

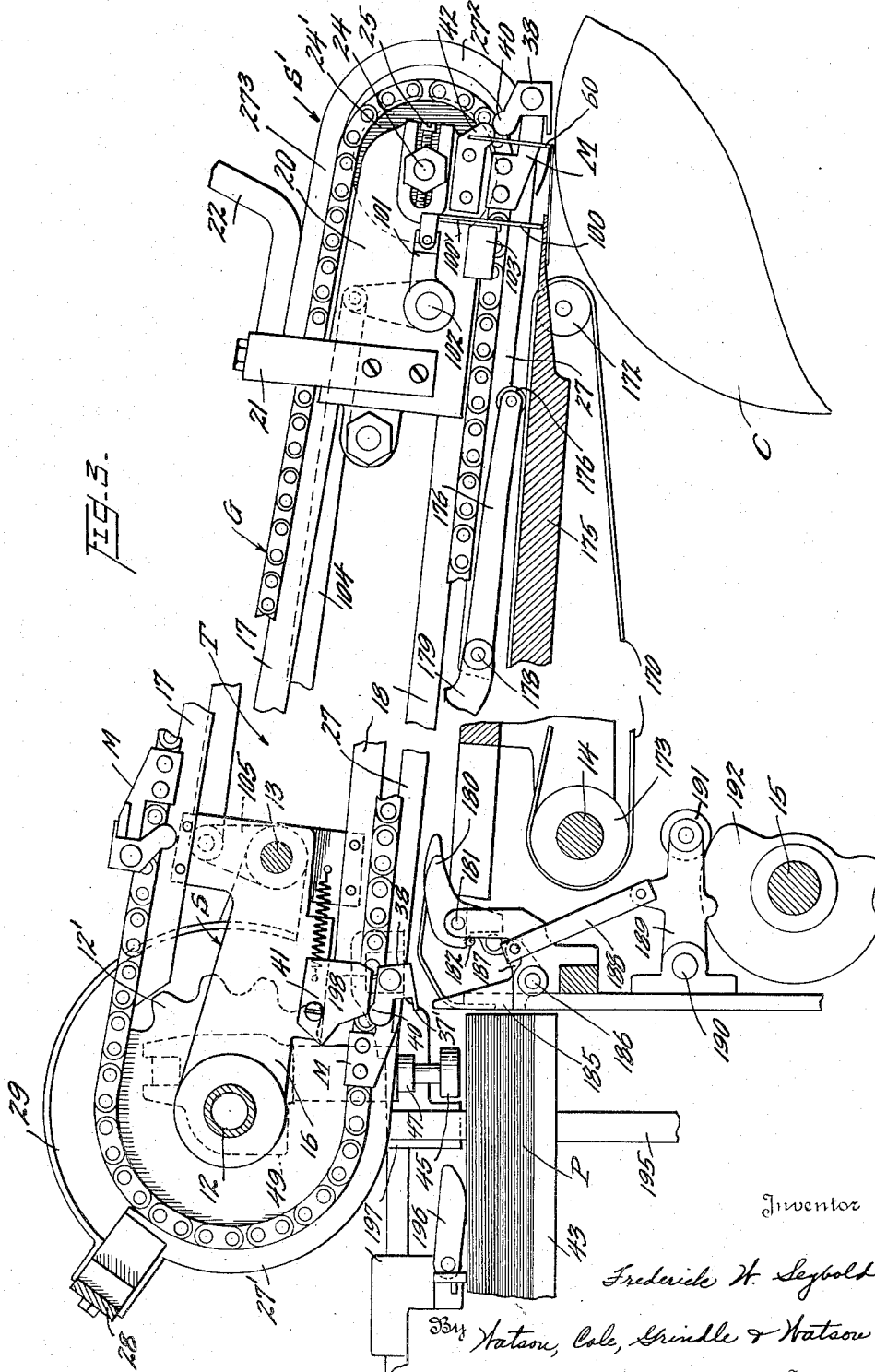
Dec. 31, 1940.

F. W. SEYBOLD
CHAIN GRIPPER FEEDER

2,227,370

Filed May 24, 1939

8 Sheets-Sheet 3



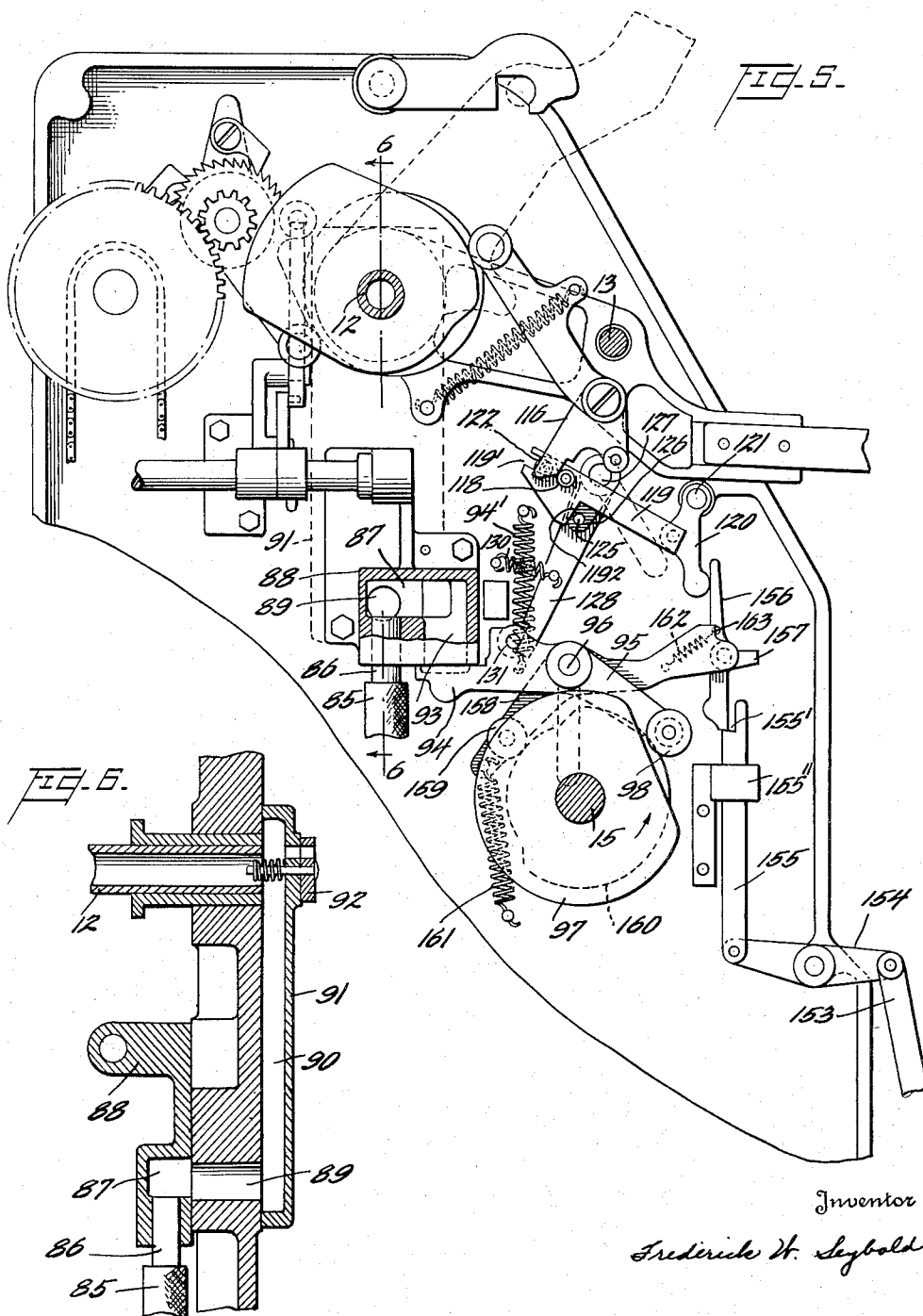
Dec. 31, 1940.

F. W. SEYBOLD
CHAIN GRIPPER FEEDER

2,227,370

Filed May 24, 1939

8 Sheets-Sheet 5



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Dec. 31, 1940.

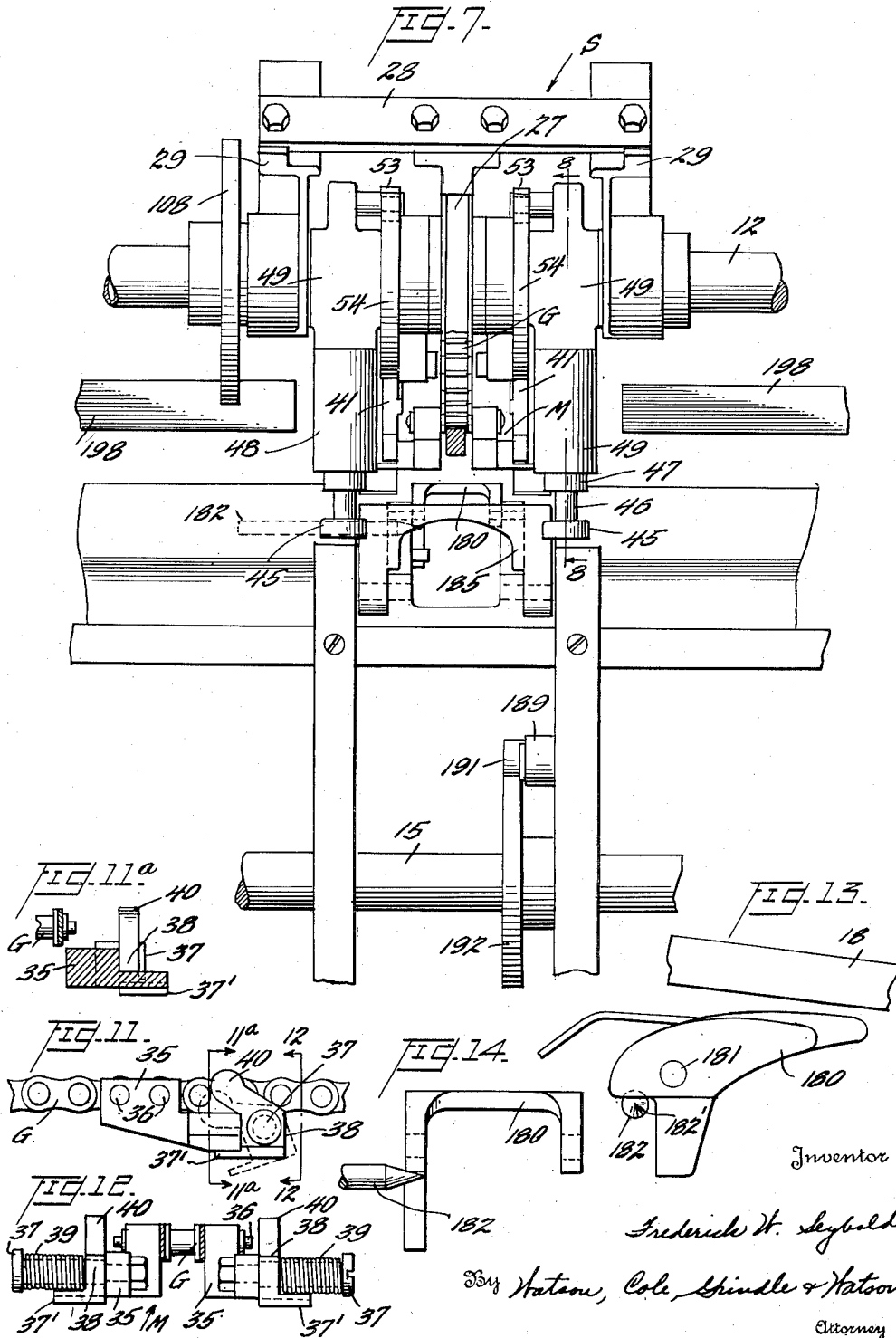
F. W. SEYBOLD

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CHAIN GRIPPER FEEDER

Filed May 24, 1939

8 Sheets-Sheet 6



Dec. 31, 1940.

F. W. SEYBOLD

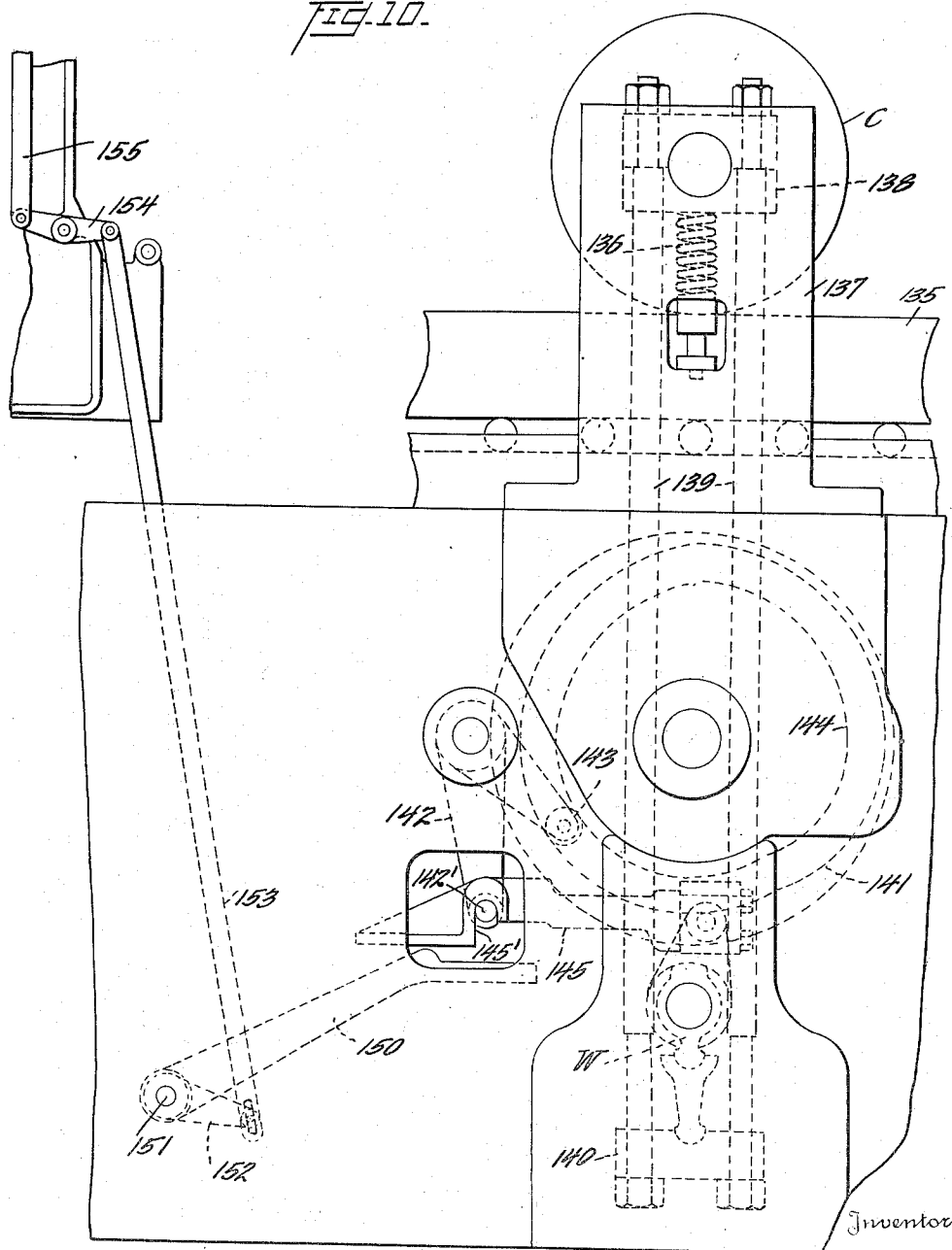
2,227,370

CHAIN GRIPPER FEEDER

Filed May 24, 1939

8 Sheets-Sheet 7

FIG. 10.



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Dec. 31, 1940.

F. W. SEYBOLD
CHAIN GRIPPER FEEDER

2,227,370

Filed May 24, 1939

8 Sheets-Sheet 8

FIG. 15.

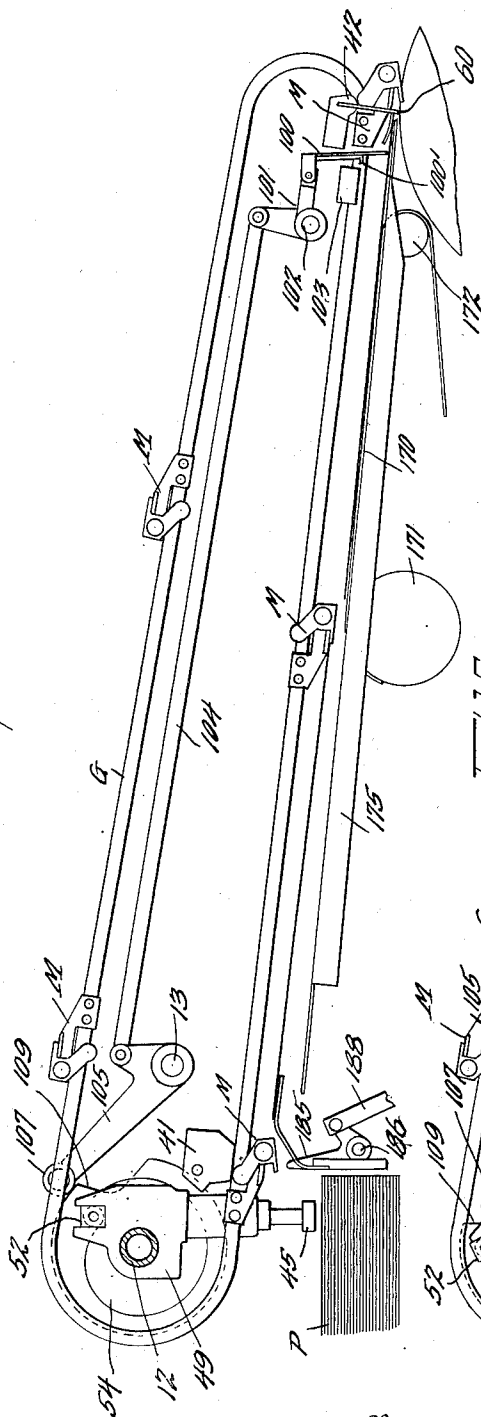
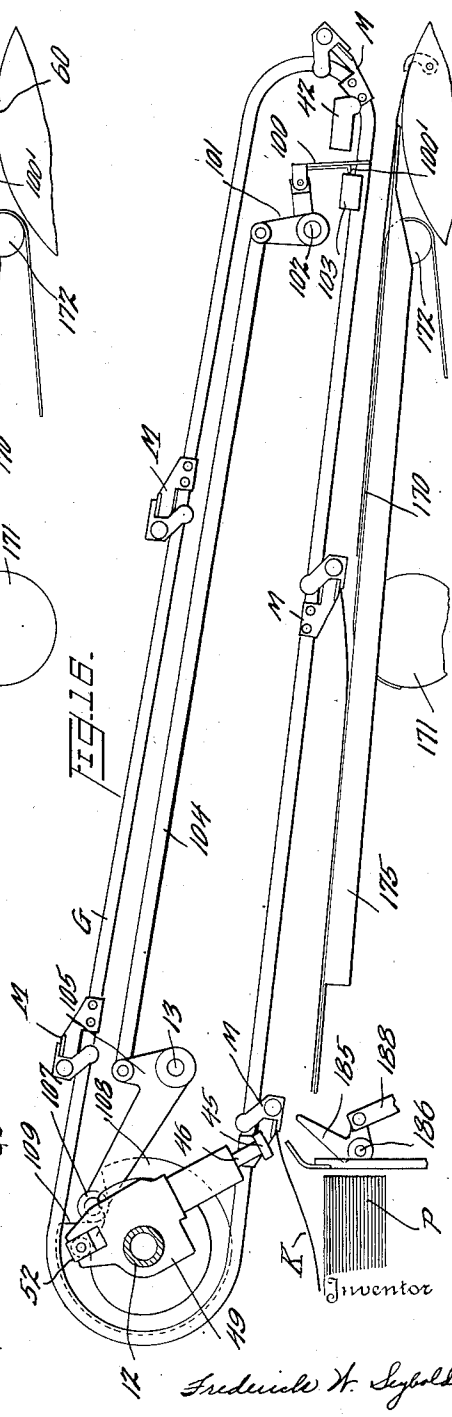


FIG. 16.



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UNITED STATES PATENT OFFICE

2,227,370

CHAIN GRIPPER FEEDER

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a corporation of New Jersey

Application May 24, 1939, Serial No. 275,555

15 Claims. (Cl. 271-12)

The present invention relates to sheet feeding mechanisms and particularly to mechanisms of this general character which are designed and intended for use in the successive feeding of individual sheets from a pile of sheets to a printing press.

sheet detecting element positioned adjacent the point at which the conveyed sheets are discharged from the conveyor, this sheet detecting element being operatively connected to that mechanism associated with the printing press which controls the rising and falling movements of the impression cylinder. This mechanism is so organized that, whenever during the operation of the feeder there is a failure of the same to deliver a sheet at a time during the operative cycle when a sheet should be delivered, the impression cylinder of the press is maintained in inoperative position and not allowed to move into printing relationship with the type bed or cylinder. In this way all chance that the printing blanket upon the impression cylinder may be directly printed upon due to failure of the paper supply is eliminated.

The improved sheet feeding mechanism includes a number of other novel features of importance all of which will be hereinafter referred to and specifically pointed out in the claims. One form of the invention is illustrated in the accompanying drawings but it will be appreciated by those skilled in the art that the mechanism so illustrated is set forth by way of example only and that minor changes may be made in the design and arrangement of the component elements of the invention without departure therefrom.

In the drawings:

Figure 1 is a top plan view of the improved sheet feeding mechanism;

Figure 2 is a side elevation of the same;

Figure 3 is a section on line 3-3 of Figure 1, with the parts being shown on a somewhat larger scale;

Figure 4 is an end view of the sheet feeding mechanism;

Figure 5 is a section on line 5-5 of Figure 1;

Figure 6 is a section on line 6-6 of Figure 5;

Figure 7 is an end view of the feeder, the side frames, and certain other laterally positioned parts being omitted and the central portion being shown upon an enlarged scale;

Figure 8 is a section on line 8-8 of Figure 7;

Figure 9 is a view showing the driving gearing, this gearing being shown partially in end elevation and partially in section along the line 9-9 of Figure 2;

Figure 10 is a partial side elevation of portion of the printing press with which the feeder is associated, showing the impression cylinder lifting mechanism;

Figure 11 is a side elevation of one of the sheet

The purpose of the invention is to provide a smoothly working rapidly acting sheet feeding mechanism by means of which sheets are positively gripped and transferred from a pile to a predetermined point of discharge. The improved mechanism is continuously effective and is not subject to interruptions such as frequently occur where the sheet transfer means is not of the positively acting type. For instance, where sheets are forwarded to a printing machine or the like by friction tapes, which is a very commonly used means for accomplishing this objective, it rather frequently happens that, by reason of the presence of static electricity or for other reasons, a sheet or sheets will not be transferred squarely to the point at which it is to be engaged by gripping instrumentalities associated with the printing press, but will swing or turn to one side or the other, or stick on the feed board, so that the passage of the sheet is delayed and stoppage of the press brought about. It has heretofore been proposed that these difficulties may be overcome by providing a mechanism equipped with devices for positively gripping each sheet at or near the pile of sheets from which it is lifted and advancing the sheet to the point of disposition while maintaining such positive grip. The mechanism which comprises the subject matter of the present invention, however, embodies a number of features of construction of novel character which, taken together, render the improved mechanism superior in action to other devices of this general character heretofore proposed.

The sheet conveyor utilized includes an endless flexible conveying element and this element is driven in one direction, its operation at no time being reversed. A novel form of driving means is provided by means of which the conveyor is intermittently actuated at predetermined time intervals, coming to a complete rest between movements to permit the discharge of one sheet at one place and the attachment of a fresh sheet just lifted from the pile. The sheet gripping devices associated with the conveyor are of novel character and likewise the mechanism for removing sheets singly from a pile of sheets and transferring such sheets to the sheet grippers on the conveyor.

The mechanism is likewise provided with a

gripping devices which forms portion of the conveyor;

Figure 11a is a section on line 11a—11a of Figure 11;

Figure 12 is a section on line 12—12 of Figure 11;

Figure 13 is a detail showing a caliper member; Figure 14 is a view of the caliper shown in Figure 13, as seen from the left in Figure 13; and

Figures 15 and 16 are generally similar to Figure 2 but are rather diagrammatic in that various parts are omitted and those which are shown are illustrated in different positions in order that operation of the sheet feeding mechanism may be more clearly understood.

As may be seen clearly in Figure 3 of the drawings, the sheet feeding mechanism is positioned to transfer sheets horizontally from a pile P to the impression cylinder of a press, indicated at C. The conveyor is generally indicated at T and the pile supporting and raising mechanism, the conveyor, and the means for removing sheets singly from the pile and transferring them in succession to the conveyor, are all supported upon a suitable framework which is preferably separate from the frame of the press but is readily attachable thereto so as to comprise, in effect, an integral portion of the press.

This frame comprises similar side frame members 10 and 11 disposed in parallel vertical planes and suitably held in fixed spaced relationship, being connected for instance by fixed shafts or rods and by rotatable shafts upon which are mounted certain of the operating parts of the feeding mechanism. Among these transversely extending shafts are the shafts 12, 13, 14 and 15, shown in section in Figure 3, shafts 12, 14 and 15 having their respective ends rotatably supported in the side frame members 10 and 11. Mounted upon the horizontally extending members 12 and 13 is a sub-frame S and secured to the central member 16 of this sub-frame are the upper ends of two downwardly and forwardly inclined conveyor chain guides 17 and 18, the opposite ends of which guide members are secured to the central member 20 of a second sub-frame S' positioned immediately above the impression cylinder C. Sub-frame S' includes a transversely extending bracket 21 to which is in turn secured a forwardly extending hook-shaped member 22 adapted to extend above a bar 23 which forms portion of the press so that the conveyor portion of the feeder may be said to be mounted upon a frame which is supported at one end upon the feeder frame and at the other end upon the press frame. The details of construction of the press frame are not illustrated, comprising no portion of the present invention.

The frame bars 17 and 18 comprise substantially parallel guides for the upper and lower reaches of a conveyor chain generally indicated at G, this chain being endless and passing around a sprocket 12' fixed upon shaft 12 for rotation therewith and around a second sprocket or disc 24' rotatably mounted upon a transversely extending shaft 24 which is carried by the frame S'. The ends of shaft 24 pass through slots in frame S' and adjusting screws 25 pass through shaft 24 at spaced points, each such screw lying in one of the aforementioned slots and having its inner end resting against the bottom of such slot. By manipulating the screws 25, the shaft 24 may be adjusted and the chain G tightened as may be necessary from time to time to com-

pensate for lengthening of the chain due to wearing of its parts, when wear occurs. The lower reach of the conveyor chain is guided not only by the member 18 but likewise by member 27 disposed parallel to member 18 and having at its ends curved extensions 27' and 27" disposed circularly around the axes of shafts 12 and 24, respectively, the end of the curved portion 27' being attached to a horizontal member 28 the ends of which are mounted upon parts 29 of sub-frame S disposed parallel to the side frame members 10 and 11 and which are supported upon shaft 12. The curved portion 27" meshes with a short straight portion 27" parallel to bar 17 and the end of which is attached to the transverse frame member 21. It will thus be perceived that the lower reach of the conveyor chain G is precisely guided between upper and lower guides 18 and 27, and that those portions of the chains which are passing around the sprockets or rotatable supports upon which the chain is mounted are substantially protected.

The conveyor chain G comprises a carrier for a plurality of sets of gripper units M, there being two gripper units in each set, as shown in Figure 12, and the several sets of gripper units being equidistantly spaced along the chain, there being five such sets in the form of the invention selected for illustration. All of the gripper units are identical in construction and only one need be described, although it will be appreciated that half of the units project from the chain in one direction and half in the opposite direction so that the two units of each set are reversed with respect to each other. Each unit includes a chain block 35 which is supported upon extensions of two adjacent chain pins 36. The chain block is extended longitudinally of the chain and at its free end has secured thereto a pin 37, disposed normally to the plane of the chain. Rotatably mounted upon the pin 37 is the movable or rocking gripper jaw 38 which is normally urged by the torsion spring 39 to rotate about pin 37 in such direction as to cause its jaw extension 37' to come into close contact with the downwardly facing surface of the stationary member just above and to grip the margin of a sheet of paper which may have been placed between the stationary and movable jaws when the movable jaw has been rocked to the position in which it is shown in dotted lines in Figure 11. Each movable gripper jaw has an extension 40 by means of which it may be rocked upon its pivotal support by stationary cam members positioned along the path of movement of the gripper. Two such members are provided, the stationary cam member 41 being positioned to effect opening of a gripper passing immediately below the same to permit the insertion of an edge of a paper sheet, and the stationary cam member 42, positioned at the opposite end of the conveyor, being provided to effect opening of the gripper to permit discharge of the paper sheet. It will be appreciated that the cams 41 and 42 are arranged in pairs, as are the grippers. Each gripper is normally closed, as previously explained, and is opened only to receive a paper sheet at one point and to permit its release at a second point, the paper sheet being positively gripped and firmly held by two such grippers while being moved from the vicinity of the pile board to its point of discharge at the opposite end of the conveyor.

A pile board is indicated at 43 and it will be understood that this board comprises portion of a

complete automatic pile raising mechanism by means of which the top of the pile is maintained substantially at a constant level with the uppermost sheet thereof in a position to be removed by a sheet feeding device. The details of construction of the pile elevation mechanism, however, comprise no portion of the present invention and need not be here described. The mechanism employed for separating from the pile its uppermost sheet and transferring this sheet to one or other of the chain supported pairs of grippers will now be described.

The effective instrumentality for actually engaging the uppermost sheet comprises a suction gripping element 45, preferably of soft rubber, which is mounted upon the lower end of a tube 46 to which the piston 47 is secured. Piston 47 slidably fits within a cylindrical member 48 attached to a frame 49 which is mounted upon and rigidly attached to the tubular shaft 12, so as to be rotatable with that shaft at all times. Frame 49 is hollow and its hollow interior is in constant communication with the interior of shaft 12 through suitable apertures 50 and in constant communication with the interior of the tube 46 through an aperture 51. The upper end of tube 46 projects through a cylindrical aperture formed in the frame and to this end is secured a block 52 slidable in a slot formed in the frame, block 52 having a roller 53 projecting laterally therefrom, the axis of the roller being parallel to the axis of the shaft 12, and the peripheral surface of the roller being adapted to engage the peripheral surface of a cam 54 which, while encircling the shaft 12, is not attached thereto but which is, on the other hand, a stationary cam.

It will be understood that in the operation of the device a control valve to be hereinafter described is provided to control communication between the recess formed in the frame 49 and a source of reduced pressure, such as a tank in which a sub-atmospheric pressure exists, or a vacuum pump. By manipulating the valve to establish a sub-atmospheric pressure in frame 49, the piston 47 will be drawn toward shaft 12 and the suction gripper 45 correspondingly retracted. When atmospheric pressure is reestablished, the piston 47, tube 46 and gripper 45 will be caused to descend under the influence of gravity so that the gripping element 45 will come into contact with the uppermost sheet of the pile. This sheet then closes the relatively small port 55 in the lower face of the suction gripper 45 so that when the interior of the frame 49 is connected to a source of reduced pressure, the suction gripper 45 will rise, carrying the margin of the paper with it. At the same time the suction gripper 45 is caused to move in a counter-clockwise direction, for instance to the position in which it is shown in Figure 16, by reason of rotation of the shaft 12 which is driven by mechanism to be hereinafter described.

As shown in Figure 16, the suction gripper 45 has released the sheet K which it has just lifted and moved forwardly and which has already been gripped by one pair of gripping elements M. Movement of the suction gripper 45 is, however, not halted at this point but continues about shaft 12 as an axis of rotation until the hollow stem 46 which supports the same is again vertically, or substantially vertically disposed, at which point the suction gripper is resting upon the uppermost sheet of the pile. Sub-atmospheric pressure within the hollow frame 49 is again established, thus causing the elevation of the suction gripper

with a sheet attached and the frame and gripper are rocked forwardly in an anti-clockwise direction to deliver a second sheet to a second set of grippers M which have in the meantime been moved into position to receive this second sheet, and opened. This cycle of movements is rapidly repeated and the action continued until the desired number of sheets have been fed, there being a sheet removed from the conveyor at the opposite end thereof for each one added at the end adjacent the pile. As may be clearly observed from the drawings, there are two suction gripping elements 45 and two rotatably mounted interconnected frames 49 upon which these gripping elements are supported, but it is not necessary to describe the second gripping means because of identity between the two.

The member 60, shown most clearly in Figures 3 and 15, comprises the front gauge of the press. While the members of the press which carry the gauge 60 are not illustrated, it will be understood that the gauge member is of the usual type and is moved into and out of position to intercept the leading edge of the sheet being advanced by the conveyor. The conveyor is so driven that it periodically is brought to a halt and the driving mechanism is so designed that the conveyor is at rest while a sheet is being moved from the pile and inserted into a gripper and is just approaching a full stop when the sheet is being released so that the leading edge of the sheet strikes the gauge member 60 while the sheet is still in motion but just after its release by the holding grippers has been effected. Thereafter the movement of the conveyor is continued and by reason of the peculiar drive mechanism employed, it is given a rapid acceleration during each cycle of its operation so that its movements are smooth but rapid.

The conveyor driving mechanism will now be described, this mechanism being illustrated most clearly in Figures 2 and 9. The shaft 15 which has previously been referred to is the power shaft and is driven by any suitable means, for instance by an electric motor at substantially constant speed or through a connection with the press with which the feeder is associated. Upon shaft 15 is mounted a gear 61 of relatively large diameter, the teeth of which mesh with the teeth of a smaller gear 62 fixed on shaft 14, also previously referred to. Upon shaft 14 is likewise fixed gear 63 which is in mesh with the small gear 64 mounted on stub shaft 65 and the rotary motion of which is communicated through gear 66 on stub shaft 67 to the large gear 68 which is rotatably mounted upon sleeve 69 which encircles the shaft 12, sleeve 69 being firmly supported in a bearing formed in the side frame. The large gear 68 is provided with a bearing 70 in which is rotatably supported a stub shaft 71, this stub shaft having fixed upon one end a planet gear 72 the teeth of which mesh with those of a sun gear 73 rigidly secured to the side frame, stub shaft 71 having fixed to its outer end a crank arm 75 carrying a pivot 76 upon which is rotatably supported a block 77. Block 77 is slidable in a slot 78 formed in arm 79 fixed upon the end of shaft 12. The planet gear 72 and sun gear 73 are provided with equal numbers of teeth and as the large gear 68 is revolved by the antecedent gear train, the arm 75 will revolve at uniform velocity about the axis of the rotatable stud 71. It will readily be perceived, however, that a variable speed will be imparted to shaft 12 due to the variable action of the crank 75 upon the arm 79, arm 79 moving at its greatest angular velocity about the axis of shaft 12 when the

crank 75 is passing to the position in which it is shown in Figure 9 and having zero velocity at the moment when the crank 75 is passing to a position 180° distant from the position in which it is shown in Figure 9. In other words, the axis of pin 76 will describe a cardioid curve and as a result of this construction the angular velocity of shaft 12 will vary from zero to an angular velocity which is one and one-third times that of the constant angular velocity of the gear 68. The various elements of the mechanism are so arranged with respect to each other that it is while shaft 12 is substantially without movement that the suction gripper 45 is caused to descend in contact with the uppermost sheet of the pile and to immediately thereafter lift the forward margin of the sheet from the pile. Likewise it is just as the velocity of the shaft 12 approaches zero that a pair of grippers is caused to release a sheet previously held thereby so that this sheet comes gently to rest against the front guides 60 of the press.

Naturally it is essential that the suction gripper 45 function in synchronism with the rotary movements of the frame 49 which is fixed on shaft 12 and to this end a sub-atmospheric pressure is established within the frame 49 at one point in the angular travel of this frame and atmospheric pressure re-established therein at another point. The means for effecting this is most clearly illustrated in Figures 5 and 6. A flexible tube is indicated at 85 in Figures 5 and 6, this tube being connected to a short tubular conduit 86 which opens into a valve chamber 87 formed in member 88 which is attached to a side frame member of the feeder. Chamber 87 communicates with a passageway 89 extending through the side frame member, which passageway is in turn in communication with a recess 90 formed in a cover plate 91 attached to the outside of the side frame member and extending upwardly so as to overlie the adjacent end of the rotatable hollow shaft 12. The vacuum tank or suction pump will be maintained in communication with the interior of the shaft 12 at all times and the degree of vacuum or the pressure within shaft 12 may be allowed to become atmospheric by bringing the valve chamber 87 into direct communication with the surrounding atmosphere through a port or duct indicated at 93 and the outer end of which may be closed by a valve 94 which forms one end of a valve lever 95 mounted for rocking movement upon the short stud 96. Lever 95 is yieldably urged toward closed position, which is the position in which it is illustrated in Figure 5, by means of a tension spring 94' and is positively rocked in the reverse direction (counter-clockwise) to open the port 93 to the atmosphere, by means of a cam 97 mounted upon the drive shaft 15, the rocking lever 95 having rotatably mounted upon its outer end a roller 98 adapted to be engaged by the periphery of the cam as the cam rotates. As may be observed from an inspection of the shape of cam 97, the roller 98 is in engagement with the periphery of this cam the major portion of the time so that the port 93 will remain open a major portion of the time, shaft 15 rotating at uniform velocity. It is of course only necessary that the suction gripper shall become effective when the frame 49 is in the position in which it is shown in Figure 15 and shall become ineffective prior to the time that it reaches the position in which it is shown in Figure 16. Hence the lever 95 is in valve closing position only briefly,

measured in terms of angular movement of the frame 49. It has previously been stated that the mechanism includes means for rendering the feeder inoperative in the event that any given pair of grippers fails to advance a sheet past a predetermined point adjacent the front guide 60 of the press. Likewise the impression cylinder of the press is withheld from movement in an operative position in the event that the conveyor fails to advance a sheet to the press guides when the conveyor is in operation. These mechanisms will now be described.

A sheet detecting finger is indicated at 100 and this finger is pivotally hung from the generally horizontally extending arm 101 of a bell crank lever pivotally mounted upon a stud 102 supported by the sub-frame S'. The lower end of detector finger 100 projects downwardly into the path of sheets being moved forwardly by the conveyor and in the event that a sheet is being moved forwardly by the conveyor, its leading edge will strike the detector finger and swing it forwardly to the position in which it is shown in Figure 15, the detector finger catch 100' being swung forwardly from beneath the transversely extending frame member 103 so that the detector finger will offer no resistance to rocking movement of the bell crank lever mounted upon stud 102, for instance from the position in which this lever is shown in Figure 15 to the position in which it is shown in Figure 16. Should, however, the detector finger 100 not be moved forwardly by a moving sheet carried by the conveyor at the proper instant in the operation of the mechanism as a whole, the detector finger catch 100' will remain beneath the frame member 103 and prevent rocking movement of the bell crank lever to which it is attached.

This bell crank lever is connected by means of a link 104 to a second bell crank 105 rockably mounted on a shaft 13, the free arm of the bell crank having rotatably mounted thereon a roller 107 which is adapted to bear on the periphery of a cam 108 fixed upon and revoluble with the shaft 12. Spring means (not shown) normally urges roller 107 against cam 108 and it is only when the cut-out portion 109 of the cam reaches the roller 107 that bell crank 105 is free to rock. Just prior to this, the leading edge of a sheet should have moved forwardly the detector finger but in the event that no sheet is presented to the detector finger at this instant the detector finger catch 100' will remain beneath the cross-piece 103 and no movement of the bell cranks and no entry of roller 107 into cut-out 109 can occur. When this happens, the valve operating lever 95 will be prevented from closing the port 93 and as a result the suction gripper 45 will not be energized and will not pick up a sheet from the pile. Hence it is clear that, should a sheet become stuck or wedged in the conveyor, the feeding of further sheets will be automatically prevented. The connection between the bell crank 105 and the valve operating lever 95 is most clearly shown in Figure 8 and is seen to include an arm 112 fixed on shaft 13, a link 113 connecting the end of arm 112, the end of a bell crank 114 rotatably mounted on stud 115 and having an arm 116 of the shape indicated. Arm 116 of this last mentioned bell crank is adapted to act upon a roller or pin 118 mounted upon a link 119 which link has one end pivotally connected to a lever 120 pivotally hung from a stud 121 and its opposite end is provided with a slot 119' within which projects a pin or stud 122 fixed on

the frame. The arm 116 of this bell crank, therefore, is adapted to move the link 119 longitudinally.

A shoulder 119² of link 119 is adapted to contact, when the link is moved in one direction, with a pin 125 on an arm 126 rotatably mounted upon a stud 127, the elongated swinging arm or lever 128 being likewise rockably mounted upon this stud and rigidly connected to arm 126. A spring 130 tends to move the lower end of the rocking lever or arm 128 into the arcuate path of movement of the stud or half round pin 131 fixed on lever 95 and if such movement occurs while lever 95 has been actuated to open the port 93, lever 128 will prevent return of the valve lever 95 to port closing position so that the duct 93 and the interior of shaft 12 is in constant communication with the atmosphere so that the suction gripping devices are rendered inoperative. However, movement of the lower end of rocker 128 into position to prevent closing of the valve can only occur when the link 119 is not moved by the bell crank comprising arms 116 and 114 and this only occurs when roller 107 is prevented from entering the cut-out 109 in the cam 108 due to retention of the detector finger catch 100² under the frame member 103. Hence the valve operating lever 95 is rendered inoperative to prevent closure of the valve only when the conveyor fails to present a sheet to the detector finger at the proper time.

Referring now to Figure 10, it will be observed that the impression cylinder C is in operative engagement with the bed 135 of the press, which bed is horizontally reciprocable. The impression cylinder is normally urged upwardly away from the bed by the springs 136 which are interposed between the frame member 137 and the impression cylinder bearings 138. Tie rods 139 connect bearings 138 to crossheads 140 and a toggle device W, which is of conventional form and need not be described in detail, normally urges the crosshead 140 downwardly and hence draws the impression cylinder C downwardly into contact with the bed 135. The toggle W is operated in synchronism with the movements of the bed 135 by means of a rotatable cam 141, a bell crank lever 142 having a follower 143 positioned in the cam groove 144 of cam 141, and a link 145 which connects the bell crank lever 142 to the toggle device W. It will be perceived that the movement of link 145 to the left, from the position in which it is shown in Figure 10, will break the toggle device, allow springs 136 to become effective to elevate the impression cylinder to inoperative position. Mechanism is provided for automatically effecting this in the event that no sheet to be printed is fed against the front guide of the press at a time just prior to an operation of the impression cylinder. This mechanism is shown in part in Figure 10 and in part in Figure 5. Just below link 145 is positioned the upper end of an arm 150 of a bell crank lever mounted upon stud 151. The other arm 152 of this bell crank is connected by a link 153 to one end of a rocking lever 154 and to the other end of this lever is pivotally connected a vertically disposed member 155 supported for sliding movement in a guide member 155². It will be clear that downward movement of member 156 will cause arm 150 of the lower bell crank to move in a counter-clockwise direction about stud 151 and cause it to contact with the end of link 145 and to raise this link so that the slot 145² therein disengages the pin 142² of the arm 142, thus

breaking the operative connection between the cam 141 and the impression cylinder. Hence rotation of the cam 141 will occur but no downward movement of the impression cylinder into operative position will result.

It will be perceived from an inspection of Figure 5 that the upper end of slide 155 is formed to provide a notch 155² for the reception of the lower end of a lever 156 pivotally mounted in turn upon the end of one arm 157 of the bell crank lever rotatably mounted upon stud 96, the other arm 158 of the bell crank being provided with a cam follower 159 which rests against the periphery of a cam 160 fixed upon rotatable shaft 15. The tension spring 161 maintains close contact at all times between roller 159 and the periphery of cam 160 and, because of the shape of cam 160, the bell crank lever 157—158 will be given an intermittent rocking movement as shaft 15 rotates, causing the lever 156 to move vertically. Lever 156 is normally held in the position in which it is held in Figure 5 by means of a tension spring 162 tending to rotate the same in a counter-clockwise direction and to maintain the stop 163 of lever 156 against an abutment surface of lever 157. With the parts as thus described, it is clear that the slide 155 will be depressed, and the impression cylinder C rendered inoperative, each time the shaft 15 rotates. As it is not desired that this shall occur, however, but only desired that the impression cylinder C shall be prevented from descending to operative position only when there is a failure in the supply of sheets printed, a connection is provided between the sheet detector finger 100 and the lever 156 whereby this lever is rendered ineffective to act upon and depress the slide 155 so long as sheets are being supplied in the proper manner and insures that lever 156 becomes active to connect slide 155 and the rocking lever 157, only in the event of a failure of the paper supply.

It has been previously pointed out that the link 119 ordinarily is caused to reciprocate and to swing aside lever 128 from the path of pin 131 whenever a sheet passes the detector finger and it has also previously been explained that the link 119 is operatively connected to the depending lever 120. The lower end of lever 120 rests against the upper end of lever 156 and hence, for every counterclockwise movement of lever 120 under the influence of the link 119, the lever 156 will be caused to revolve about its pivotal axis upon the end of bell crank arm 157, and this in turn disengages the lower end of 156 from the notch 155². When this occurs, lever 155² will not be forced downwardly to render the impression cylinder inoperative and of course this is the normal condition in the operation of the mechanism, since it is only rarely that a sheet fails to reach the detector finger 100 at the proper time.

To ensure close contact of the leading edge of a sheet reaching the front guides 60 of the press with those guides at all times prior to engagement of the sheet by the impression cylinder grippers (which grippers are not illustrated but which may be of any conventional type), friction tapes are employed, one of these tapes being indicated at 170 in Figures 2 and 3. There may be any desired number of these tapes which pass over tape guide rollers 171 and 172 and over the tape driving roller 173 mounted upon shaft 14. A tightening roller resting upon the upper reach of the endless tape in the vicinity of roller 171 is indicated at 174. Approximately one-half of the

upper reach of each tape overlies the feed table 175, the other half of this upper reach running below the feed table. The purpose of this is to cause the friction tapes to engage the underside of a sheet only where needed, i. e., at the end of the conveyor adjacent the press front guides, at which point the feed tapes will serve to press the edge of the sheet against the front guide after it has been released by a pair of grippers and to thus maintain the edge in correct position to be engaged by the impression cylinder grippers. To ensure the development of adequate frictional forces by the tapes against the undersurface of the paper sheet, the pressure rollers 176 are employed, each such roller being on the forward end of an arm 177 pivoted at 178 to a bracket 179 which is adjustably supported upon the chain guide bar 18 so that the roller 176 may be most advantageously positioned to accomplish its intended function.

A caliper device is provided to detect and prevent the transfer of two or more sheets by the conveyor to the press front guide and this caliper comprises a member 180 formed as shown most clearly in Figures 13 and 14 and pivotally mounted for rocking movement of adjustment about a horizontal axis as determined by studs 181. The distance between the upper surface of the caliper and the undersurface of the lower chain guide 27 may be adjusted by means of a horizontally extending adjusting member 182 which extends from the caliper to the outside of the machine, having a thread portion 183 which has threaded engagement with an aperture formed in the side frame member 11 and provided with a knurled finger piece 184. Rotation of the spindle-like member 182 will cause it to approach or recede from the caliper member and hence to raise or lower this member by rocking it about the axis of pivots 181, the inner end of the rod 182 being conical, as indicated at 182', and acting as a wedge. By the adjusting means just described, the distance between the upper surface of the caliper and the lower surface of rod 27 may be easily regulated for different thicknesses of the paper. After being adjusted to permit passage of one sheet only, the caliper will readily intercept a double sheet to prevent the passage of two sheets simultaneously onto the printing press.

The invention likewise includes a pile straightener which comprises essentially a plate 185 mounted for rocking movement about a horizontal axis upon pins 186, the inner face of member 185 being normally vertically disposed as shown in Figure 3. This rocking member is provided with an arm 187 connected by means of a link 188 to a lever 189 pivoted at 190 and having a cam follower 191 which normally rests upon the periphery of a cam 192 mounted upon the driving shaft 15. The cam 192 is so shaped that the pile straightening plate 185 is given a rocking movement from the vertical position in which it is shown in Figures 3 and 15 to the inclined position in which it is shown in Figure 16 and then back to the vertical position. Hence it is rocked out of the path of movement of the suction gripper 45 as that member carries forward to a pair of grippers M the leading edge of the sheet, but after passage of the suction gripper 45, the straightening plate 185 is returned to the position in which it is shown in Figure 3 to properly reposition on the top of the pile any sheets which may have been displaced by the withdrawal of a preceding sheet.

Associated with the pile board and pile elevating mechanism are vertically extending side guides 195 which are adjustably supported for movement laterally of the machine. Also hinged corner holders indicated at 196 are provided for definitely locating the corners of the pile of sheets to be fed, both the side guides and the corner holders being carried by brackets 197 which are supported for sliding movement upon aligned bars 198 projecting inwardly from the side frame members 10 and 11.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A sheet feeding mechanism comprising in combination, an endless conveyor element having spaced sheet grippers attached thereto, a circular guide about which the conveyor element passes, and a suction gripper revoluble about the axis of said guide for gripping the uppermost sheet of a pile and moving the same toward a sheet gripper on the conveyor element.

2. A sheet feeding mechanism comprising a pile support, an endless conveyor element, a circular guide about which said element passes a suction gripper above the support and mounted for revolution about the axis of said guide and also for movement toward and away from said axis, and mechanism for intermittently revolving said gripper and for moving the same toward and away from said axis, for the purpose set forth.

3. A sheet feeding mechanism comprising a pile support, a circular guide above the support, a conveyor chain passing around said guide, sheet grippers mounted on said chain and means revoluble about the axis of said guide for removing sheets singly from a pile on said pile support and transferring them to said sheet grippers.

4. In a sheet feeding mechanism, in combination, a suction gripper, means mounting said gripper for revolution about an axis and for movement toward and away from said axis, means for establishing a sub-atmospheric pressure in said gripper to cause it to grip a sheet and to move toward said axis, and means to retract said gripper mechanically in the event that it is caused to revolve while said first mentioned means is inoperative or ineffective.

5. In a sheet feeding mechanism, in combination, a suction gripper, means mounting said gripper for revolution about an axis and for movement toward and away from said axis, a sheet guide positioned in the path of movement of said gripper when extended, suction means for retracting the gripper, and mechanical means for retracting the gripper in the event that it is caused to revolve while said first mentioned means is inoperative or ineffective.

6. A sheet feeding mechanism comprising a conveyor, a pile board, a suction gripper, means for moving said gripper through an angle of 360° about a horizontal axis during which movement a paper sheet is transferred from a pile on said pile board to said conveyor, a pile straightening element normally disposed in the path of movement of said gripper, and means for withdrawing said pile straightener from said path and replacing the same after passage of the gripper.

7. In a sheet feeder, in combination, a pile board, a sheet stop spaced therefrom, a feed board intermediate the pile board and stop, a conveyor for positively gripping sheets in the vicinity of the pile board and releasing them in the vicinity

ity of the sheet stop, and endless tapes active only in the vicinity of said stop for urging released sheets against said stop.

8. A sheet feeding mechanism comprising in combination, a pile support, an endless conveyor having sheet gripping devices thereon, a conveyor support including means for guiding the conveyor along a circular path about a horizontal axis above the pile, and second means also revolvable about said axis for lifting a sheet from the pile and inserting it into one of said grippers while the conveyor is in motion.

9. The combination set forth in claim 8 in which said second means includes a frame revolvable about said horizontal axis at the same angular velocity as the conveyor, a suction gripper carried by the frame and revolvable therewith said suction gripper being more remote from the axis of rotation than is the conveyor so that it has a higher linear velocity than the conveyor, for the purpose set forth.

10. A sheet feeding mechanism including a sheet conveyor and means for advancing the conveyor at variable velocities, said means comprising a revolvable shaft to which the conveyor is operatively connected, an arm fixed upon and extending radially from said shaft, a second shaft parallel to said first shaft, means for revolving the said second shaft about the axis of the first shaft at uniform angular velocity and simultaneously rotating said second shaft about its own axis at uniform angular velocity, a second arm fixed on said second shaft and a member mounted on said second arm which slidably engages said first arm.

11. Means for actuating the driving shaft of a sheet conveyor comprising a second shaft parallel to the driving shaft, means for rotating the second shaft about its axis and also revolving it about the axis of said driving shaft, arms extending radially from both of said shafts, and means operatively connecting said arms whereby the driving shaft is revolved at a variable angular velocity when the second shaft is revolved at uniform angular velocity.

12. A sheet feeding mechanism comprising, in combination, an endless conveyor element, a circular guiding member about which the bight of said element passes, a member rotatable about the axis of said guide member, means for rotating said member in synchronism with the movement of said conveyor element, a sheet gripper mounted for reciprocation upon said rotatable element and also rotatable therewith, means for

reciprocating said sheet gripper to cause it to be extended from said member at one point along its orbit of rotation to seize a sheet, and for retracting it to deliver said sheet to said conveyor element at another point on said orbit.

13. A sheet feeding mechanism comprising, in combination, an endless chain conveyor element, a sprocket wheel about which the bight of said element passes, a member rotatable about the axis of said sprocket wheel, spaced grippers on said chain element, means for rotating said member in synchronism with the movement of said conveyor element, a suction sheet gripper mounted for reciprocation upon said rotatable element and also rotatable therewith, means for reciprocating said sheet gripper to cause it to be extended from said member at one point along its orbit of rotation to seize a sheet, and for retracting it to deliver said sheet to a gripper on said conveyor element at another point on said orbit.

14. A sheet feeding mechanism comprising, in combination, an endless chain conveyor element, a sprocket wheel about which the bight of said element passes, a member rotatable about the axis of said sprocket wheel, spaced grippers on said chain element, means for rotating said member in synchronism with the movement of said conveyor element, a suction sheet gripper mounted for reciprocation upon said rotatable element and also rotatable therewith, means for reciprocating said sheet gripper to cause it to be extended from said member at one point along its orbit of rotation to seize a sheet, and for retracting it to deliver said sheet to a gripper on said conveyor element at another point on said orbit, said means for reciprocating said suction gripper comprising both a suction actuator and a cam surface adapted to be contacted by a portion of said gripper during its rotation.

15. The combination set forth in claim 8 in which said second means includes a frame revolvable about said horizontal axis at the same angular velocity as the conveyor, a suction gripper carried by the frame and revolvable therewith, said suction gripper being more remote from the axis of rotation than is the conveyor so that it has a higher linear velocity than the conveyor, for the purpose set forth, and means for extending and retracting said suction gripper substantially radially with respect to said axis for seizing said sheet and delivering the same to the conveyor gripper respectively.

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