller 397 into close proximity with the cooperating roller 394 on shaft 368. Rollers 394 and 397 are the entrance rollers for the turnover device.

Fixed to the projecting portion of shaft 379 is an operating arm 399 (Fig. 22) having an offset lug 400 secured to its free end. A cam arm 401 is pivotally mounted on a stud 635 extending from frame section 3 and carries a cam follower 402 on its lower end which cooperates with a cam 403 secured to secondary camshaft 366 outside frame section 3. Lug 400 is maintained in contact with a camming surface on the upper end of arm 401 through tension of bracket springs 398. Cam 403 is proportioned so that it normally urges the lower end of cam arm 401 upward, as viewed in Fig. 22, to depress operating arm 399 and open rollers 394 and 397.

At the end of each backprint cycle of operation the rise on cam 403 moves away from follower 402 and allows closure of the rollers for sheet feeding by springs 398. At the same time that rollers 394 and 397 are brought together on a bill sheet, an abrupt depression in

cam 403 allows spring 389 to rock the shaft 386 in a counterclockwise direction to lower sheet stop 381 out of the path of the bill sheet which is now ready to be directed forward by rollers 394 and 397. This sheet stop restores the intermittently advancing bills to a uniform place in the cycle. The bill sheet is fed into a turnover device with harmonic acceleration where the bill sheet is inverted and positioned for the faceprinting operation.

Turnover device

The faceprint unit is mainly constructed between frame sections 2 and 4. A turnover device is provided between frame sections 2 and 4 for receiving a bill sheet from the second belt conveyor after it has been backprinted. The bill sheet is inverted in the turnover device and directed toward a printing station for faceprinting.

Referring to Figs. 18, 19 and 20, the turnover device 409 comprises a frame assembly including front and rear frames 410 and 411 respectively. Spacing rods 412 are secured between the frames 410 and 411, thereby maintaining a constant distance between them. Frames 410 and 411 are fastened on stub shafts 413 and 414 respectively. Shafts 413 and 414 are in turn rotatably mounted in frames 2 and 4 respectively, shaft 413 projecting through frame 2 to engage with driving means for bill sheet advancing mechanism in the turnover device. There are three sets of feed roller shafts for advancing a bill sheet through the turnover device, the feed roller shafts being designated 415, 416, 417, 418, 419 and 420 and mounted for rotation in frames 410 and 411. A plurality of rollers 421 are fastened to each feed roller shaft for gripping the advancing bill sheet.

Driving mechanism for the turnover device

A train of gearing extends across the outside of the rear frame section 4 to reach the drive connections for the turnover device as shown in Fig. 20. The faceprint unit is provided with a shaft 9a which is adapted to be connected with drive shaft 9 of the backprint unit through a coupling 408 (Fig. 1). Attached to shaft 9a is a right angle worm gear 422 in mesh with a worm wheel 423 fastened to shaft 424 which rides in frame sections 2 and 4. A spur gear 425 is fixed to a portion of shaft 424 projecting through frame section 4. A constantly driven cam shaft 428 (Fig. 20) rides in and extends through frame sections 2 and 4. The camshaft 428 carries a spur gear 429 and cams 430, 431, 432, 433 and 434 on the outside of frame section 4. Idler gears 435 and 436 are rotatably mounted on stub shafts 437 and 438 respectively. Spur gear 425 meshes with idler gear 435 which in turn is meshed with idler 436. Spur gear 429 is engaged by idler gear 436 to drive camshaft 428 in a counterclockwise direction as viewed in Fig. 20.

A stud 439 projecting from frame section 2 carries a sector rack 440 pivoted thereon as shown in Fig. 21. Rack 440 is spring biased toward a cam 443, fixed to shaft 428, outside frame section 2, and engages said cam through a cam follower 444. The teeth of rack 440 engage a gear 445 (Fig. 19) pivotally mounted on a stud 446 extending from frame section 2. Gear 445 is driven in a clockwise direction as viewed in Fig. 21 when rack 440 is displaced counterclockwise about stud 439 by cam 443 as it rotates through 180°. As cam 443 moves through the following 180° to complete a machine cycle, spring 447 urges rack 440 to its restored position, thereby causing gear 445 to rotate counterclockwise about stud 446.

Ratchet wheel 448, brake disk 449 and gear 450 are fastened together and rotate freely as a unit on stud 446 (Fig. 19). Secured to the face of gear 445 is an arm 451 which carries a dog 452. Spring plunger 453 keeps dog 452 in engagement with ratchet wheel 448. When gear 445 is rotated by rack 440, the dog 452 moves with it and engages the first ratchet tooth encountered on

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wheel 448 causing said wheel and the attached mechanisms 449 and 450 to be moved clockwise as viewed in Fig. 21. During the restoring operation of rack 440, gear 445 is turned counterclockwise carrying dog 452 with it. It is thus seen that gear 450 is intermittently driven each machine cycle. The teeth of ratchet wheel 448 are so shaped as to enable dog 452 to slip over them without effecting engagement. In order to prevent over travel of the turnover device 409 and ratchet wheel 448 from rotating counterclockwise with gear 445 by force of friction between dog 452 and the ratchet teeth of wheel 448 during the restoring operation of rack 440, a braking device is provided.

The braking device is comprised of a block 454 having an extension rod 455, plate 456, locking screw 457 seated in block 454 and brake shoe 458 as shown in Fig. 21. The parts are pivoted on a stud 459 projecting from frame section 2 and assembled in the same manner as previously described for the braking mechanism of brake disk 61 mounted on frame section 3. A cam 460 is fixed to shaft 428 outside frame section 2 and has two rise portions thereon designated 460a and 460b. The timing of cam 460 is such that toward the end of rotation of gear 443 by rack 440, rise portion 460a engages rod 455 causing a displacement of block 454 about stud 459 to effect an engagement between shoe 458 and disk 449. The braking device prevents over travel of the turnover device 409 in this manner and rod 455 drops off rise 460a when the turnover is completed. As the restoring movement of rack 440 commences, the rise 460b of cam 460 engages rod 455 causing brake shoe 458 to again engage disk 449. The braking device holds turnover device 409 in position during the time that sector rack 440 is restoring.

Gear 450 is in mesh with a gear 461 (Fig. 19) which is fastened to stub shaft 413 on the outside of frame section 2. It is thus seen that rotation of gear 450 causes rotation of the turnover mechanism through gear 461. The turnover mechanism is rotated one half revolution per machine cycle.

Driving mechanism for feed rollers of turnover device

A stud 462 projecting from frame section 4 carries a sector rack 463 pivoted thereon as shown in Figs. 19 and 20. Rack 463 is spring biased toward cam 432, fixed to shaft 428, and engages said cam through cam follower 464. The teeth of rack 463 engage a gear 465 pivotally mounted on a stud 466 extending from frame section 4. Gear 465 is driven in a counterclockwise direction as viewed in Fig. 20 when rack 463 is displaced clockwise about stud 462 by cam 432 as it rotates through 180°. As cam 432 moves through the following 180° to complete a machine cycle, spring 467 urges rack 463 to its restored position, thereby causing gear 465 to rotate clockwise about stud 466.

Ratchet wheel 468, brake disk 469, and gear 470 are fastened together and rotate freely as a unit on stud 466 (Fig. 19). Secured to the face of gear 465 is an arm 471 which carries a dog 472. Spring plunger 473 keeps dog 472 in engagement with ratchet wheel 468. When gear 465 is rotated by rack 463, the dog 472 moves with it and engages the first ratchet tooth encountered on wheel 468 causing the ratchet wheel and the attached mechanisms 469 and 470 to be moved counterclockwise as viewed in Fig. 20. During the restoring operation of the rack 463, gear 465 is turned clockwise carrying dog 472 with it. The teeth of ratchet wheel 468 are so shaped as to enable dog 472 to slip over them without effecting engagement. In order to prevent over rotation of gear 470 and ratchet wheel 468 from rotating clockwise with gear 465 by force of friction between dog 472 and the ratchet teeth of wheel 468 during the restoring operation of rack 463, a braking device is provided. Gears 404 and 405 are fastened together (Fig. 23) and mounted for rotation on a stud 406 projecting from

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frame section 4. Gear 470 meshes with gear 404 moving it and gear 405 in a clockwise direction as viewed in Fig. 20. Gear 405 in turn engages sliding key 480 to drive the turnover feed rolls as explained hereinafter.

The braking device is comprised of block 474 having an extension rod 475, plate 476, locking screw 477 seated in block 474 and brake shoe 478 as shown in Fig. 20. These parts are pivoted on a stud 479 projecting from frame section 4 and assembled in the same manner as previously described for the braking mechanism of brake disk 61 mounted on frame section 3. Cam 431 has two rise portions thereon designated 431a and 431b. The timing of cam 431 is such that toward the end of rotation of gear 470 by rack 463, rise portion 431a engages rod 475 to effect an engagement between shoe 478 and disk 469. The braking device prevents over rotation of gear 470 in this manner and rod 475 drops off rise 431a after rack 463 has been fully displaced in a clockwise direction as viewed in Fig. 20. As the restoring movement of rack 463 commences, the rise 431b of cam 431 engages rod 475 causing brake shoe 478 to again engage disk 469. The braking device holds the sliding key 480 stationary during the time that sector rack 463 is restoring.

Referring to Figs. 22 and 23, a sliding key 480 is mounted for reciprocation in and moves through an opening in frame section 4. A bracket member 481 is secured outside frame section 4 and has an extension 481a with a cutout portion to receive the end of the sliding key 480 which extends outwardly from frame section 4. A section of key 480 of reduced diameter rests in the forked end of an L-shaped link 482. The central portion of link 482 is pivotally mounted on a flange 481b of bracket 481. An operating arm 484 is pivotally connected to link 483 and reaches down to pivotally engage a cam arm 485. In addition to sector rack 463, stud 462 carries cam arm 485 pivoted thereon (Fig. 20). Cam arm 485 is biased toward cam 434, fixed to shaft 428, and engages said cam through cam follower 486. Cam 434 is so shaped that operating arm 484 and the connecting links 482 and 483 are activated once each machine cycle to cause sliding key 480 to move to the left (Figs. 22 and 23) once each machine cycle.

Sliding key 480 has teeth on its outside diameter that are engaged by the teeth of gear 405 and is driven thereby in a counterclockwise direction as viewed in Fig. 20. A projecting portion 480b of key 480 is adapted to engage a slot in a gear 487 which is fastened to feed roller shaft 419, inside a hollow portion of turnover rear frame 411, whereby gear 487 turns feed roller shaft 419 in a counterclockwise direction. A gear 488 is secured to feed roller shaft 420 and is in mesh with gear 487 to drive shaft 420 in a clockwise direction. Feed roller shafts 417 and 418 have gears 489 and 490 respectively secured to them inside the hollow portion of frame 411 (Fig. 19). Idler gears 491 and 492 are also mounted for rotation in frame 411. Gear 488 engages idler 491 which in turn is in mesh with gear 490 to drive shaft 418 in a clockwise direction as viewed in Fig. 20. Gear 490 is in constant engagement with gear 489 which turns shaft 417 in a counterclockwise direction. Gear 489 engages idler 492 which in turn is in mesh with a gear 493 fixed to shaft 415 to drive the shaft in a counterclockwise direction. Gear 493 is in constant engagement with gear 494 secured to shaft 416 which is turned in a clockwise direction thereby. It is thus seen that the bill sheet advancing mechanism in the turnover device is intermittently operated from camshaft 428 through the rack and gearing arrangement located outside frame section 4.

Operation of turnover device

The machine timing is such that when sheet stop 381 is lowered and turnover entrance rollers 394 and 397 feed a bill sheet into turnover device 409, sector rack

463 is rotated in a clockwise direction as viewed in Fig. 20 about stud 462 by cam 432. Before rack 463 starts its movement, sliding key 480 is moved to the left by action of cam 434 and into the slot in gear 487. The turnover feed roller shafts 415, 416, 417, 418, 419 and 420 are rotated two revolutions by the action of sector rack 463 and carry the bill sheet on into a central position in the turnover device 409 where they decelerate harmonically to a stop. Pressure between the feed roller shafts is derived from the rubber faces of rollers 421 to push the bill sheet through the turnover device. Since the feed rollers shafts are rotated two complete revolutions, it is readily seen that sliding key 480 engages and disengages gear 487 in exactly the same angular position. With the bill sheet held motionless between the rollers 421, the entire turnover device 409 is rotated one half revolution. This half revolution is harmonically accelerated and decelerated by the sector rack 440 and gearing arrangement located on front frame section 2. Since the turnover feed roller shafts are all the same size and interconnected by a gearing arrangement described above, the gears of the opposite diagonal shafts are provided with slots which start and stop in the same angular relation as explained above. Therefore, upon disengagement of key 480 from gear 487, the turnover device rotates one half revolution and the opposite diagonal gear 494 is in the proper horizontal position to be engaged by the sliding key. Two revolutions of the turnover feed rolls move the bill sheet approximately five and one half inches. One bill is fed out toward the faceprinting station, described hereinafter, while another bill sheet is accepted and fed to a central position between the feed rolls where it remains for the turnover operation.

Print feeding and ink roll drive connections for faceprint unit

Referring to Figs. 20 and 21, a platen 495 is rigidly mounted on a shaft 496 and a faceprint cylinder or drum 497 is similarly mounted on a shaft 498. Shaft 496 is mounted for rotation in frame sections 2 and 4 and has a gear 499 fixed to a portion which extends through frame section 4. Shaft 498 is rotated in guide blocks 500 and 501 which are fitted for vertical movement in housings 502 and 503 respectively. A spur gear 504 is secured to shaft 498 on the outside of frame section 4. Idler gear 435 drives platen gear 499 which in turn meshes with an idler gear 506 pivoted on stud 507 projecting from frame section 4. A floating idler gear 508 is pivoted on floating stub shaft 509 and is maintained in engagement with idler gear 506 and cylinder gear 504 by means of connecting links 510 and 511 each of which is pivoted at one end on stub shaft 509 and on the opposite end to stud 507 and shaft 498 respectively. Idler gear 506 drives print cylinder gear 504 through floating idler 508.

Ink roll 512 (Fig. 24) is driven from the same train of gears that operate print cylinder 497 and platen 495. It is already explained that gear 506 is driven by the speed reduction gearing connected to the motor 7. Ink roll 512 is mounted on shaft 513 which in turn is secured to a subframe 514 pivoted on shaft 515 which rides in a fixed bearing in frame section 4 and in an eccentric bearing in frame section 2, as shown in Fig. 18, to permit adjustment of ink roll 512 for even inking pressure on both ends of print cylinder 497. Shaft 513 extends beyond frame section 4 and has a gear 516 (Fig. 20) fixed to the end thereof. Idler gear 506 meshes with a pinion 517 secured to another gear 518 which is loosely pivoted on a rod 519 fixed in front and rear frame sections 2 and 4 and projecting through frame section 4. Gear 518 meshes with an idler gear 560 which in turn engages gear 516 to drive ink roll 512.

Referring to Figs. 18 and 20, it is seen that a gear 520 is freely mounted on a stud 521 projecting from frame

section 4 and is in mesh with gear 470 which drives gear 520 in a clockwise direction, as viewed in Fig. 20, whenever rack 463 is actuated. Gear 520 in turn engages the teeth of an idler gear 393 rotatably mounted on a stud 407 projecting from frame section 4. When frame sections 2 and 4 of the faceprint unit are connected to frame sections 1 and 3 respectively of the backprint unit, idler 393 meshes with gear 371 which is mounted on frame section 3 of the backprint unit (Fig. 22). Gear 371 and connected gear 372 are driven in a counterclockwise direction as viewed in Fig. 1 and gear 372 in turn drives gear 369 secured to feed roller shaft 368 clockwise, as previously explained.

Platen gear 499 also meshes with an idler gear 522 pivotally mounted on a stud 523 projecting from frame section 4. A gear 524 is fastened to gear 522 and transmits motion to a gear 525 attached to a feed roller shaft 526 rotating in frame sections 2 and 4. Shaft 526 is thereby moved in a clockwise direction as viewed in Fig. 20.

A stud shaft 527 extends through and bears in frame section 4. A gear 528 is fixed to shaft 527 on the outside of frame section 4 and is engaged by gear 518 which turns it counterclockwise as viewed in Fig. 20. Gear 529 is attached to shaft 527 on the inside of frame section 4 (Fig. 18) and meshes with a gear 530 secured to a conveyor shaft 531 to move it in a clockwise direction. Shaft 531 is rotatably mounted in frame sections 2 and 4.

The first set of faceprint feed rollers

Directly following the turnover device are mounted feed roller shaft 526 and pressure roller shaft 533 (Figs. 21 and 24) which receive the bill sheet after the turnover device 409 has turned it over for the faceprinting operation. Feed roller shaft 526 is driven by the gear chain previously described in the print feeding driving mechanism for the faceprint unit. Shafts 526 and 533 have fastened thereto a plurality of cooperating rollers 534 and 535, respectively, which move the bill sheet to the faceprinting position.

Shaft 533 is not mounted in fixed bearings in frame sections 2 and 4 as is shaft 526. Instead, it is loosely supported at both ends by arms 536 and 537 each of which is pivotally connected to a side frame (Fig. 18). Springs 538 and 539 are attached to arms 536 and 537, respectively, and anchored to the adjacent frame section, thereby pulling shaft 533 in a counterclockwise direction as viewed in Fig. 24 to press rollers 535 down upon rollers 534. Rollers 535 are rotated through the force of friction between rollers 534 and 535. It is thus seen that rollers 535 are free to be raised from contact with rollers 534 thereby permitting a bill sheet to be inserted or removed from between them in the event of faulty machine operation. The bill sheet is carried from rollers 534 and 535 into the faceprinting station.

The faceprint station

The faceprint cylinder or drum 497 has only one print plate on its periphery instead of three as shown for the backprint cylinder 31. Faceprint cylinder 497 is keyed to shaft 498 and is composed of cast iron or a material with similar properties as illustrated in Fig. 24. Print plate 541 consists of a rubber print face mounted on a thin brass backing. The single print plate is rapidly removable in the same manner as the backprint plates 324a, 324b and 324c of the backprint cylinder 31 but has portions of its rubber print face stripped from its brass backing. In these stripped portions changeable data and names may be attached. The length of each plate is approximately 5¼" and the width may vary up to the width of the print cylinder 497. The top and bottom edges of the plate are scalloped and perforated with a plurality of holes approximately ⅝ inch in diameter and spaced about ¾ inch apart.

Perforations in the top edge of the plate are penetrated by stationary pins 542 (Fig. 24) which hold the edge to the periphery of cylinder 497, while the perforations in the bottom edge are made secure by adjustable hooks 543 which extend through each perforation and exert stretching pressure on plate 541. The provision of adjustable hooks as securing means facilitates placing and removing the print plate 541. A row of hooks 543 are spaced across the cylinder and pivoted about a shaft 545 which extends the length of cylinder 497 in a depressed portion of the surface. Pivottally connected to the base of each hook 545 is a pull rod 546 riding in a slotted portion of cylinder 497 and extending radially of shaft 498. A coil spring 547 is interposed between the free end of each rod 546 and the end of the slotted portion, urging each rod radially outward and maintaining hook 543 in a retracted position. Also, extending the length of cylinder 497 in a hollowed-out portion is a square rod 548 which is rotatably mounted in fixed bearings in end plates 549 and 550 as revealed in Fig. 25. Fastened on one end to rod 548 is a series of circular springs 551 each having an extension 551a which engages one side of a depression in each pull rod 546. Rod 548 is keyed to a segment 552 on the outside of end plate 549 (Fig. 25). A hole 553 is provided in plate 549 adjacent to segment 552 for receiving and inserting the key which meshes with the teeth of segment 552 to rotate it in a counterclockwise direction. At the same time rod 548 moves with segment 552 causing springs 551 to move pull rods 546 in toward the center of the cylinder 497 and springs 547 to be depressed. When the segment is thus tightened, a latch dog 555 pivoted at 556 falls into place by force of a spring 557 to hold the segment in the displaced position. The inward movement of each rod 546 causes each hook 543 to pivot in a counterclockwise direction, as viewed in Fig. 24, about shaft 545 and engage the side of the corresponding perforation on the bottom edge of the print plate 541 to secure the plate to the periphery of cylinder 497. The plate 541 is mounted in a manner similar to that described for the mounting of print plates 324a, 324b and 324c to the periphery of backprint cylinder 31 as previously described.

Print cylinder shaft 498 is seated in guide blocks 500 and 501 (Figs. 20 and 21) which are fitted for vertical movement in housings 502 and 503 respectively as previously explained and shown in Figs. 20 and 21. Set screws 560 and 561 are mounted in recessed portions of caps 502a and 503a of housings 502 and 503 respectively and extend into the top portion of guide blocks 500 and 501 respectively. Encircling set screws 560 and 561 respectively are positioning springs 562 and 563. This structure permits print cylinder 497 to be adjusted vertically by set screws 560 and 561 to secure the best printing pressure against platen 495 without disengaging the teeth of floating idler gear 508 from print cylinder driving gear 504 or allowing an excess of backlash. Print cylinder 497 makes one revolution per machine cycle. When a bill sheet is fed to the faceprinting station by rollers 434 and 435, print cylinder 497 moves print plate 541 into position to engage the bill sheet between it and platen 495 to print the required data on the face of the bill sheet.

Print plate inking mechanism for faceprint unit

Referring again to Figs. 21 and 24, it is seen that sub-frame 514 is constantly urged in a clockwise direction, as viewed in Fig. 21, about shaft 515 by spring 564 which is fastened to frame section 2. An adjusting screw 565 is situated at the top of sub-frame 514 to maintain the proper spaced relationship between sub-frame 514 and print cylinder 497. Ink roll 512 is thus maintained in a position to engage print plate 541 shortly after a bill sheet has been printed, thereby transferring ink from roll 512 to plate 541 in preparation for printing data

on the face of the next following bill sheet. An ink pot 566 is pivotally mounted to lugs on frame sections 2 and 4 at 567 and 568 respectively (Figs. 20 and 21). Inking transfer rolls 569, 570 and 571 (Fig. 24) are mounted for rotation within ink pot 566. Rolls 569 and 570 are positioned to engage ink roll 512 when the ink pot 566 is placed in an operating position as shown in Figs. 21 and 24. Rolls 569 and 570 are driven by friction through engagement with the constantly rotating ink roll 512. Roll 571 is in turn driven by friction through engagement with rolls 569 and 570. It is readily seen that rolls 569 and 570 can be moved to and from engagement with ink roll 512 by rotating ink pot 566 about pivot points 567 and 568. The inking material is placed in the ink pot 566 and is moved by rolls 571, 570 and 569 onto the surface of ink roll 512. This ink pot device is similar to the one used with the backprint unit and is in general use on printing machines.

In summary, the bill sheet is fed into the turnover device 409 by the turnover device entrance rollers 394 and 397. The bill sheet is advanced to a central position in the turnover device by a series of feed rollers 421 located within the turnover device. Then the turnover device is rotated through 180 degrees to invert the bill sheet which is discharged from the turnover device by rollers 421 and advanced to face-printing position between print cylinder 497 and platen 495 by feed rollers 534 and 535. Print plate 541 is coated with ink once each machine cycle and is timed to meet the bill sheet passing between print cylinder 497 and platen 495. The imprinted sheet is discharged from the faceprint station onto a belt conveyor which carries it to a stacking pocket 594 of a stacker 595.

The belt conveyor for faceprint unit

When an imprinted bill sheet leaves the faceprint station, it passes onto a belt conveyor. Referring to Figs. 18, 21 and 24, the belt conveyor comprises five individual endless belts 580 having flat surfaces on top and bottom and a rubber bonded fabric composition. Stationary shaft 581 is rigidly fixed in frame sections 2 and 4, projecting through frame section 4. Five tension pulleys 582 are pivotally mounted on shaft 581, there being one pulley for each conveyor belt 580. The forward ends of belts 580 pass around rolls on their corresponding pulleys 582 and extend back over constantly rotating conveyor shaft 531 as revealed in Fig. 24. Each pulley 582 has a tension spring 583 which urges it in a counterclockwise direction as viewed in Fig. 24 about shaft 581 causing each belt 580 to be maintained in a taut condition. Belts 580 are constantly running during machine operation. When a bill sheet is discharged from the faceprinting station onto the belt conveyor, it is moved to pocket 594 of a stacker 595 and rests upon a spring supported stacker plate 596.

Mechanism is also provided for holding the faceprinted bill sheet against the conveyor belts 580 as shown in Figs. 18 and 21. Crossbars 584 extend between and are rigidly secured in frame sections 2 and 4. Guide frame 585 comprises a lower plate 586, the long edges of which are crimped to enable it to snugly engage crossbars 584. An upper plate 587 engages on its under surface crossbars 584. Screws 588 and 589 extend through frame plates 586 and 587 and are engaged by nuts 590 and 591 respectively to provide for adjustment of guide frame 585 along the crossbars 584. Fastened to lower plate 586 are a pair of side plates 592, each plate having three rollers 593 pivotally mounted thereto. Side plates 592 are spaced apart a sufficient distance to allow rollers 593 to cooperate with a pair of conveyor belts 580. It is readily seen from Fig. 18 that this structure enables a choice of conveyor belts 580 to be used to engage the bill sheet on an unprinted part and thereby reduce smearing of the freshly printed parts. Rollers 593 may in addition be grooved with one or more V grooves to pre-

sent a minimum of surface contact with the bill sheet face if desired.

Machine timing

Referring to Figs. 25a, b, c and d which taken together comprise a timing chart of the assembled backprint and faceprint units of the imprinter, it is noted that the first sheet starts its travel through the imprinter after leaving the cutoff blades 228 and 229 and has a starting position at the upper left hand position of the chart. Bill lengths of 3½", 4", 4½" and 5" are shown in their travel from cutoff blades 228 and 229 to the final position in stacker 595.

It should be noted that on the timing chart the horizontal axis is divided into inches of distance traveled by a loose bill sheet in going from the cutoff blades 228 and 229 to the sheet stacker 595. The vertical axis is divided into six successive complete machine cycles, each being subdivided into forty-four cycle points.

At the twenty-second cycle point of the first machine cycle, the leading edge of web 180 passes between the cutoff blades and into engagement with feed rollers 295 and 296 which hold the leading edge while a bill length is being severed by blades 228 and 229. This severing occurs at the twelfth cycle point of the following machine cycle and allows the bill length to be handled as a loose bill throughout the remainder of the machine operation. From the beginning of the second machine cycle to the instant when the bill is severed, selector pins 249, 250 and 251 scan the intended bill sheet for the hole controlling the selection of a print plate on backprint cylinder 31.

After leaving feed rollers 295 and 296, the loose bill sheet is advanced by belts 300 of the first belt conveyor to sheet stops 311 where it is held until the sheet stops are lowered. It is readily seen from the timing chart that sheet stops 311 may be lowered at three different times depending upon which of the three print plates 324a, 324b or 324c is selected to print information on the advancing bill sheet. If the first print plate 324a is selected by the selector pins as previously described, the sheet stops are lowered at the beginning of the third machine cycle. If the second print plate 324b or third print plate 324c is selected, the sheet stops are lowered at the eleventh or twenty-second cycle point respectively of the third machine cycle. At the same times in the cycle that sheet stops 311 release the bill sheet, ink roll 34 is moved into contact with the selected print plate.

Feed rollers 308 and 309 advance the bill sheet into engagement with feed rollers 319 and 390 which move the bill sheet to the backprint station where print cylinder 31 is closed against platen 24 to backprint the bill sheet moving between them. The printing operation occurs at varying times in the third machine cycle depending upon the selected print plate. The first print plate backprints the bill sheet on approximately the eleventh cycle point. The second and third print plates become effective on approximately the twenty-second and thirty-third cycle points.

After leaving the backprinting station, the bill sheet is advanced by belts 377 of the second belt conveyor to sheet stops 381 where it is held until the sheet stops are lowered. If the bill sheet has been printed by the third print plate 324c, it will reach sheet stops 381 on the fifth cycle point of the fourth machine cycle. Six cycle points later the sheet stops are lowered and the bill sheet is advanced by the turnover entrance rollers 394 and 397 into turnover device 409 where it is moved to a central position by rollers 421. On the twenty-seventh cycle point of the fourth machine cycle sliding key 480 is withdrawn from driving engagement with the turnover feed rollers 421 in five cycle points. At this time turnover device 409 is rotated one half revolution and comes to a stationary position on the sixth cycle point of the fifth machine cycle. Sliding key 480 is then re-inserted to a

driving position with respect to feed rollers 421 in five cycle points and the bill sheet is discharged from the turnover device.

The bill sheet is advanced by feed rollers 534 and 535 to the faceprint station where it passes between print cylinder 497 and platen 495. At approximately the twenty-third cycle point of the fifth machine cycle, print plate 541 engages the face of the bill sheet to print a bill form around previously prepared data on the face of the bill sheet. After leaving the faceprint station, the bill sheet is moved by belts 580 of the third belt conveyor and reaches the stacker 595 on the thirty-ninth cycle point of the fifth machine cycle.

In order to obtain a desirable output during machine operation, the imprinter is arranged to allow a plurality of bill sheets to pass through it in successive order. It is noted from the timing chart that web 180 is again fed through cutoff blades 228 and 229 at the twenty-second cycle point of the second machine cycle and into engagement with feed rollers 295 and 296. A second bill length is severed by blades 228 and 229 at the twelfth cycle point of the third machine cycle and started in its travel to the first belt conveyor. While the first bill sheet is being backprinted at the backprint station, the second bill sheet is moved against sheet stop 311 where it is held until the sheet stops are lowered. Similarly, a bill sheet can be started through the imprinter on each succeeding machine cycle, and be subjected to the same operations at equivalent cycle points during the succeeding machine cycles as was the first bill sheet whose path was traced in detail above.

This overlapping operation effects a saving in time and increases machine efficiency in that one machine mechanism can operate on one bill sheet while other machine mechanisms operate on the following bill sheets. The overlapping feature of the machine is preferably extended to five bill sheets, as shown in the timing chart.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a machine for printing different data on sheets of paper having print determining indicia thereon, a printing drum having a plurality of separate impression devices for printing on said sheets, a platen cooperating with said printing drum to effect printing on said sheets, sensing means for sensing indicia related to said devices for predetermining which device is to effect printing on a sheet, means for moving said sheets to a position between said drum and said platen, and means under control of said sensing means for causing the sheets to be moved by the moving means at differential time intervals in accordance with the selection of one of said devices, whereby a selected one of said devices causes printing to be effected on the sheets.

2. In a machine for printing different data on sheets of paper having a series of print selecting perforations, a printing station, a printing drum having a plurality of arcuate print plates thereon at said printing station, a platen cooperating with said printing drum to effect printing on said sheets, sensing means for sensing perforations related to said plates for predetermining which plate is to effect printing on a sheet, means for moving said sheets to a position between said drum and said platen, and means under control of said sensing means for causing the sheets to be moved by the moving means at differential time intervals in accordance with the selection of one of said plates, whereby a selected one of said plates causes printing to be effected on the sheets.

3. In a machine for printing on a continuous web of material, a main operating means having first and second driving control devices, means for cutting the web into separate sheets and operated through a cam means located on the first driving control device of said operating means, a first means for printing on one face of the sheets, a turning device for inverting said sheets, said turning device comprising a frame member, a plurality of sets of feed rollers rotatably mounted in the frame member, said frame member being mounted for rotation on an axis parallel to said feed rollers, a gear drive extending from said second driving control device, a key adapted to connect said feed rollers and said gear drive, means for shifting said key to connect said feed rollers and gear drive thereby causing said feed rollers to be intermittently driven and advance a sheet through said turning device, another gear drive extending from said second driving control device for causing the frame member to intermittently turn about said axis whereby a sheet is inverted so that the face of the sheet which was on top upon entering the turning device is on the bottom when leaving said turning device and a second means for printing on the other face of said sheets after they have been expelled from the turning device.

4. In a machine for printing on sheets having print determining indicia thereon, a web, means for cutting the web into separate sheets, a first means having a plurality of separate impression devices for printing on one face of the sheets, means for turning said sheets, a second means for printing on the other face of said sheets, means for advancing said web to said cutting means, means for sensing the print determining indicia on the sheets while they are being severed from the web, a sheet stop, means for carrying the sheets severed from the web against said stop, a main operating means having a control device for actuating said sheet stop, means under control of said sensing means for controlling said control device to cause actuation of said stop, to release said sheet at a differential interval of time in accordance with selection of one of said impression devices, means for moving said sheets from said carrying means to said first printing means when said stop is moved from the path of the sheets, whereby a selected one of said impression devices causes printing to be effected on the sheets, means for carrying the sheets which have been printed on one side to said turning means, another sheet stop for preventing advance of the next sheet to be fed to the turning means until said turning means is actuated, means for receiving the sheets from the turning means and advancing them to the second printing means and means for carrying the printed sheets away from the second printing means.

5. In a machine for printing on sheets having indicia thereon, a web, means for cutting the web into separate sheets, a drum having a series of arcuate print plates thereon for printing on one face of the sheets, a platen cooperating with said drum to effect printing on said sheets, means for turning said sheets, means for printing on the other face of said sheets, means for advancing said web to said cutting means, means for sensing indicia related to said plates for predetermining which plate is to effect printing on a sheet, said sensing means being effective while the sheets are being severed from the web, a sheet stop, means for carrying the sheets severed from the web against said stop, a main operating means having a control device for actuating said sheet stop, means under control of said sensing means for controlling said control device to cause actuation of said stop to release said sheets at differential time intervals in accordance with selection of one of said plates, means for moving said sheets from said carrying means to a position between said drum and said platen when said stop is moved from the path of the sheets, whereby the selected one of said plates causes printing to be effected on the sheets, means for carrying the sheets which have been printed on one side to said turning means, another sheet stop for preventing advance

of the next sheet to be fed to the turning means until said turning means is actuated, means for receiving the sheets from the turning means and advancing them to the second printing means and means for carrying the printed sheets away from the second printing means.

6. In a machine for printing on sheets having print determining perforations therein, a web, means for cutting the web into separate sheets, a first means having a plurality of separate impression devices for printing on one face of the sheets, means for turning said sheets, a second means for printing on the other face of said sheets, means for advancing said web to said cutting means, pin sensing means for reaching the perforations on the sheets while they are being severed from the web, means for carrying the sheet severed from the web against said stop, means for retracting said pins to permit the sheets to be moved by said carrying means, a main operating means having a control device for actuating said sheet stop, means under control of said pin sensing means for controlling said control device to cause actuation of said stop to release said sheets at differential time intervals in accordance with the selection of one of said impression devices, means for moving said sheets from said carrying means to said first printing means when said stop is removed from the path of the sheet, whereby a selected one of said impression devices causes printing to be effected on the sheets, means for carrying the sheets which have been printed on one side to said turning means, another sheet stop for preventing advance of the next sheet to be fed to the turning means until said turning means is actuated, means for receiving the sheets from the turning means and advancing them to the second printing means and means for carrying the printed sheets away from the second printing means.

7. A cyclically operable sheet turning device comprising a frame member, a plurality of sets of feed rollers rotatably mounted in the frame, said frame member being mounted for rotation on an axis parallel to said feed rollers to invert a sheet fed thereto, a first means for driving said feed rollers, means for connecting said feed rollers and the first driving means, cyclically operable cam means for making the connecting means effective to connect said feed rollers and the first driving means, thereby causing said feed rollers to be cyclically driven and advance a sheet through said turning device in each circle of operation, other cyclically operable cam means for engaging the frame rotating means to cause the frame member to cyclically turn about said axis with a sheet thereon, whereby a sheet is inverted so that the face of the sheet which was on top upon entering the turning device is on the bottom when leaving said turning device.

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