Jan. 8, 1946. C. R. KADDELAND 2,392,391

PRINTING PRESS CONTROL MECHANISM

Filed March 11, 1942 6 Sheets-Sheet 1

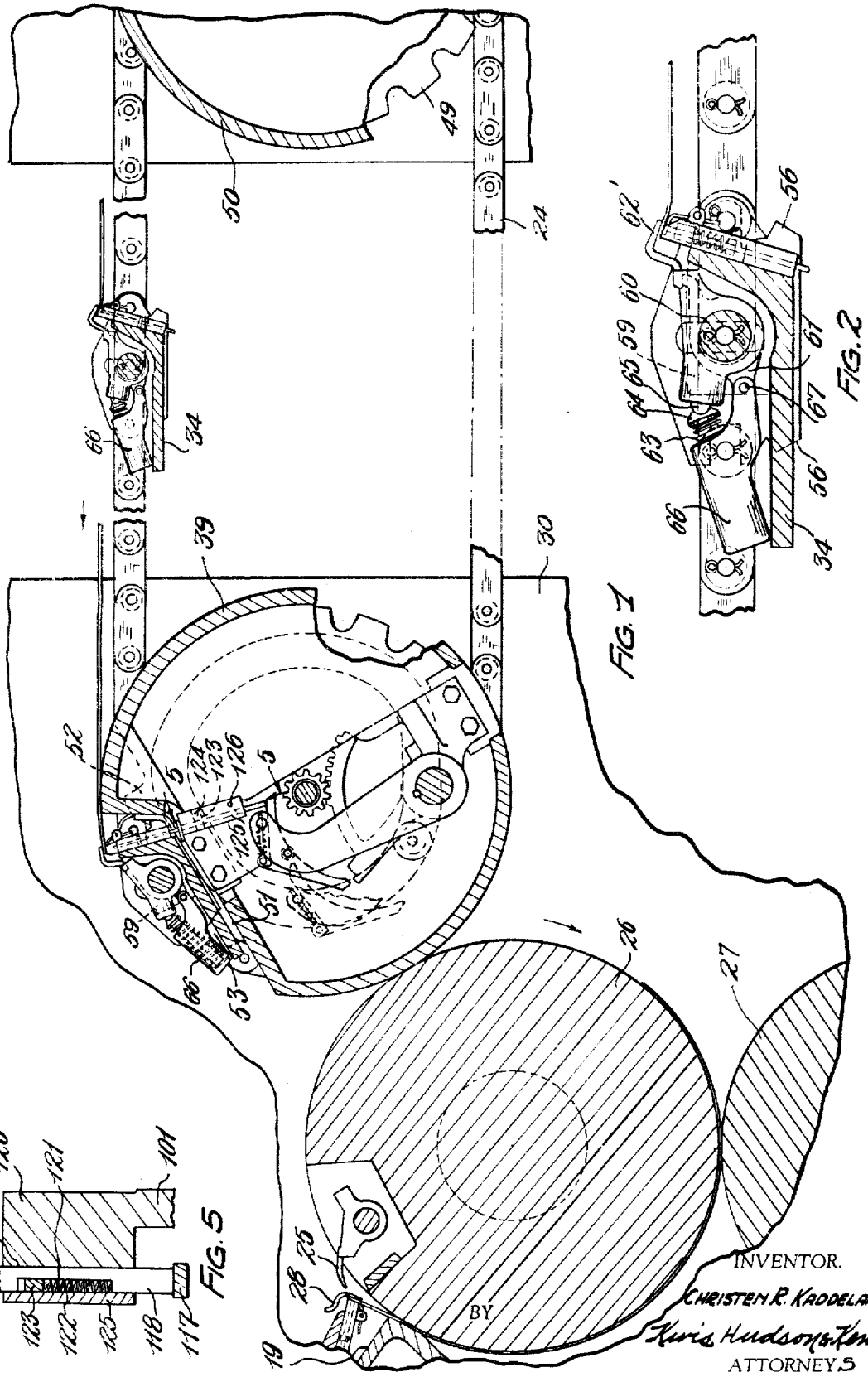

FIG. 1

FIG. 2

FIG. 5

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PRINTING PRESS CONTROL MECHANISM

Filed March 11, 1942 6 Sheets-Sheet 2

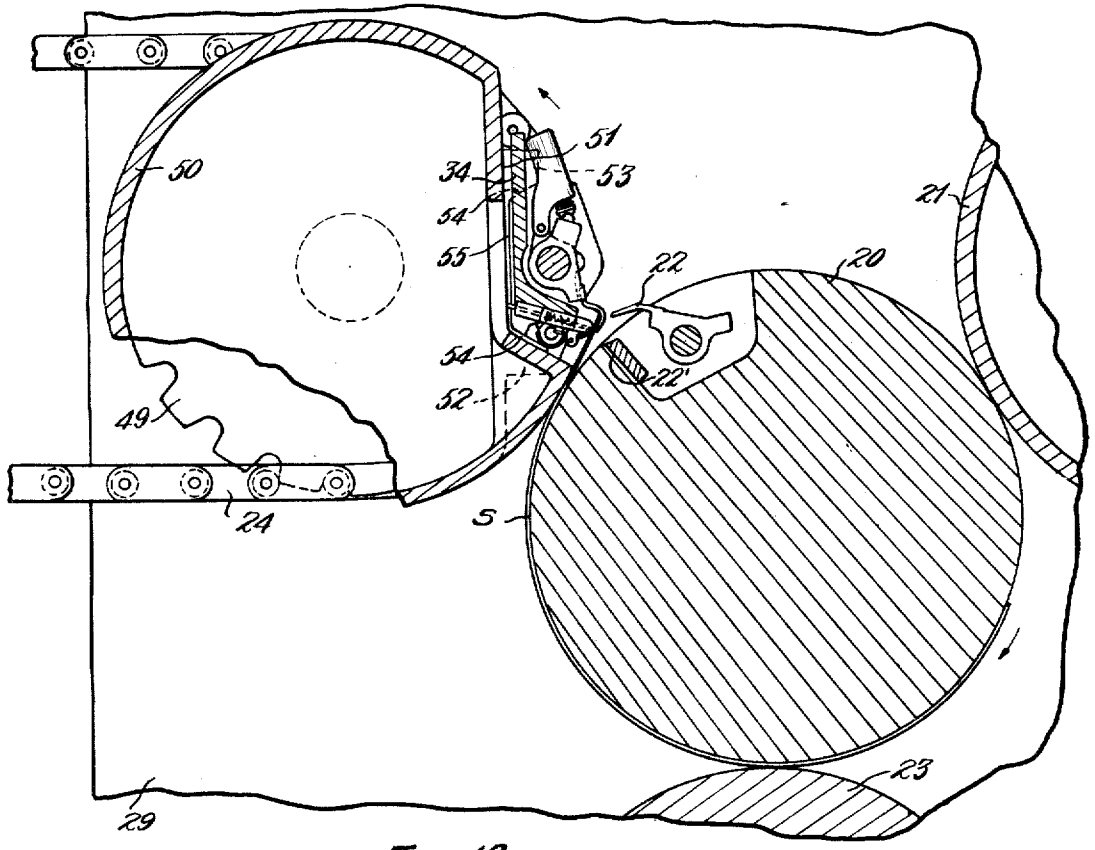

FIG. 1a

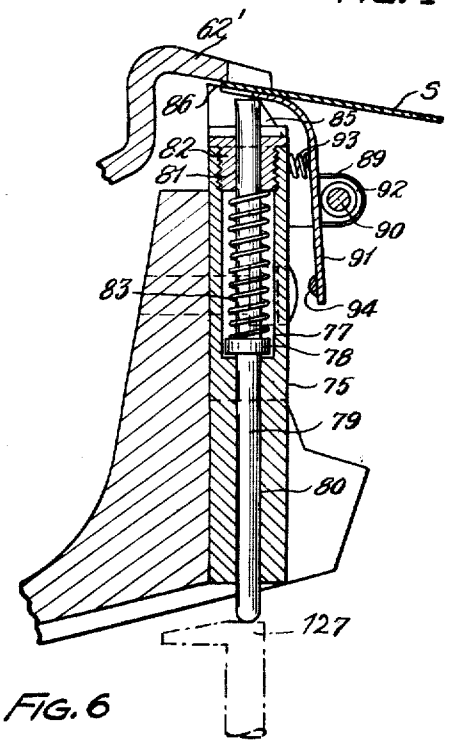

FIG. 6

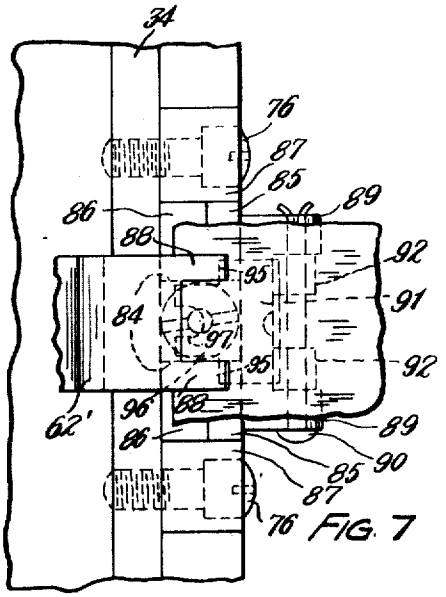

FIG. 7

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PRINTING PRESS CONTROL MECHANISM

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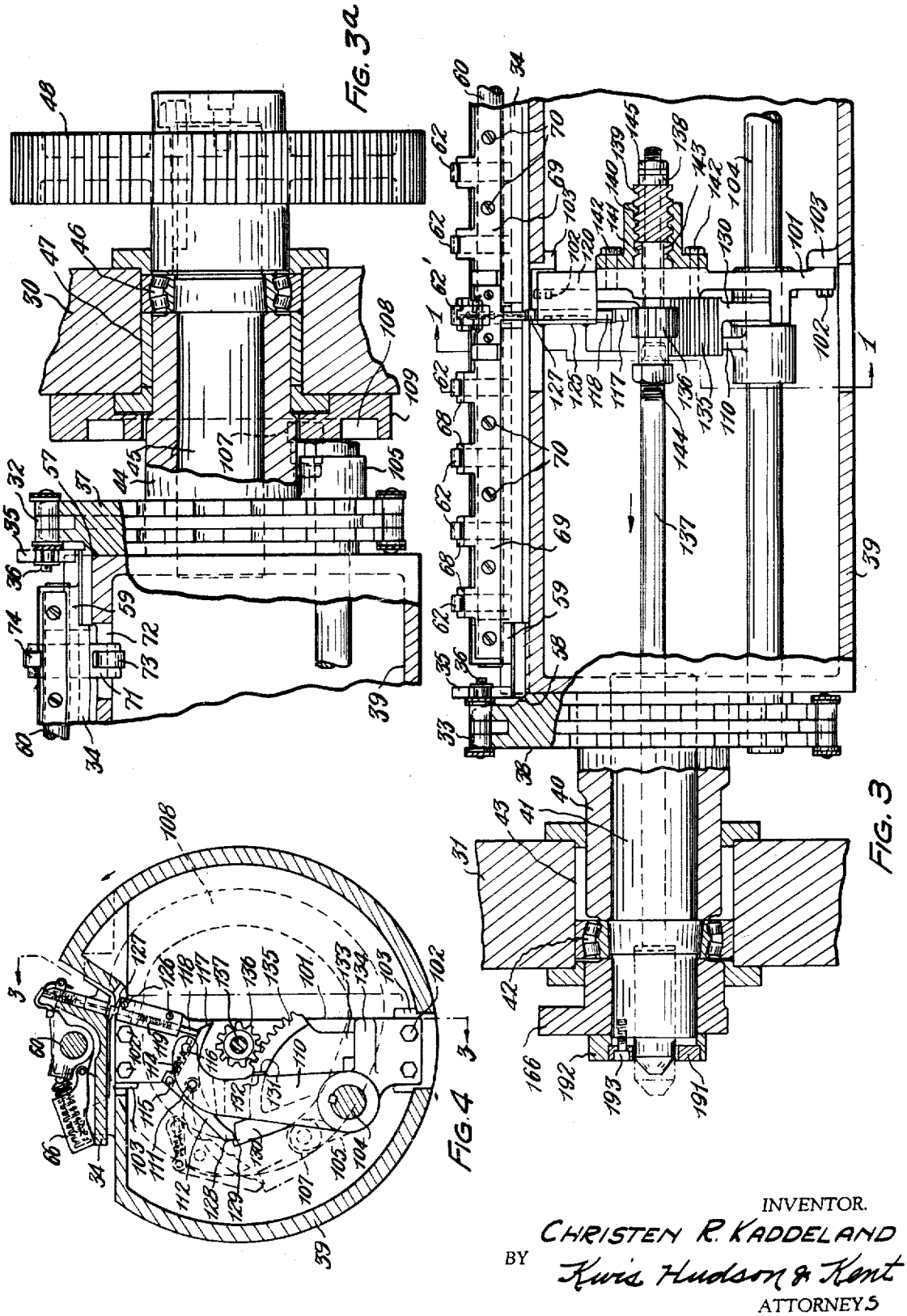

FIG. 3

FIG. 4

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PRINTING PRESS CONTROL MECHANISM

Filed March 11, 1942 6 Sheets-Sheet 4

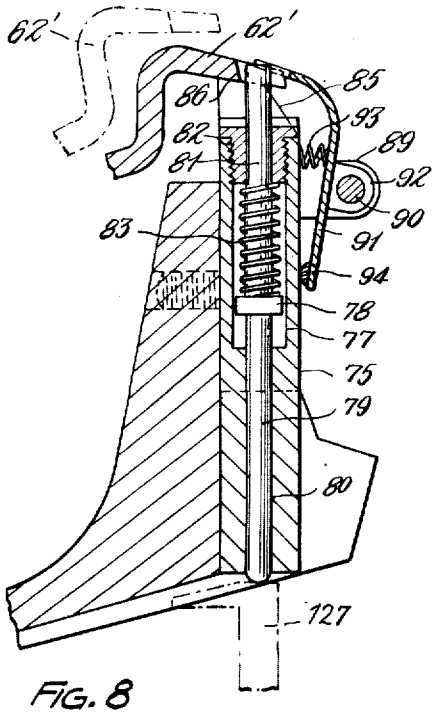

FIG. 8

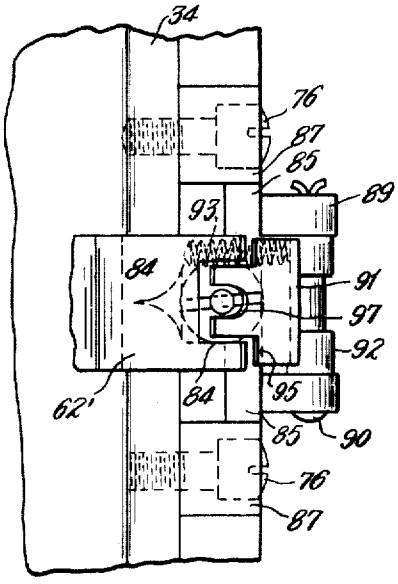

FIG. 9

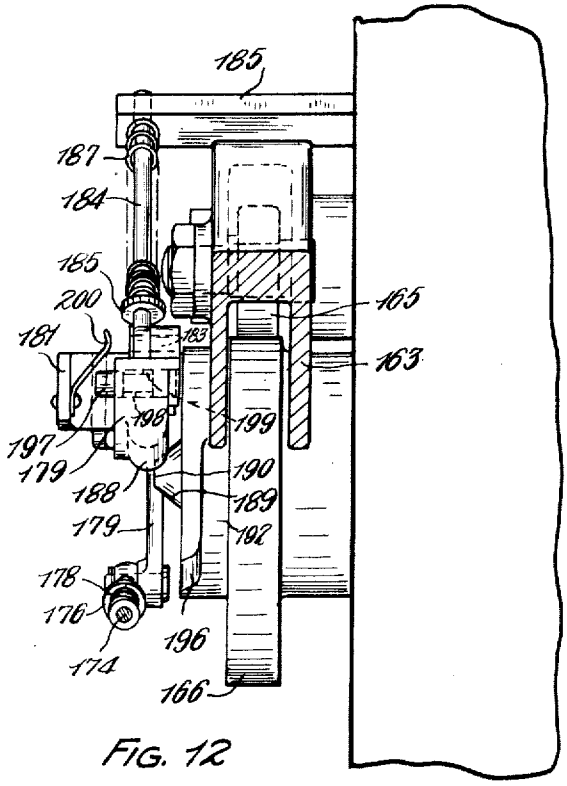

FIG. 12

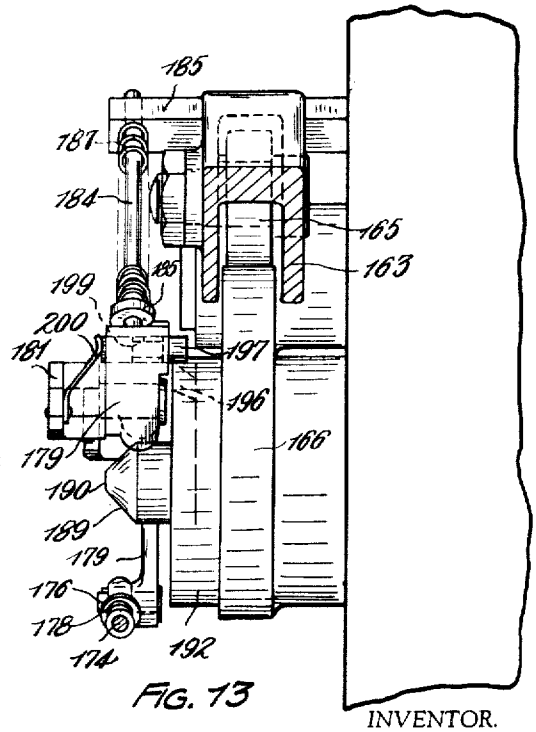

FIG. 13

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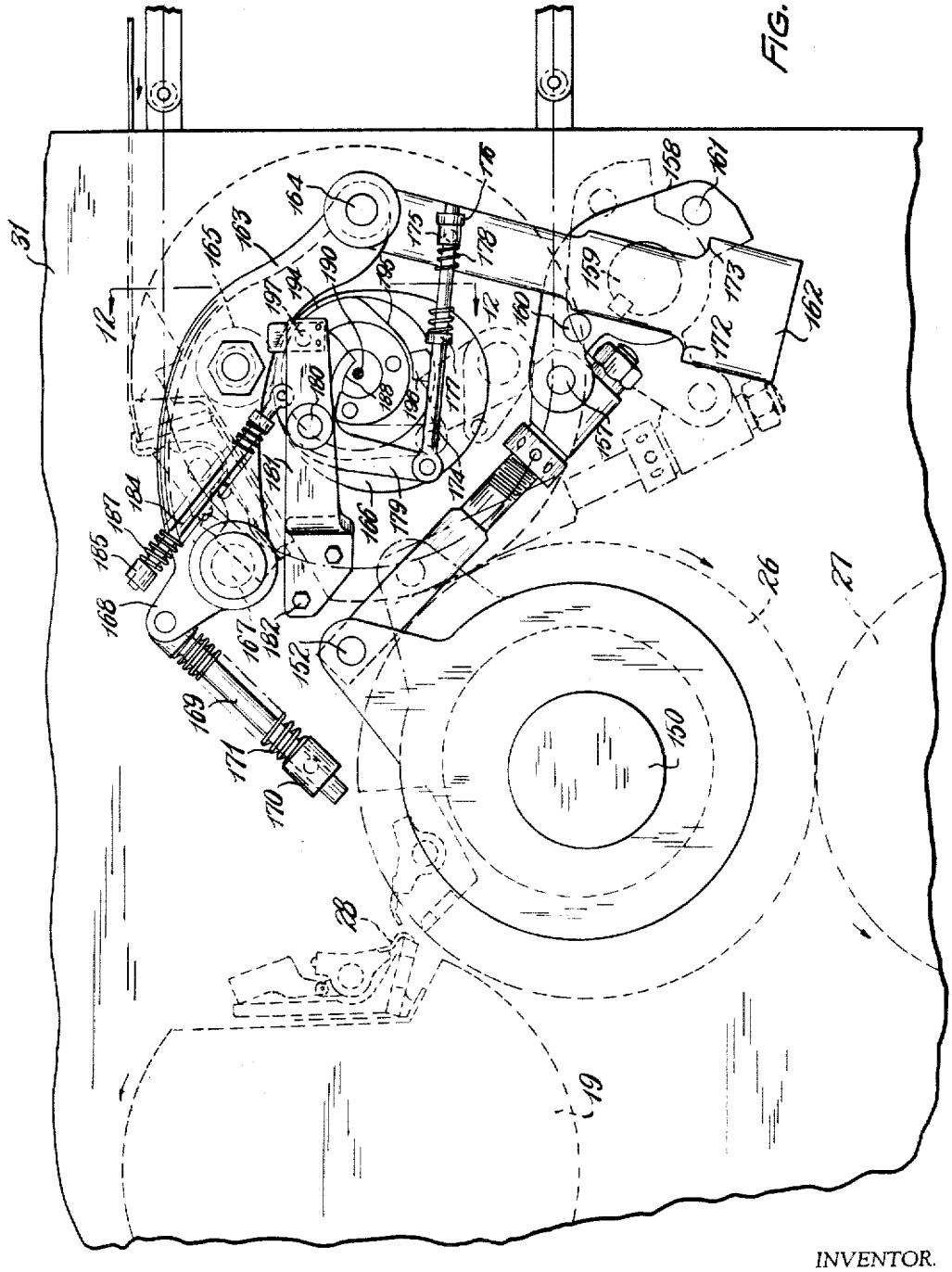
FIG. 10



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PRINTING PRESS CONTROL MECHANISM

Filed March 11, 1942 6 Sheets-Sheet 6

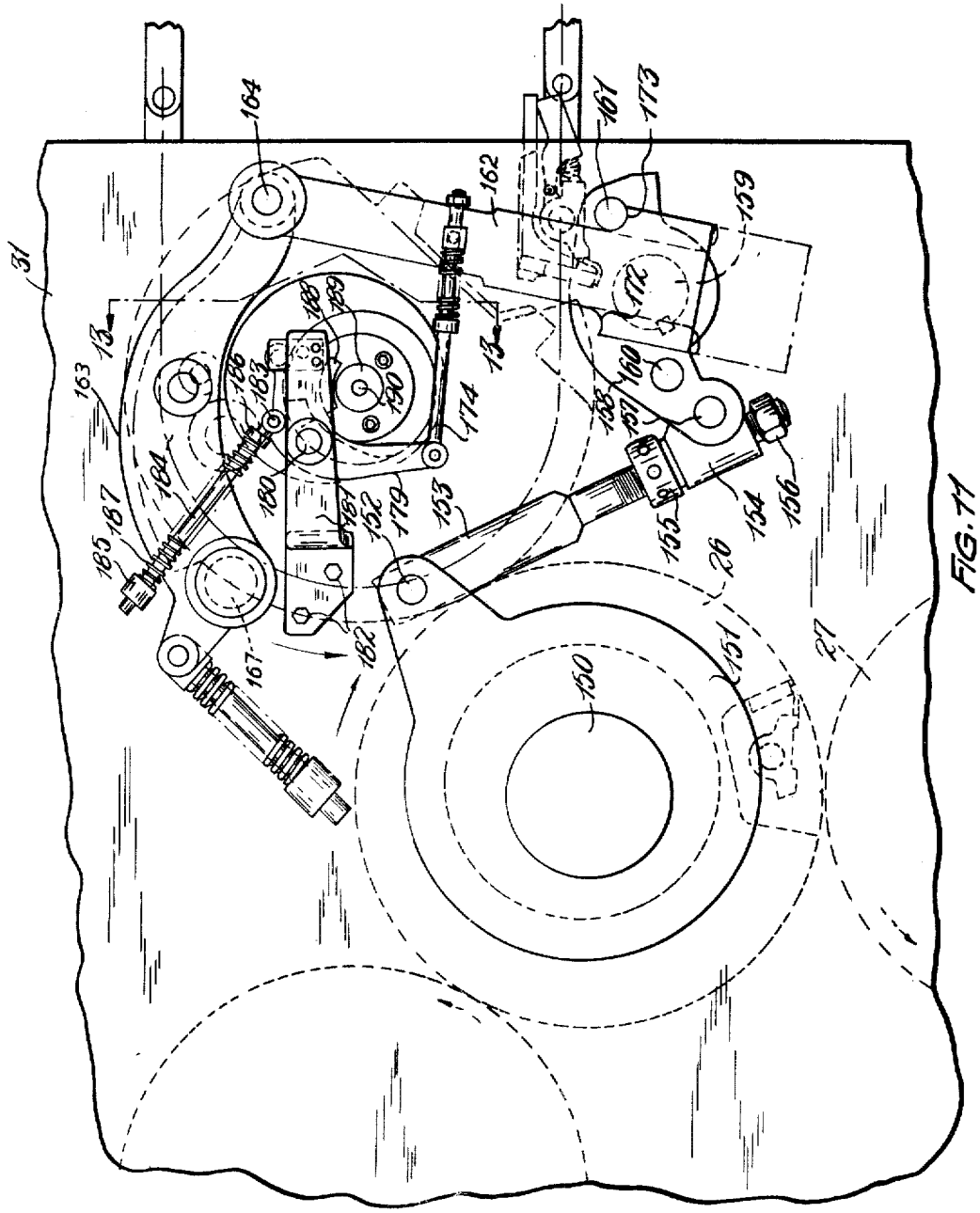

FIG. 11

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Patented Jan. 8, 1946 2,392,391

UNITED STATES PATENT OFFICE

2,392,391

PRINTING PRESS CONTROL MECHANISM

Christen R. Kaddeland, Shelton, Conn., assignor to Harris-Seybold-Potter Company, Cleveland, Ohio, a corporation of Delaware

Application March 11, 1942, Serial No. 434,182

19 Claims. (Cl. 101—184)

This invention relates to improvements in printing presses, more particularly to mechanism for controlling the impression of printing presses dependent upon the presence or absence of a sheet at a point in advance of the printing point.

One of the objects of the invention is the provision of mechanism of the type indicated which is particularly adapted for use in multi-color presses.

Another object is the provision of mechanism of the type indicated whereby the impression condition of each unit of a multi-unit printing press may be controlled independently of the impression condition in any of the other units.

Another object is the provision of sheet detecting means particularly adapted for use with an endless sheet conveyor having a multiple of sets of sheet carrying devices.

Another object is the provision of sheet detecting means which is positive in action and equally effective upon different weights and grades of stock.

Still another object is the provision, in association with sheet grippers, of sheet detecting means particularly adapted to detect the presence or absence of a sheet being presented by other grippers.

Other objects and features of novelty will appear as I proceed with the description of that embodiment of the invention, which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevational view partly in vertical longitudinal section of the delivery end of an endless conveyor shown in sheet transferring relation with the impression cylinder of the second unit of a multi-unit printing press. The section is taken substantially along the line 1—1 of Fig. 3.

Fig. 1a is, in effect, an extension of Fig. 1, showing the receiving end of the endless conveyor in sheet taking relation with the impression cylinder of the first unit of the press.

Fig. 2 is a detail view on a larger scale of a gripper mechanism carried by the endless conveyor.

Fig. 3 is a sectional view of the delivery drum of the endless conveyor, the section being taken substantially on the line 3—3 of Fig. 4.

Fig. 3a is an extension of Fig. 3.

Fig. 4 is a transverse sectional view through the delivery drum showing certain of the parts in the positions which they occupy when no sheet is in the grippers.

Fig. 5 is a detail sectional view of a control plunger.

Fig. 6 is a detail sectional view on a larger scale of the sheet detector mechanism when at its normal position, a sheet being held in the grippers.

Fig. 7 is a fragmental plan view of the same.

Fig. 8 is a view similar to Fig. 6 but showing the condition of the parts when there is no sheet in the grippers.

Fig. 9 is a plan view of the same.

Fig. 10 is an end view of the delivery drum showing the adjacent impression cylinder and its throw-off mechanism, illustrating the parts in normal position.

Fig. 11 is a similar view with the impression off.

Fig. 12 is a sectional view taken substantially on the line 12—12 of Fig. 10, and

Fig. 13 is a view similar to Fig. 12 but taken on the line 13—13 of Fig. 11.

In the drawings 20 is the impression cylinder of the first unit of any pair of successive units of a multi-unit printing press. Sheets are fed individually to cylinder 20 by a feeding transfer drum 21 or by any other suitable means capable of presenting them to the grippers 22 of cylinder 20. These grippers convey the sheets into contact with a printing cylinder 23 which in this case may be the form cylinder of an intaglio printing unit, the grippers 22 being recessed slightly below the periphery of cylinder 20 so that they may pass cylinder 23 in case the latter is a full cylinder.

After taking an impression from cylinder 23, the sheets are transferred by grippers 22 to an endless conveyor, referred to generally as 24, which conveys them to the grippers 25 of the impression cylinder 26 of the second printing unit of the press. The sheets are carried by cylinder 26 into contact with form cylinder 27, from which they take a second impression, after which they are transferred by grippers 25 to the grippers 28 of a further conveyor, which may be a second endless conveyor similar to conveyor 24, the receiving drum of which is indicated at 19. This latter conveyor carries the sheets to a succeeding operating point, as for example to another printing unit, or to a delivery mechanism.

The first of the two printing units illustrated is mounted in a frame, one member of which is shown at 29 in Fig. 1a. The second printing unit is likewise mounted in a frame, one member of which is shown at 30 in Fig. 1 and the other at 31 in Figs. 10 and 11, these frame members being illustrated also in Figs. 3 and 3a. Driving

mechanism, not shown, is provided for rotating the cylinders and the conveyor drums in the directions indicated in the drawings.

The conveyor 24 comprises a pair of parallel chains 32 and 33 at opposite sides of the press, to which are secured a plurality of gripper support bars 34 whose ends are formed into plates 35 having slots to receive pins 36 of the chains 32, 33. These chains travel around sprocket wheels 37, 38 which are bolted or otherwise secured to the ends of the conveyor drum 39.

As best seen in Fig. 3, cylinder 39 is provided at one end with a hollow shank 40 in which is secured a stud 41 which carries an anti-friction bearing 42 mounted in a bore 43 of frame member 31. At its other end, as shown in Fig. 3a, drum 39 has a hollow shank 44 in which is secured a stud 45 carrying an anti-friction bearing 46 which is held against axial movement in bore 47 of frame member 30. Stud 45 at its outer end also carries a gear 48 which forms one of the elements of the driving mechanism previously referred to.

At the rear end of the conveyor, chains 32 and 33 are trained around a pair of sprocket wheels, one of which is shown at 49, Fig. 1, these sprocket wheels being secured to the ends of a conveyor drum 50 which is rotatably mounted in the frame of the first printing unit.

The drums 39, 50 rotate once for each revolution of the impression cylinders, and the gripper bars 34 are so spaced along the chains 32, 33 that a bar receives a sheet from the impression cylinder 20 upon each revolution thereof and that a bar delivers a sheet to the impression cylinder 26 upon each revolution of that cylinder. Each of the drums 39, 50 is formed with a recessed portion 51 to accommodate a gripper bar and its associated mechanism.

Near each of their ends the drums 39, 50 are formed with upstanding lugs 52, 53 having oppositely disposed beveled faces 54 for accurately positioning the bars 34 as they travel around the drums. Between the beveled faces 54 each of the drums is provided with a flat area 55. Each bar 34 is formed at its sides with beveled faces 56 (Fig. 2) arranged to fit between the faces 54 and permit the bars to be clamped against the flat area 55.

Mechanism of any suitable type, as for example that disclosed in my copending application, Serial No. 409,547 filed September 4, 1941, may be provided for momentarily clamping the bars 34 to drum 50 during the time that the grippers of each bar are receiving a sheet from impression cylinder 20 and for clamping them to drum 39 as the bars travel around that drum prior to and during delivery of the sheets to the impression cylinder 26. The bars 34 are held against sidewise movement by the beveled faces 57, 58 provided on sprockets 37, 38.

Formed integral with each bar 34 are bearings 59 which support a gripper shaft 60. The latter has keyed to it a plurality of gripper dogs 61. Associated with each dog except one, preferably the center one, there is a gripper finger 62 pivotally mounted on the shaft and urged toward closed position by spring 63 which forces rod 64 against rounded heel 65 of gripper 62, the other end of the spring bearing against the bottom of a hollow socket 66 which is pivotally connected to dog 61 at 67 and bears against the upper face of gripper support bar 34.

The grippers 62 bear against gripper blocks 68 formed in two bars 69 which are secured by screws 70 to the gripper support bar 34. All the grippers are opened and closed at the proper times by a rocking movement of shaft 60 imparted by mechanism not herein shown in detail but more fully disclosed in my copending application above referred to. This mechanism comprises a lever 71 which is keyed to shaft 60 and extends inwardly through an opening 72 in the drum 39 or 50, as the case may be. This arm carries a roller 73 at its lower end which cooperates with the gripper operating mechanism. Lever 71 is provided with an abutment 74 which bears against one of the bars 69 to limit movement of the shaft 60 in one direction.

The central one of the grippers, marked 62', and its associated sheet detecting mechanism will now be described. The two bars 69 are spaced apart somewhat at the middle of bar 34 and interposed between them there is a block 75 which is secured by screws 76 to bar 34. This block is provided with a bore 77 (see Figs. 6 and 8) which slidably accommodates the shouldered portion 78 of a detector plunger 79. The lower end of the latter is slidably guided in bore 80 of block 75, while the upper portion is similarly guided by the bore 81 of a plug 82 that is threaded into block 75 to close bore 77. A spring 83 is confined between the plug 82 and the plunger shoulder 78, thereby tending normally to force the plunger 79 to its lowermost position with its shoulder 78 against the bottom of the bore 77. The block 75 is cut away centrally at its upper end to form a slot 84 of sufficient width and depth to accommodate the plug 82 and to provide space for the end of the pivoted detector finger, later referred to, when the latter is positioned below the sheet and the gripper 62', Fig. 6. The upper part of block 75 at each side of slot 84 is beveled as at 85 also for the purpose of providing clearance for the detector finger. Thus there are formed at the top of the block two lands 86 which form the surfaces against which the sheet is clamped by gripper 62'. Outwardly of each of these lands 86 the block 75 is cut away to form low shoulders 87 which provide clearance for the opening of grippers 22 as the latter transfer a sheet to grippers 62 and 62', and likewise for the open grippers 25 when a sheet is transferred from the conveyor to impression cylinder 26.

Gripper 62' is bifurcated, the space between the bifurcations being of approximately the same width as the slot 84 of block 75 and extending sufficiently far back to permit the upper end of plunger 79 to pass upwardly through it (see Fig. 8). The end of the gripper 62' is thus formed in two spaced portions 88 which cooperate with lands 86 of block 75 to grip the sheet.

Block 75 carries two ears 89 which support a pin 90 upon which a detector finger 91 is pivotally mounted by means of a pair of integral lugs 92. A spring 93 bearing against the bottom of a hole in block 75 and against the upper part of detector finger 91 tends to move the latter about its pivot in the clockwise direction, which movement is limited by the engagement of an abutment 94 on the finger with the face of block 75. The upper portion of finger 91 is bent forward, that is in the direction of movement of the sheet, to present a substantial surface area parallel to and adjacent the plane of a sheet S being presented to the grippers 62, 62', so that the finger is contacted by the surface of the sheet rather than by the edge thereof.

The finger 91 occupies either of two different positions, depending upon whether or not a sheet

is gripped between the grippers and the gripper pads, these two positions being illustrated in Figs. 6 and 8. The upper end of the finger is narrower than the body portion thereof, with shoulders 95 therebetween so located that when the finger 91 is in the position corresponding to the presence of a sheet, as shown in Figs. 6 and 7, these shoulders 95 lie under the ends of the spaced gripper portions 88. Beyond these shoulders the finger 91 is provided with a bifurcated extension 96 slightly narrower than the slot 84 and the corresponding slot in the gripper 62', which extension 96 is sufficiently long to project under the gripper 62', as shown in Figs. 6 and 7. Thus, when a sheet is present, the detector finger 91 is positively held against movement in the clockwise direction by the fact that gripper 62' overlies extension 96 as well as shoulders 95.

The slot 97 between the bifurcations of detector finger 91 is of sufficient size to permit the passage of plunger 79 therethrough when the finger 91 is in its position corresponding to the absence of a sheet, that is in the position of Figs. 8 and 9. This slot 97, however, is so located that when finger 91 is in its position corresponding to the presence of a sheet, as in Figs. 6 and 7, the plunger 79 strikes against finger 91 and is prevented from passing upward through the plane of the sheet. The length of the extension 96 and the location of the shoulders 95 are such in relation to gripper 62' that when the finger 91 is in the position of Figs. 8 and 9, gripper 62' is free to open and close without affecting finger 91, but when a sheet is present, as in Figs. 6 and 7, the finger 91 is moved by the sheet counterclockwise and is clamped firmly in that position by the gripper 62'.

In order to make use of the position of detector finger 91, in other words in order to make the machine function in accordance with the presence or absence of a sheet in a set of grippers, mechanism is provided within and upon the forward drum 39 of the conveyor for controlling the impression of the second unit of the press. This mechanism will now be described.

About midway of the length of drum 39 there is a bracket 101 which extends across the body of the drum and is fastened by bolts 102 at each end to lugs 103 integral with the wall of the drum. The bracket 101 forms a central bearing for a shaft 104, the ends of which are journaled in the ends of the drum. At the right-hand end, as viewed in Fig. 3a, shaft 104 carries an arm 105 clamped to the tapered end of the shaft by a nut 106. On the outer end of arm 105 there is a roller 107 which runs in the groove 108 of a cam plate 109 which is secured to the frame member 30. By means of the mechanism just described the shaft 104 is given a complete oscillation forward and backward for each revolution of the drum 39.

Keyed to shaft 104 and adjacent bracket 101 is a lever 110 carrying a pin 111 on which is pivotally mounted a double-ended pawl 112 which is biased in the counter-clockwise direction, as viewed in Figs. 1 and 4, by a compression spring 113 carried on spring rod 114. One end of this rod is pivoted at 115 to pawl 112, and the other end passes loosely through a hole in an oscillatable pin 116 mounted in lever 110. Spring 113 is confined between the head of its spring rod and the pin 116, and the latter pin extends into the path of pawl 112 to limit the movement of the latter in the counter-clockwise direction under the influence of the spring.

As shaft 104 oscillates, the lever 110 and the pawl 112 are likewise oscillated back and forth. The end 117 of pawl 112 is adapted in one of its extreme positions to engage an intermediate plunger 118 which, as illustrated, is of rectangular cross-section and is arranged to slide in a slot 119 formed in a boss 120 that is integral with bracket 101. Plunger 118 is cut away for part of its length to form a recess 121 in which is placed a compression spring 122, the lower end of which bears against the bottom of recess 121 and the upper end of which bears against a small cross bar 123 situated in a slot extending crosswise of the boss 120 and secured in place by a pin or a screw 124. A plate 125 held in place by screws 126 confines the spring 122 and the plunger 118. Thus it is seen that the plunger 118 is biased downwardly by the spring 122 but may be lifted against the action of that spring by the end 117 of pawl 112. When a gripper supporting bar comes into position in the cavity 51 of the drum, intermediate plunger 118 and detector plunger 79 come into alignment. A head 127 on the outer end of plunger 118 is shaped to enable plunger 79 to properly engage plunger 118 as the gripper bar 34 moves into position between the beveled faces 54 of the drum.

The pressure of spring 113 tending to rotate pawl 112 counter-clockwise is sufficient to overcome the pressure of springs 122 and 83. Hence when no sheet is present in the grippers and plunger 79 is accordingly free to move upwardly through the plane which would ordinarily be occupied by a sheet, pawl end 117 will raise both plungers 118 and 79 each time the lever 110 is rocked to its right-hand position.

The opposite end 128 of pawl 112 is arranged to engage a notch 129 in a segment arm 130 which is pivotally mounted on shaft 104 between lever 110 and bracket 101. Segment arm 130 is provided with an abutment 131 which cooperates with an abutment 132 on lever 110, so that when the lever 110 is oscillated toward the right from its dotted-line position in Figs. 1 and 4, segment arm 130 will likewise be moved toward the right, its movement in that direction being limited by the engagement of a further abutment 133 forming a part of arm 130, against a lug 134 on bracket 101. It will be seen that so long as the pawl end 128 remains in engagement with notch 129 of arm 130 the latter arm will be oscillated back and forth between the dotted-line position and the solid-line position of Figs. 1 and 4, the pawl moving arm 130 to the left and lever 110 moving it to the right.

Arm 130 has formed thereon a gear segment 135 which meshes with a pinion 136 fixed upon a rod 137. This rod is oscillatably and rotatably mounted, being supported at one end in a bore through the center of stud 41 and at the other end in a sleeve 138 which has a steep pitch screw thread 139 that meshes with a mating thread 140 in a bracket 141 which is secured by bolts 142 to cross bracket 101. Between the pinion 136 and the sleeve 138 is a tubular member 143 which surrounds rod 137. The pinion 136, tubular member 143, and threaded sleeve 138 are clamped in rigid relationship endwise upon the rod 137 by nuts 144 and 145 which engage threaded portions of rod 137. The tubular member 143 is rotatably and oscillatably supported by the cross bracket 101. As pinion 136 is rotated, first in one direction and then in the other, by gear segment 135, the rod 137 is caused to move endwise be-

tween the solid-line and dotted-line positions shown at the left of Fig. 3. Segment 135 ordinarily does not oscillate and hence pinion 136 does not turn relative to the drum. Consequently rod 137 ordinarily remains in the full-line position of Fig. 3. It is only when pawl end 128 engages notch 129 that arm 130 moves with lever 110, and this occurs only when plungers 118 and 79 are free to move outwardly, in other words, when there is no sheet in the grippers that are traveling around the drum 39 at the time.

The forward and backward movement of rod 137 is utilized to control the impression mechanism of the second printing unit by means which will now be described with reference particularly to Figs. 10 and 11 of the drawings. Shaft 150 of impression cylinder 26 is rotatably mounted in eccentric bearings in each of the frame members 30, 31, one such eccentric being shown at 151. The latter eccentric carries a pin 152 to which is pivotally connected one end of a link 153, the other end of which carries a sleeve 154 which is adjustably clamped to the link 153 by clamping nuts 155 and 156. Sleeve 154 is pivotally connected by a pin 157 to a lever 158 which is keyed to one end of shaft 159 extending across the press and journalled in frame members 30, 31. At the opposite side of the press parts similar to those just described are provided, that is the other end of shaft 150 is journalled in an eccentric similar to eccentric 151, and connections between that eccentric and shaft 159 are provided similar to link 153, sleeve 154, and lever 158.

It will be seen that movement of shaft 159 alters the position of the lever and link connections at the opposite sides of the machine, thus rotating the eccentrics in which the impression cylinder 26 is journalled, so that the latter cylinder is moved toward and away from the form cylinder 27. With the parts as shown in Fig. 10 impression cylinder 26 and form cylinder 27 are in printing relation. As shown in Fig. 11, impression cylinder 26 has been moved away from form cylinder 27 to avoid printing on the bare impression cylinder when no sheet is carried thereby. Preferably connections should be provided for displacing the drum 19 or other device which carries grippers 28 by an amount sufficient to maintain a fixed relation between the drum and the impression cylinder, so that there will be no interference between those grippers 28 or drum 19 and the impression cylinder 26, but for the sake of simplifying the disclosure, such connections are omitted from the drawings in this case.

For operating shaft 159 and thereby displacing cylinder 26, the lever 158 is provided with two studs 160 and 161 on opposite sides of the shaft 159, and a two-sided hook member 162 is arranged between these studs to selectively engage one or the other thereof and thereby impart limited rotation to the lever 158. Hook member 162 is given periodic up and down movement by a cam lever 163 to which the hook member 162 is pivotally joined at its upper end by pin 164. Cam lever 163 carries a roller 165 which travels on a cam 166 secured to the end of drum stud 41, as later described. Lever 163 is pivotally mounted on stud 167 secured in frame member 31, and is equipped with a short arm 168 to which is pivotally secured one end of a spring rod 169, the other end of which slides in an opening in stud 170, oscillatably mounted in frame member 31. Spring 171 surrounds rod 169 and operates to cause roller 165 to follow its cam.

As mentioned above, the hook member 162 is arranged to swing on its pivot 164 so that one of its shoulders, 172, may engage stud 160 to lift the latter, or the other of its shoulders, 173, may engage the stud 161 to lift that stud. The position of member 162 is controlled by a rod 174 which slidably extends through perforated stud 175 oscillatably mounted in hook member 162. Collars 176, 177 are fixed to rod 174 and a compression spring 178 is confined between collar 177 and stud 176. When rod 174 is moved to the right from the position shown in Fig. 10, it pushes hook member 162 against pin 161, any excess movement of rod 174 being absorbed by compression spring 178. When rod 174 is moved to the left from the position shown in Fig. 11, it swings member 162 toward the left and against stud 160.

Rod 174 is pivotally connected to the lower arm of a bell crank 179 which is mounted for oscillation upon a stud 180 fixed in a bracket 181 that is bolted to frame member 31 by bolts 182. The upper arm of bell crank 179 carries a pin 183 to which is connected spring rod 184, the other end of which passes loosely through a hole in a stud 185 which is oscillatably mounted in frame member 31. Between a collar 186 on rod 184 and the stud 185 is a compression spring 187 which biases bell crank 179 in the clockwise direction, its movement in that direction being limited by the collar 176 on rod 174, as shown in Fig. 10. The upper end of bell crank 179 is also provided with a transversely rounded lower face 188 which is arranged to be engaged by the beveled end 189 of the head 190 of sliding rod 137. The head 190, as shown in Fig. 3, extends through the center of clamping ring 191 located in a counterbore of cam 192 carried on the end of the drum stud 41. Screws 193 extend through ring 191 into the end of stud 41 to clamp cams 192 and 166 and the inner race of anti-friction bearing 42 against the shoulder of shank 40.

Cam 192 has a circular portion 194 which extends for somewhat less than three-quarters of its circumference, a portion 195 sloping toward the cam axis and a portion 196 sloping in the direction of its axis. These three surfaces of cam 192 cooperate with a pin 197 (see Figs. 12 and 13), slidably carried in a hole in the upper end of bell crank 179. This pin has a reduced central portion 198 forming a recess into which projects a stop pin 199 driven into the bell crank 179 and cooperating with the shoulders of the recess of pin 197 to prevent the latter from moving beyond a certain desired position in either direction.

When pin 197 is in the position of Fig. 13, it functions as a follower for cam 192. Part of the time its side wall contacts the periphery of the cam and part of the time its inner end contacts the face of the cam. While it rides on the circular periphery 194, it maintains bell crank 179 raised, as illustrated in Fig. 11. When it rides down the slope 195, it permits bell crank 179 to swing clockwise to the position shown in Fig. 10. When it contacts the slope 196, it is slid outwardly from its Fig. 13 position to that of Fig. 12, the flat spring 200 carried by bracket 181 being shaped to permit this outward movement of pin 197, as shown in Fig. 12. Whenever the bell crank 179 is raised to its upper position, spring 200 resiliently pushes pin 197 to its inner position, as shown in Fig. 13.

Operation.—Assuming that the press is in normal operation, that is sheets are being fed in regular succession and being printed on each of the

printing units, the impression throw-off mechanism will occupy the position illustrated in Figs. 10 and 12. Under these conditions impression cylinder 26 is in printing relation with form cylinder 27, being held in this position by the link and lever arrangement connecting eccentric 151 and shaft 159, the pins 152 and 157 being in substantial alignment with the shaft 159. Hook member 162 is raised and lowered during each revolution of the press by cam 166 and is held in sliding contact with stud 160 by the pressure of spring 187 acting through bell crank 179 and connecting rod 174.

After each sheet is printed by the impression cylinder 20 of the first printing unit, it is transferred by grippers 22 to one of the sets of conveyor grippers 62, 62'. During the transfer operation the sheet is supported at rather closely spaced points along its forward edge by the gripper pads 22' and their associated grippers 22 so that the zone directly behind the forward edge and between the grippers may be said to be straight and taut, that is, this zone is firmly held by the grippers against any substantial displacement by an object pressing against the sheet. This portion of the sheet engages the upper forwardly directed surface of detector finger 91, swinging the latter upon its pivot 90 and depressing it sufficiently to cause the sheet and finger 91 to lie under the gripper 62' as the latter closes. When the gripper 62' closes upon the sheet, its forwardly extending portions 88 overlie the shoulders 95 of the detector finger and the central portion of the gripper 62' overlies the bifurcated end 96 of the detector finger so that the gripper 62' firmly holds the detector finger 91 in the position shown in Fig. 6. After transfer of the sheet, the grippers 62, 62' and the associated gripper bar 34 leave the taking drum 50 and are conveyed by the chains 32, 33 towards the delivery drum 39.

Somewhat before the gripper bar 34 reaches the drum 39 the shaft 104 is oscillated by cam 108 to swing lever 110 and its associated pawl 112 into the position shown in Fig. 4, in which the pawl end 117 is in engagement with intermediate plunger 118. As the gripper bar 34 carrying the sheet moves into cooperation with drum 39 and is clamped thereto between the sloping faces 54, the detector plunger 79 comes into contact with the head 127 of intermediate plunger 118, which has been lifted by the pawl end 117 through the action of its spring 113 into the position shown in Fig. 1, the plunger spring 122 being slightly compressed. Owing to the fact that plunger 79 cannot be forced upward in block 75 due to the fact that its upper end strikes against detector finger 91, this plunger 79 acts upon plunger 118 to force the latter down against the upward pressure of pawl end 117. This results in turning pawl 112 so that its other end 128 is raised out of engagement with notch 129. Subsequently and shortly after the position illustrated in Fig. 1 the shaft 104 is oscillated to the left by the cam 108. Owing to the disengagement of pawl end 128 and notch 129, however, the arm 130 and its associated gear sector 135 are not disturbed but remain in the full-line position illustrated in Fig. 1. The pinion 136 likewise remains stationary, with the result that no movement is transmitted to rod 137 which remains retracted in its Fig. 3 full-line position. The bell crank 179 is thereby permitted to remain in its extreme clockwise position, as shown in Fig. 10, thus maintaining the lower end of hook member 162 to the left against stud 160, with the result that the impression mechanism is kept in the "on" position. When the grippers 62, 62' reach the proper position, they transfer the front end of the sheet to grippers 25 on impression cylinder 26 and the latter conveys the sheet into contact with the form cylinder 27 and subsequently transfers it to the further grippers 28 which convey the sheet to the next operating point.

So long as each sheet is properly transferred from the first impression cylinder 20 to one of the sets of conveyor grippers 62, 62', the operation of the mechanism will continue as just described. But if for any reason the grippers 22 fail to present a sheet to the conveyor grippers 62, 62', as when the feeding of sheets to the press is stopped, or a sheet is improperly fed, the detector finger 91 of that set of grippers remains in the position which it normally occupies under the influence of spring 93, that is in its extreme clockwise position as shown in Fig. 8. As the gripper unit carrying no sheet comes into engagement with drum 39 and is clamped thereto, the detector plunger 79 engages the head 127 of intermediate plunger 118 as before, but in this case, owing to the absence of a sheet and the fact that detector finger 91 lies outside the path of movement of plunger 79, the latter plunger is pushed upward through the slot in the end of gripper 62' to the position shown in Figs. 8 and 4 by the pawl end 117, acting through the intermediate plunger 118. As previously stated, the pawl spring 113 is of sufficient strength to overcome the intermediate plunger spring 122 and the detector plunger spring 83 when the plunger 79 is free to move upwards. The pawl 112 is thereby permitted to remain in the position shown in Fig. 4, with its end 128 remaining in engagement with the notch 129. Shortly following the position illustrated in Fig. 4, the cam 108 oscillates shaft 104 to the left and swings the lever 110 and its pawl 112 to the dotted-line position shown in that figure. This movement is imparted to arm 130 and its gear segment 135 which results in the rotation of pinion 136 and through the agency of the steep pitch intermeshing threads 139 and 140 causes the rod 137 to move towards the left in Fig. 3 to the position shown in dotted lines. This movement brings the tapered end 189 of rod 137 into engagement with the rounded portion 188 of bell crank 179, to cause the upper arm of the bell crank to be raised to the position illustrated in Figs. 11 and 13. The upward movement of this arm brings sliding pin 197 into contact with the spring 200, which pushes the pin resiliently toward the cam 192. As soon as the bell crank 179 is turned sufficiently to bring the pin 197 above the circular periphery 194 of the cam 192, the pin 197 is snapped toward the right by spring 200 into the position shown in Fig. 13, where it overlies the cam 192. The counter-clockwise movement of bell crank 179 thus caused by rod 137 in turn causes rod 174 and spring 178 to move toward the right in Figs. 10 and 11 to resiliently force the hook member 162 to the right and into contact with the stud 161. Upon the next upward movement of hook lever 162 caused by cam 166, the shoulder 173 will engage stud 161 and lift the latter, thus turning the shaft 159 in the counter-clockwise direction to the position shown in Fig. 11. This movement causes rotation of the impression cylinder eccentrics in a direction to raise the impression cylinder 26 away from the form cylinder 27, so that their printing relation is destroyed. Thus when the grippers 62, 62' fail to

transfer a sheet to the grippers 25 of the second impression cylinder 26, the throw-off mechanism is operated to move the latter cylinder out of printing relation so that no printing is placed upon the bare cylinder.

So long as each successive set of grippers 62, 62' fails to receive a sheet, the detector plunger 78 will be permitted by detector finger 91 to be raised by the upward pressure of pawl 112 acting through plunger 118, thereby causing the pawl end 128 to remain in engagement with its notch 129 of arm 130, thereby transmitting the oscillation of shaft 104 through gear sector 135 and pinion 136 to the rod 137 which will continue to be moved outward at each revolution of the drum 39 to the dotted-line position shown in Fig. 3. The rod 137 will be moved back and forth upon each revolution in one direction due to the continued engagement of pawl end 128 and notch 129, and in the opposite direction due to the engagement of abutment 132 of lever 110 with abutment 131 of arm 130.

During the time the rod 137 is retracted into the solid-line position of Fig. 3, the outer periphery 194 of cam 192 cooperates with sliding pin 197 to hold the upper arm of bell crank 179 raised as illustrated in Fig. 13. During the time the cut-away portion of cam 192 corresponding to the slopes 195 and 196 is adjacent to pin 197, the rod 137 is in its extended position, as shown in dotted lines in Fig. 3. Thus, as long as no sheets are fed, the bell crank 179 is maintained in its anticlockwise position at all times, thus maintaining the lower end of hook lever 162 to the right in contact with stud 161.

Upon the resumption of the feeding of sheets, whereby a sheet is presented by the grippers 22 to one of the sets of conveyor grippers 62, 62', the detector plunger 78 associated with that set is prevented by finger 91 from being pushed upward, so that when it comes into engagement with the intermediate plunger 118, the pawl 112 is tilted to raise its end 128 out of the notch 129 so that the motion of lever 110 is not transmitted to the arm 130, and the sliding rod 137 remains retracted within the drum 39. As the drum 39 continues to rotate, carrying with it the cam 192, the slope 196 of the latter cam comes into line beneath the pin 197 and owing to the pressure of spring 187, the latter pin follows the incline 195 downward and the bell crank 179 swings clockwise to its Fig. 10 position. As cam 192 continues to rotate, the slope 196 comes into engagement with the end of pin 197 and pushes the latter pin to the left in the bell crank until it occupies the position shown in Fig. 12. Thereafter, if sheets continue to be fed to each of the sets of grippers 62, 62', the rod 137 remains retracted within the drum 39 and the bell crank 179 remains in its extreme clockwise position, thereby maintaining hook member 162 against stud 160 as it travels up and down. The first upward movement of hook member 162 subsequent to the initial clockwise rotation of bell crank 179 acts to raise stud 160 and throw the printing impression on between cylinders 26 and 27.

In the embodiment described, it is to be noted that each of the plurality of sets of grippers which, together with the chains, comprise the conveyor for conveying sheets from the first unit to the second, is provided with a detecting device which assumes one condition when a sheet is present in the grippers, and another condition when a sheet is absent, and as each of the sets of grippers approaches the succeeding printing unit, its detecting device cooperates with further detecting devices in the conveyor drum associated with that unit, to control the impression mechanism in accordance with the condition of each of the first detecting devices. Thus one part of the detecting mechanism is set at the point where the grippers receive a sheet, and this part is carried to a remote point where it actuates the other part of the detecting mechanism.

Although in some of its aspects the invention is particularly applicable to flexible conveyors, as disclosed in the drawings, it is obvious that the detector mechanism herein disclosed may be employed in connection with any set of sheet grippers on a cylindrical transfer device employing one or more sets of grippers, as well as upon a flexible conveyor, or, in fact upon cylinders other than transfer cylinders, such, for example, as impression cylinders.

It is also obvious that the cylinder 28 instead of being an impression cylinder may be merely a feeding cylinder which conveys the sheet from some previous point in the machine to the grippers which convey the sheet to the impression cylinder 26.

Having thus described my invention, I claim:

1. In sheet handling mechanism, a sheet gripper finger and pad, means for presenting sheets to said gripper and pad with their forward portions transversely taut, a detector finger associated with said gripper and pad on the side of the sheet path remote from the gripper finger, said detector finger being biased toward one position and having a portion adapted to present a substantial surface area to the taut surface of the advancing sheet, whereby the finger is deflected toward another position, and control means functioning in response to the position of said detector finger.

2. In sheet handling mechanism, a sheet gripper finger and pad, means for presenting sheets to said gripper and pad with their forward portions transversely taut, a detector finger associated with said gripper and pad on the side of the sheet path remote from the gripper finger, said detector finger being biased toward one position and having a portion adapted to present a substantial surface area to the taut surface of the advancing sheet, whereby the finger is deflected toward another position, and control means functioning in response to the position of said detector finger, the parts being so constituted and arranged that when a sheet is taken, said gripper finger acts to hold said detector finger in deflected position.

3. In a printing machine, a printing couple, means for conveying sheets to said printing couple comprising a set of traveling sheet grippers, means for feeding sheets to said grippers at a given point in their travel, a sheet detector finger traveling with said grippers arranged to assume at that point either of two positions depending upon whether or not a sheet is taken from said feeding means, and mechanism functioning at a point with respect to the direction of sheet travel substantially spaced from said first-named point for controlling the impression of said printing couple, the operation of said mechanism being dependent upon the position of said finger.

4. In a printing machine, a printing couple, throw-off mechanism therefor, means for conveying sheets to said printing couple comprising a set of traveling sheet grippers, means for feeding sheets to said grippers, a sheet detector finger traveling with said grippers arranged to assume

either of two different positions depending upon whether or not a sheet is taken from said feeding means, and means associated with said conveying means at another point thereof for detecting the position of said finger, said last-named means functioning when no sheet is in the grippers for initiating the operation of said throw-off mechanism.

5. In a printing machine, a printing couple, an endless conveyor comprising a set of sheet grippers arranged in alignment transversely of the conveyor, means at one end of the conveyor for feeding sheets to said grippers, a sheet detector finger traveling with said grippers arranged to assume either of two different positions depending upon whether or not a sheet is taken from said feeding means, and control mechanism at the opposite end of the conveyor responsive to the position of said finger.

6. In a printing machine, a printing couple, an endless conveyor therefor comprising a plurality of sets of sheet grippers, means for feeding sheets to said grippers, a sheet detector finger traveling with each set of grippers arranged to assume either of two different positions depending upon whether or not a sheet is taken from said feeding means by that set of grippers, and mechanism associated with said conveyor at a point remote from said feeding means for controlling the impression of said printing couple, the functioning of said mechanism being dependent upon the position of each finger as it passes said point.

7. In a printing machine, a printing couple, an endless conveyor comprising a set of sheet grippers, a finger traveling with said grippers mounted to swing on an axis transverse to the direction of travel, means for feeding sheets to said conveyor in a transversely taut condition comprising grippers staggered in relation to said conveyor grippers, one end of said finger being spring-biased to a given position and being swung to another position by the engagement of a sheet as it is transferred from the feeding grippers to the conveyor grippers, and control means associated with said conveyor at a point remote from the sheet-taking point, said control means functioning in response to the position of said finger.

8. In a printing machine, a printing couple, an endless conveyor comprising a set of sheet grippers, a finger traveling with said grippers mounted to swing on an axis transverse to the direction of travel, means for feeding sheets to said conveyor comprising grippers staggered in relation to said conveyor in a transversely taut condition grippers, said finger being spring-biased to a given position and being arranged to present a substantial surface to the surface of a sheet being taken from said feeding means, whereby the finger is swung to another position by the movement of the sheet into said conveyor grippers, and control means associated with said conveyor at a point remote from the sheet-taking point, said control means functioning in response to the position of said finger.

9. In sheet-handling mechanism, a set of sheet-feeding grippers and a set of sheet-receiving grippers, the grippers of one set being staggered with respect to those of the other set, a finger associated with one of the grippers of the receiving set mounted to swing about an axis transverse to the direction of travel of the sheet, said finger being arranged to present a surface of substantial extent to a surface of the sheet while the latter is held taut by the feeding grippers on opposite sides of said finger, whereby the finger is swung upon its axis by the transfer of a sheet from the feeding grippers to the receiving grippers, and control means responsive to the position of said finger.

10. In sheet-handling mechanism, a set of sheet-feeding grippers and a set of sheet-receiving grippers, the grippers of one set being staggered with respect to those of the other set, a finger associated with one of the grippers of the receiving set mounted to swing about an axis transverse to the direction of travel of the sheet, said finger being arranged to present a surface of substantial extent to a surface of the sheet while the latter is held taut by feeding grippers on opposite sides of said finger, whereby the finger is swung upon its axis by the transfer of a sheet from the feeding grippers to the receiving grippers, the receiving gripper associated with said finger overlying said finger after the latter is swung on its axis, whereby the finger is positively held in its deflected position, and control means responsive to the position of said finger.

11. In a printing machine, sheet conveying means comprising a set of sheet grippers arranged in alignment transversely of the conveying means, means for feeding transversely taut sheets to said grippers at one point in the travel of the latter, a finger associated with one of said grippers mounted to swing on an axis transverse to the direction of movement of the sheet, one end of said finger being bifurcated and bent over toward the direction of movement of the sheet to present a surface of substantial extent to a surface of the sheet, whereby the finger is swung on its axis by the advancing sheet, one of the receiving grippers being bifurcated and overlying said finger in its deflected position for positively retaining the finger in that position, a plunger on the conveying means capable of passing through the bifurcations of said gripper and finger, said plunger abutting said finger when deflected, and control means associated with said conveying means responsive to the capacity of said plunger for moving or not moving through said gripper and finger bifurcations.

12. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, connections between the drum and the rod for reciprocating the rod when it is oscillated relative to the drum, detector mechanism operatively associated with said grippers, said means for oscillating said rod being responsive to the condition of said detector mechanism, and throw-off mechanism responsive to axial movement of said rod.

13. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum for axial and oscillating rotational movement with respect to the drum, connections between the drum and the rod for reciprocating the rod when it is oscillated relative to the drum, a lever within the drum, means for imparting a complete oscillation thereto for each revolution of the drum, drive mechanism for imparting rotary oscillation to said rod from said oscillating lever, detector mechanism associated with said grippers, means responsive to the condition of said detector mechanism for controlling said drive mechanism, and throw-off mechanism responsive to axial movement of said rod.

14. In mechanism of the character described, a drum, sheet grippers associated with the drum,

a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, connections between the drum and the rod for reciprocating the rod when it is oscillated relative to the drum, detector mechanism associated with said grippers, said means for imparting oscillation to the rod being responsive to the condition of said detector mechanism when no sheet is carried by the grippers, and impression throw-off mechanism arranged to be set in operation by the outward movement of the rod.

15. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, connections between the drum and the rod for reciprocating the rod when it is oscillated relative to the drum, detector mechanism associated with said grippers, said means for imparting oscillation to said rod being responsive to the condition of said detector mechanism when no sheet is carried by the grippers, and impression throw-off mechanism arranged to be set in operation toward impression-off position by the outward movement of the rod, said throw-off mechanism comprising means for automatically maintaining itself in impression-off position during the inward movement of the rod.

16. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, a coarse screw connection between the drum and the rod for moving the rod lengthwise when it is rotated relative to the drum, detector mechanism associated with said grippers, said means for imparting oscillation to said rod being responsive to the condition of said detector mechanism when no sheet is carried by the grippers, impression throw-off mechanism arranged to be set in operation toward impression-off position by the outward movement of the rod, said throw-off mechanism comprising means for automatically maintaining itself in impression-off position during the inward movement of the rod, and means for automatically shifting the throw-off mechanism to impression-on position when the rod fails to rotate.

17. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum for axial and rotational movement with respect to the drum, a coarse screw connection between the drum and the rod for moving the rod lengthwise when it is rotated relative to the drum, a lever within the drum, a pinion keyed to said rod, a rack in mesh with said pinion, means dependent upon drum movement to impart a complete oscillation to the lever, detector mechanism associated with said grippers, and means responsive to the condition of said detector mechanism when no sheet is carried by the grippers for coupling said rack to said lever.

18. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum for axial and rotational movement with respect to the drum, a coarse screw connection between the drum and the rod for moving the rod lengthwise when it is rotated relative to the drum, a lever within the drum, a pinion on said rod, a rack in mesh with said pinion, means dependent upon drum movement to impart a complete oscillation to the lever for each revolution of the drum, detector mechanism associated with said grippers, coupling means between said lever and rack biased toward operative position, and means responsive to the condition of said detector mechanism when a sheet is carried by the grippers for disabling said coupling means.

19. In a printing machine, a printing couple, a sheet gripper comprising a bifurcated gripper finger and spaced pad lands with which the said bifurcations cooperate, a detector finger adapted to be moved by an advancing sheet into position between said lands and to be held in that position by the closed grippers, a plunger mounted between said lands held against movement in one direction by said detector finger when the latter is held by said closed grippers, and means for effecting a throw-off of the impression of said printing couple functioning when said plunger is free to move in said direction.

CHRISTEN R. KADDELAND.

CERTIFICATE OF CORRECTION.

Patent No. 2,392,391. January 8, 1946.

CHRISTEN R. KADDELAND.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, first column, lines 54 and 55, claim 8, strike out the words "in a transversely taut condition" and insert the same after "conveyor", line 53, same claim; page 8, second column, line 28, claim 18, strike out "for each revolution of the drum"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of April, A. D. 1946.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.

a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, connections between the drum and the rod for reciprocating the rod when it is oscillated relative to the drum, detector mechanism associated with said grippers, said means for imparting oscillation to the rod being responsive to the condition of said detector mechanism when no sheet is carried by the grippers, and impression throw-off mechanism arranged to be set in operation by the outward movement of the rod.

15. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, connections between the drum and the rod for reciprocating the rod when it is oscillated relative to the drum, detector mechanism associated with said grippers, said means for imparting oscillation to said rod being responsive to the condition of said detector mechanism when no sheet is carried by the grippers, and impression throw-off mechanism arranged to be set in operation toward impression-off position by the outward movement of the rod, said throw-off mechanism comprising means for automatically maintaining itself in impression-off position during the inward movement of the rod.

16. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum means dependent upon drum movement operable to impart a complete oscillation to said rod, a coarse screw connection between the drum and the rod for moving the rod lengthwise when it is rotated relative to the drum, detector mechanism associated with said grippers, said means for imparting oscillation to said rod being responsive to the condition of said detector mechanism when no sheet is carried by the grippers, impression throw-off mechanism arranged to be set in operation toward impression-off position by the outward movement of the rod, said throw-off mechanism comprising means for automatically maintaining itself in impression-off position during the inward movement of the rod, and means for automatically shifting the throw-off mechanism to impression-on position when the rod fails to rotate.

17. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum for axial and rotational movement with respect to the drum, a coarse screw connection between the drum and the rod for moving the rod lengthwise when it is rotated relative to the drum, a lever within the drum, a pinion keyed to said rod, a rack in mesh with said pinion, means dependent upon drum movement to impart a complete oscillation to the lever, detector mechanism associated with said grippers, and means responsive to the condition of said detector mechanism when no sheet is carried by the grippers for coupling said rack to said lever.

18. In mechanism of the character described, a drum, sheet grippers associated with the drum, a rod axially mounted in the drum for axial and rotational movement with respect to the drum, a coarse screw connection between the drum and the rod for moving the rod lengthwise when it is rotated relative to the drum, a lever within the drum, a pinion on said rod, a rack in mesh with said pinion, means dependent upon drum movement to impart a complete oscillation to the lever for each revolution of the drum, detector mechanism associated with said grippers, coupling means between said lever and rack biased toward operative position, and means responsive to the condition of said detector mechanism when a sheet is carried by the grippers for disabling said coupling means.

19. In a printing machine, a printing couple, a sheet gripper comprising a bifurcated gripper finger and spaced pad lands with which the said bifurcations cooperate, a detector finger adapted to be moved by an advancing sheet into position between said lands and to be held in that position by the closed grippers, a plunger mounted between said lands held against movement in one direction by said detector finger when the latter is held by said closed grippers, and means for effecting a throw-off of the impression of said printing couple functioning when said plunger is free to move in said direction.

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