

Jan. 18, 1955

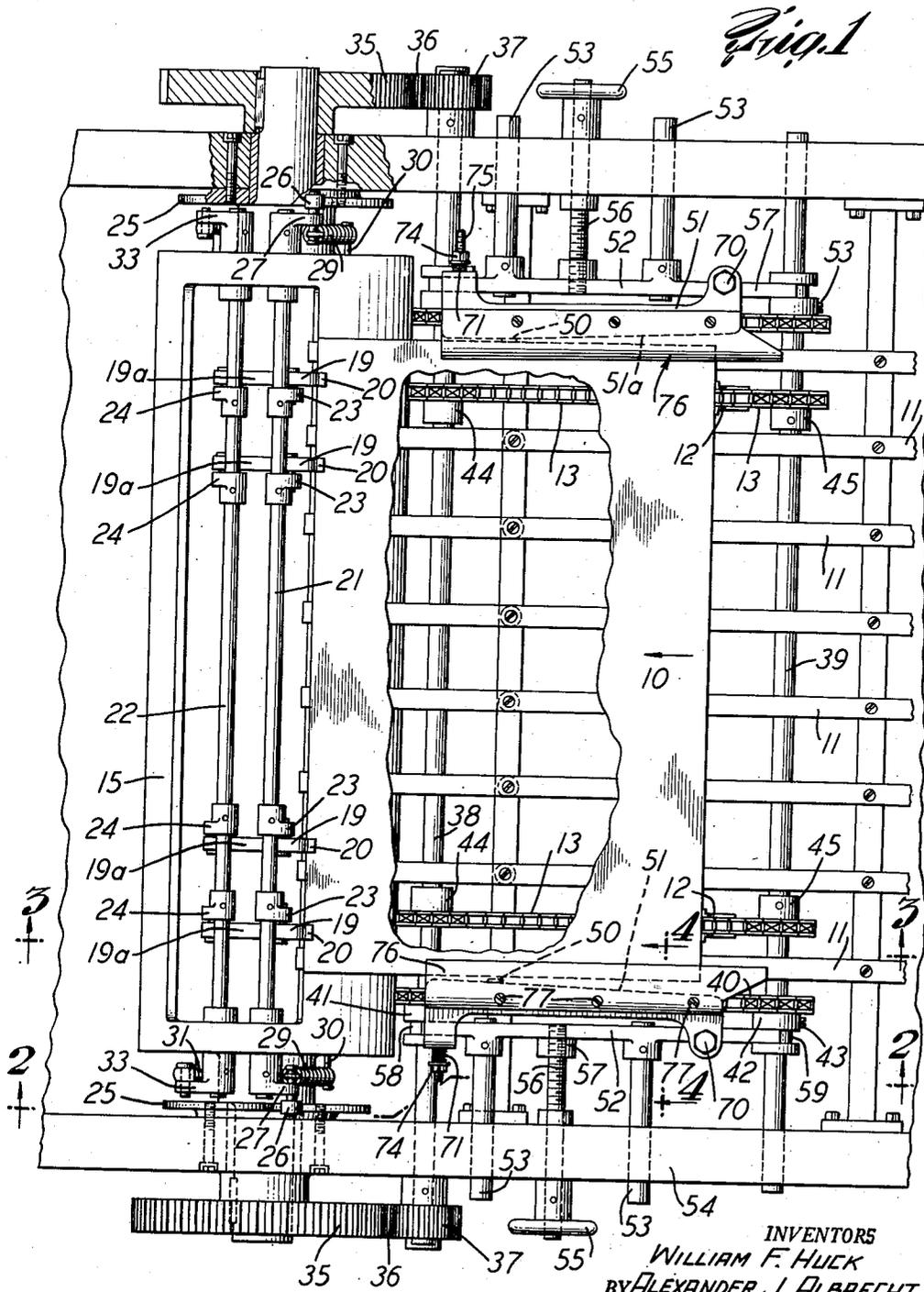
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2,699,941

REGISTERING AND GRIPPER MEANS FOR SHEET-FED PRINTING PRESSES

Filed Dec. 15, 1949

5 Sheets-Sheet 1



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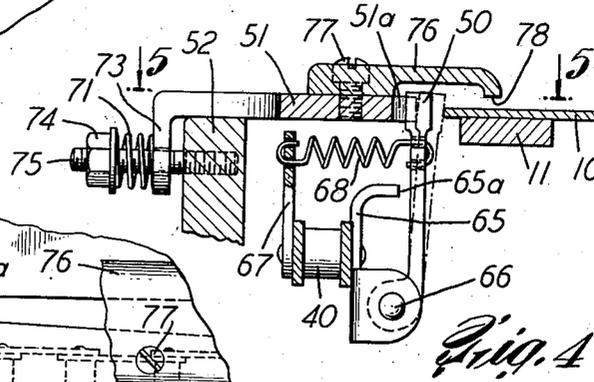
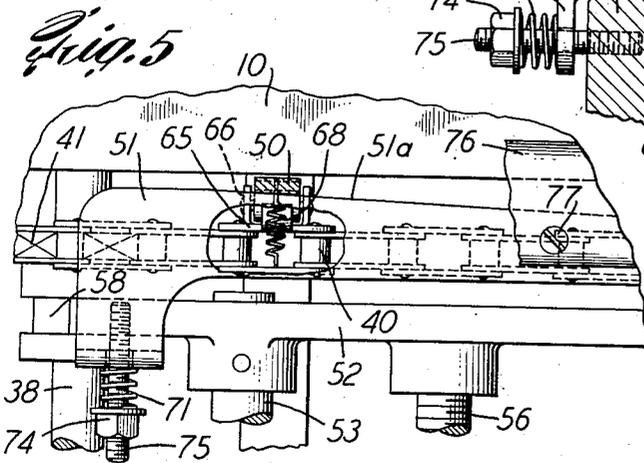
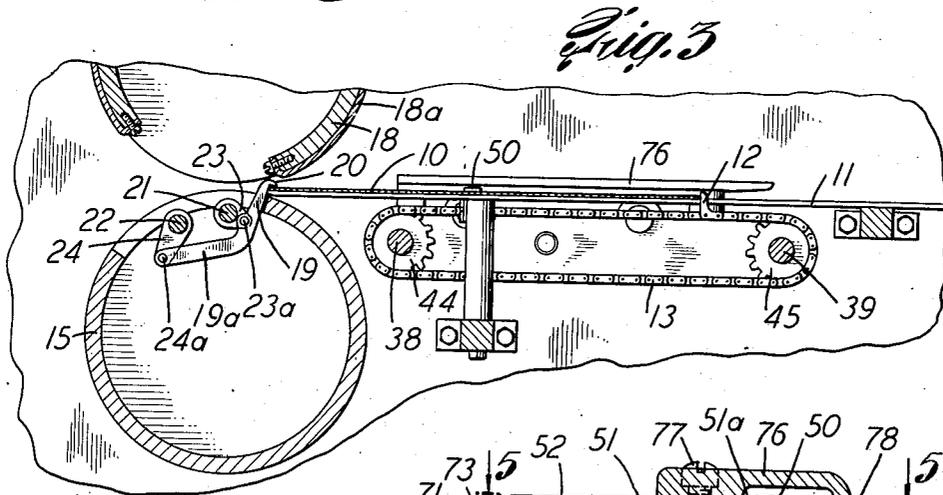
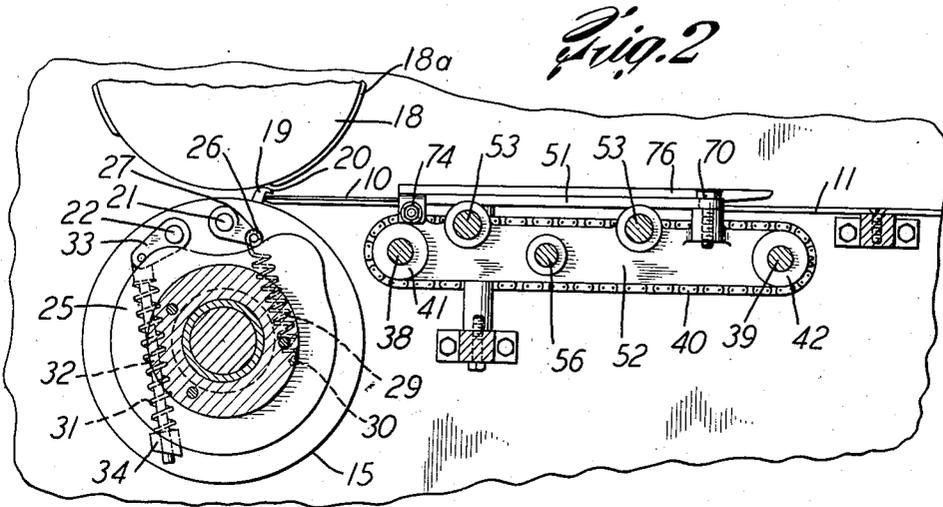
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REGISTERING AND GRIPPER MEANS FOR SHEET-FED PRINTING PRESSES

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5 Sheets-Sheet 2



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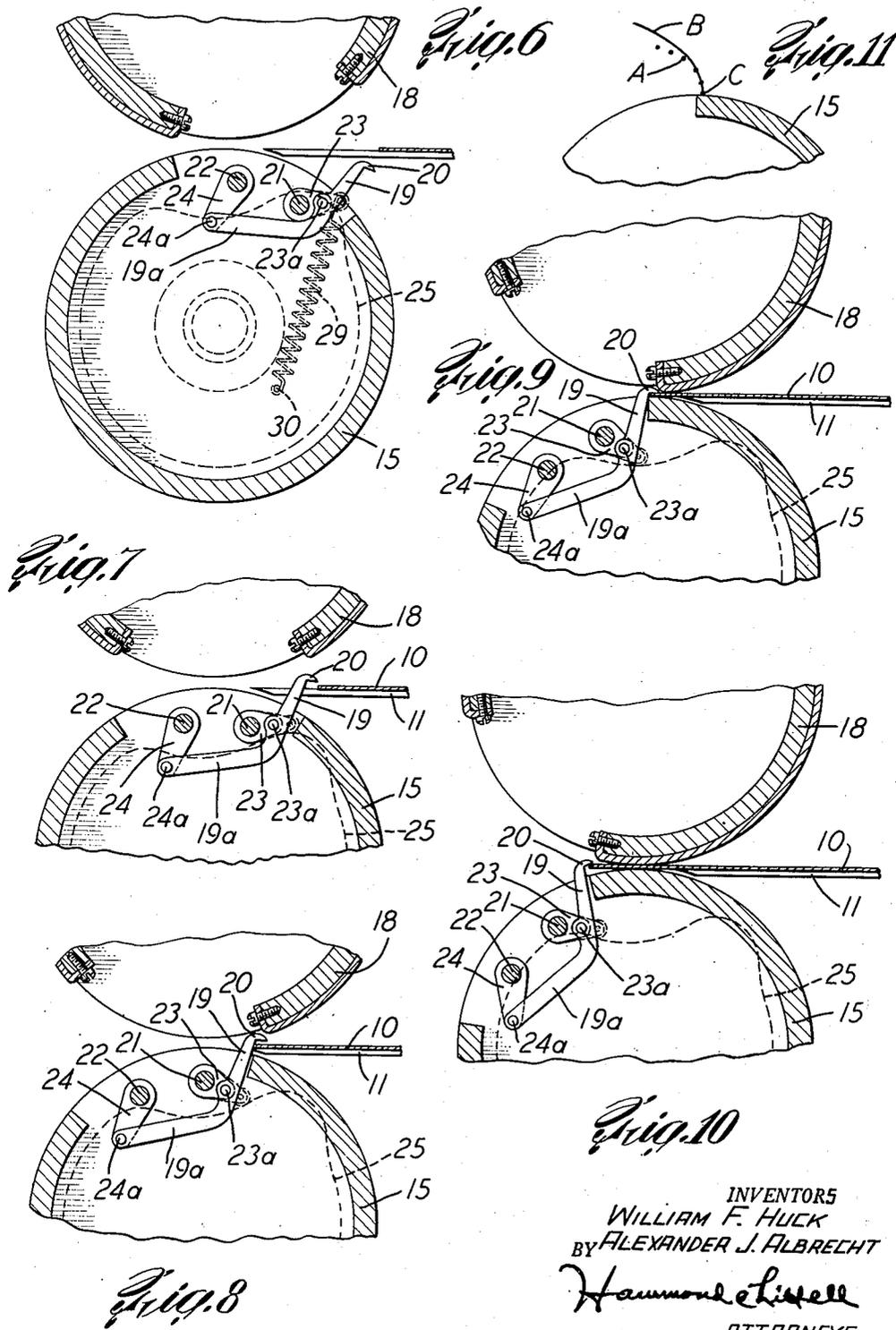
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REGISTERING AND GRIPPER MEANS FOR SHEET-FED PRINTING PRESSES

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5 Sheets-Sheet 3



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REGISTERING AND GRIPPER MEANS FOR SHEET-FED PRINTING PRESSES

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5 Sheets-Sheet 4

Fig. 12

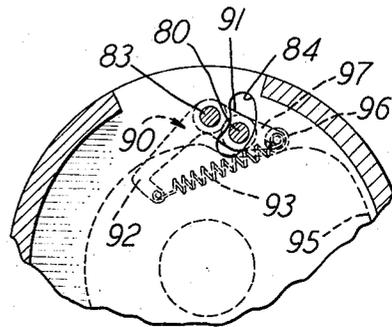
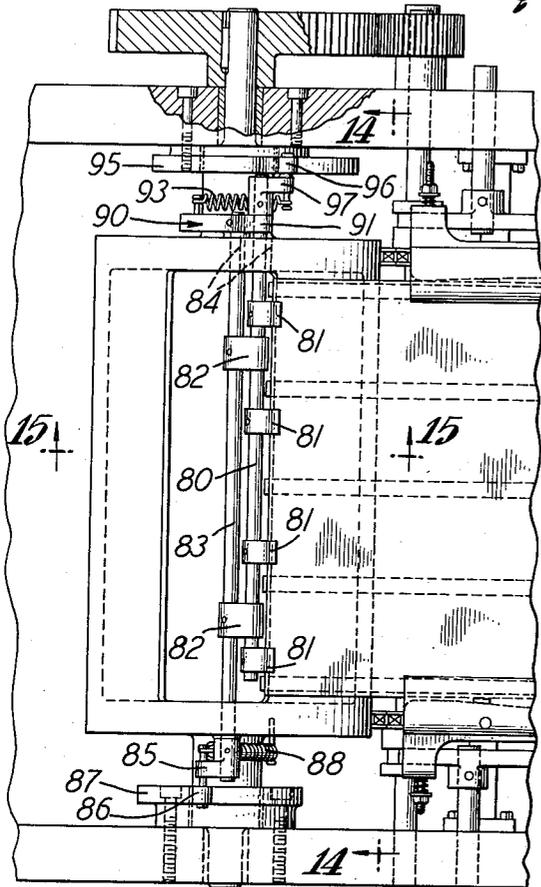
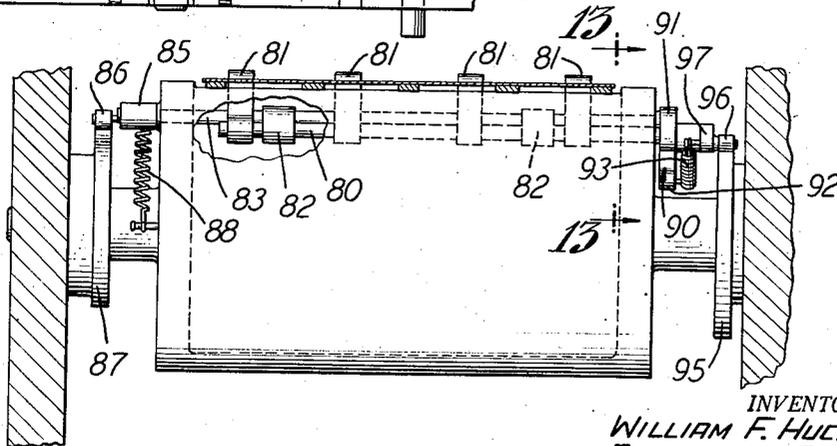


Fig. 13

Fig. 14



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5 Sheets-Sheet 5

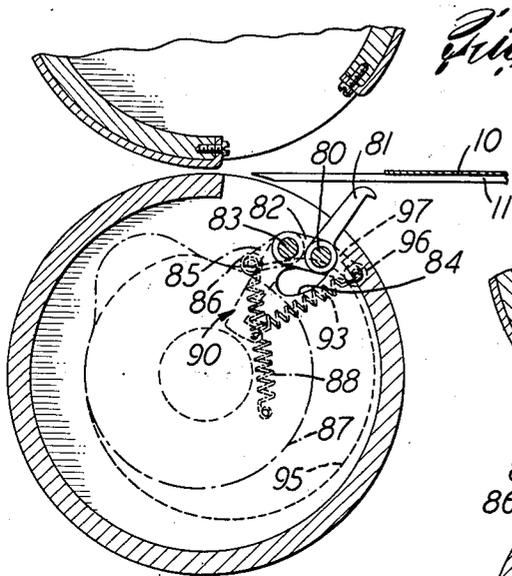


Fig. 15

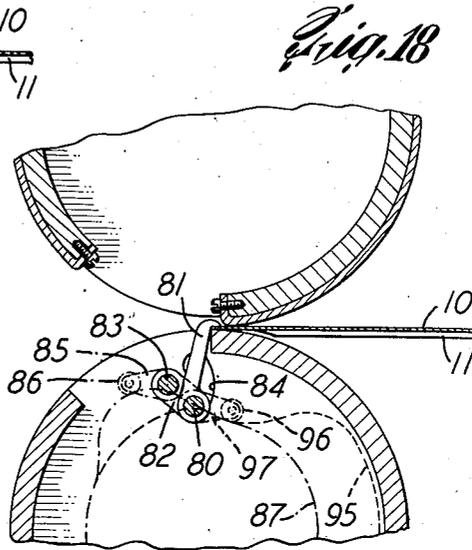


Fig. 18

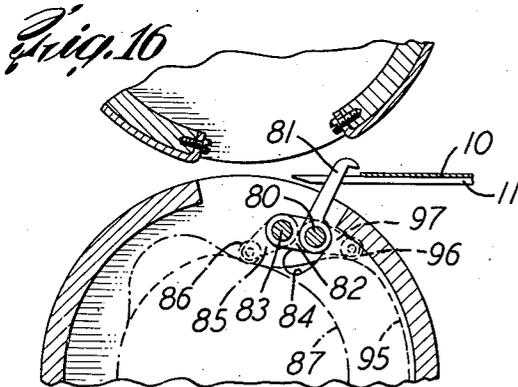


Fig. 16

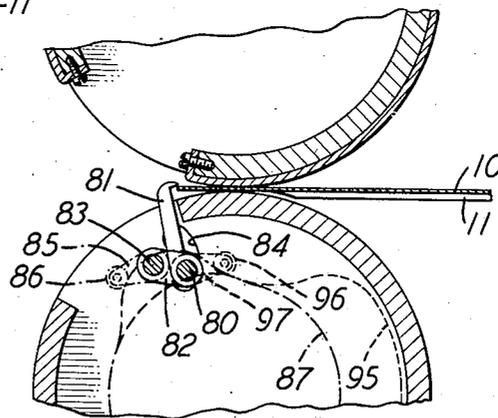


Fig. 19

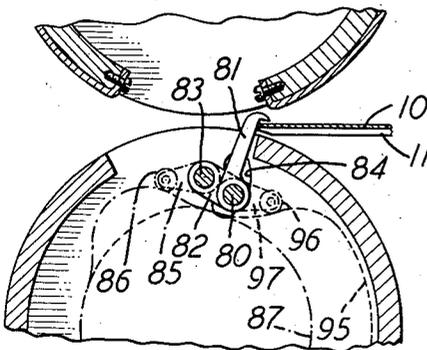


Fig. 17

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REGISTERING AND GRIPPER MEANS FOR SHEET-FED PRINTING PRESSES

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Application December 15, 1949, Serial No. 133,192

16 Claims. (Cl. 271—53)

This invention relates to sheet-fed printing presses and more particularly to such presses of the type used primarily to print on sheet metal, cardboard or other materials in the form of sheets stiff enough to be fed to printing position by being pushed from their trailing edges.

In printing presses of that type the mechanism usually employed for bringing each sheet into register with the printing member operates to force the leading edge of the sheet against front register elements and one side edge of the sheet against a side register element by applying pressure to the opposite edges of the sheet. The front register elements are surfaces of sheet grippers which are carried by an impression cylinder and operated by mechanism connected with it.

The constructions used in existing presses are such that the grippers and their front register surfaces have a linear speed in the direction of travel of the approaching sheet that is considerably less than the surface speed of the impression cylinder. A sheet moving forward to printing position and momentarily retarded by contact with the moving register surfaces does not move at cylinder surface speed at the moment the grippers close upon it, so if perfect registration is to be attained a considerable pushing force is required at the trailing edge of the sheet to bring it up to the cylinder surface speed and maintain firm contact between the leading edge and the register surfaces. The magnitude of the pushing force necessary depends upon the acceleration required to impart the higher speed to the sheet within the short interval occupied by closing of the grippers.

Since the pushing force necessary increases at a rate proportional to the weight of a sheet and proportional to the square of the speed of the press there is a severe limitation upon the production speed of printing presses of the type under consideration. If the press speed and pushing force exceed a certain limit the sheets cannot withstand the force at their edges without buckling or indenting, so the force applied and therefore the press speed must be limited. If the pushing force is less than a certain minimum, which minimum will vary with the press speed, the sheet will slip under the grippers, edge contact with the register surfaces is not maintained and mis-register results.

Side register of the sheets also presents a problem. In customary printing press construction lateral positioning of the sheet is effected most commonly by a side register element which moves transversely to the line of sheet travel and makes contact with a side edge of each sheet only momentarily just before the grippers close upon it. Such register elements are generally in the form of small rollers mounted on axes transverse to the plane of the sheet, so that the area of contact with the sheet is small. The rollers and their mountings are of substantial mass and, especially at high speeds, have more or less the action of hammers with momentarily too much pressure which tends to indent the sheet but is not continued as a sustained pressure to insure lateral movement of the sheet against an opposite register-stop. Damage to the sheet edge and mis-registration result.

Side register devices moving with the sheet have been proposed to overcome this difficulty but the devices proposed have been costly, inconvenient for installation and unsatisfactory in operation; also they have presented sheet engaging means of limited contact area yet of considerable mass, which are liable to damage edges of the sheets when accelerated to follow the sheet movement just before the time of gripper action.

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The general purpose of this invention is to provide improved registering means for sheet-fed printing presses of the type under consideration and for other analogous uses which make it practical to operate the presses at increased speeds and to obtain accurate registration without damage to the edges of the sheets being printed.

A more particular object is to provide improved means for registering the leading edge of the sheets which will operate effectively and accurately at high press speeds.

A further object of the invention is to provide improved printing press constructions which include means for registering the leading edge of a sheet and means for registering the side edges of the sheet which will insure accurate positioning thereof as the sheet is advanced to the printing zone at high speeds, and especially as it engages the registering means for the leading edge, and which will not damage the sheet.

According to this invention sheets successively fed to the printing zone between a printing member and a rotating impression cylinder are each brought into accurate register with the printing member by means of front edge positioning elements and side edge positioning elements which all move together in even contact with the sheet at a linear speed equal to that of the surface of the impression cylinder as the sheet approaches a predetermined gripping point where it is held to the cylinder surface.

The desired front edge positioning may be obtained by providing register elements on the impression cylinder, which make contact with the leading edge of an approaching sheet ahead of the gripper closing point and define a path of abutment for the point of contact of that edge which extends to the gripping point as an involute of a circular section of the cylinder surface. In order to avoid relative motion and friction between the moving sheet and these register elements, the latter may be moved relative to the gripping point, as the cylinder rotates, in such manner that their sheet contacting surfaces progress on such an involute from an outwardly projected position where they extend across the path of the leading edge of an approaching sheet to an inward position adjacent the gripping point. The effective linear motion of the front register surfaces thus is tangential with respect to the printing zone and occurs at a speed corresponding to the surface speed of the cylinder until the register elements have reached a final inward position where grippers, preferably though not necessarily carried on the free ends of these elements, act to grip the leading edge of the sheet to the impression cylinder surface. Accordingly, the forces required for front register contact remain moderate and constant at all press speeds.

The required side edge positioning may be obtained through an arrangement of co-acting, relatively stationary and moving elements along at least one side of the sheet path. A moving side register or positioning element of little mass, which presents a relatively large register surface to a side edge of the sheet approaching the printing zone, is moved along a relatively stationary guide or cam surface with mathematically determined accuracy into smooth contact with the sheet edge. The moving element is advanced toward the front register elements with each sheet at a speed in tangential or sheet-feeding direction equal to the speed of the sheet, and while it moves forward it is gradually brought laterally toward the desired position and into contact with a side edge of the sheet so as to reach that position and insure accurate lateral positioning of the sheet just before the grippers close. A similar arrangement may be provided on the opposite side of the sheet, its presser or register element moving forward with the sheet and the other side register element so that positive engagement between the latter and the sheet will be insured. In a press for printing fairly massive sheets, such as metal sheets, the register arrangement on one side of the sheet path is provided with a guide or cam member which is held yieldably at a desired registering position and is displaceable laterally from that position whenever the lateral pressure exerted through the advancing register element by the side edge of an advancing sheet exceeds a predetermined value. The spring force or other force applied to position said member may be selected so that it will resume its normal position and

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thus move the displaced sheet laterally to the desired register position before the leading edge of the sheet reaches the gripping point.

Other objects, features and advantages of this invention and a preferred manner of practicing it will be apparent from the following description of mechanism embodying same, for the purpose of which description reference should be had to the accompanying drawings, in which

Fig. 1 is a plan view of sheet feeding and registering mechanism embodying the principles of the invention, certain parts being shown in section.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1, showing the several sheet positioning elements in the condition of first engagement of an advancing sheet with the front register surfaces.

Fig. 4 is a sectional detail view, taken on the line 4—4 of Fig. 1, of the side positioning mechanism.

Fig. 5 is a plan view of the side positioning mechanism seen in Fig. 4, with certain parts broken away.

Figs. 6, 7, 8, 9 and 10 are fragmentary vertical sections showing successive positions assumed by the front register and gripper mechanism in operation.

Fig. 11 is a diagram indicating the approximate path of movement of the sheet-engaging surface of a front register element relative to the gripping point on the surface of the impression cylinder.

Fig. 12 is a plan view, partly in section, showing the registering and gripping mechanism of another embodiment of the invention.

Fig. 13 is a fragmentary vertical section taken on line 13—13 of Fig. 14.

Fig. 14 is a front elevation, partly in vertical section, of the impression cylinder and front edge positioning mechanism as viewed approximately from line 14—14 of Fig. 12.

Figs. 15, 16, 17, 18 and 19 are fragmentary vertical sections showing successive positions assumed by the front register and gripper mechanism of the second embodiment in operation.

In the arrangements shown for the purposes of illustrating the principles of the invention, registering mechanism is provided whereby the leading edge of each sheet advancing to the printing zone engages front register elements which are carried by an impression cylinder 15 and are operated as it rotates so that the point of engagement of the sheet with each register element moves toward a gripping or register point on the cylinder surface in a curve which is approximately an involute of a circular cross section of that surface. Accordingly, during registering engagement of the sheet and until it has reached gripping position its speed of movement can be kept constant. Provision is made also for lateral registration of the sheet by mechanism which moves smoothly into contact with a side edge of the advancing sheet at a speed in the direction of sheet movement equal to the linear speed of the front register points in that direction, so that the required proper positioning of the whole sheet with respect to the impression cylinder and a printing member 18a on a cooperating printing cylinder 18 will be obtained without damage to the edges of the sheet.

Referring more particularly to Figs. 1, 2 and 3, the sheet 10 is moved forward on a table comprising parallel bars or runners 11 by pusher elements 12 on chains 13. The chains and pushers are driven at the surface speed of the cylinders 15 and 18 by mechanism to be described, and the pushers engage the trailing edge of the sheet so as to advance it into printing position between the two cylinders. In order to obtain accurate positioning of the leading edge of the sheet with respect to printing member 18a at printing position a plurality of register elements 19 are carried by one of the cylinders, more conveniently the impression cylinder, and these elements are brought into contact with the advancing sheet as it approaches printing position and move evenly with it until it reaches substantially the point of tangency to the impression cylinder, at which point it is gripped to the cylinder surface by grippers 20 which may be integral parts of the register elements and are so shown.

The register grippers 19 are so controlled in their approach to sheet gripping position that their points of contact with the sheet follow a path, relative to the gripping or register point on the rotating impression cylinder surface, which corresponds to an involute of a

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cross section of that surface. At that point the gripper ends 20 close upon the leading edge of the sheet to hold it to the impression cylinder as the printing member 18a comes into action. The two cylinders having thus taken hold of the sheet, elements 19 promptly afterward are released from engagement with it by being moved first outwardly and beyond its leading edge and then angularly away from it so that the sheet can advance freely beyond the printing zone in a straight line. Then these elements are carried around the cylinder orbit in an idle position until they again approach the sheet path, when they are projected forwardly and outwardly to extend across that path first ahead of the leading edge of another approaching sheet and then in contact with the latter.

The particular mechanism shown in Figs. 1 to 10 for giving these movements to the front register elements comprises two rock shafts 21, 22 parallel to the impression cylinder axis, journaled in and extending through the cylinder heads. Sets of arms 23, 24 keyed to the shafts 21, 22, respectively, carry pivoted thereto the register and gripper elements 19, each of which has a swivel connection at 23a with an arm 23 and has a tail portion 19a swivelled at 24a to an arm 24. The rock shaft 22, which controls the angular position of tail portions 19a, is urged clockwise by a compression spring 31 acting on shaft 22 through an arm 33 keyed to an end of the shaft; spring 31 being carried on a guide rod 32 pivoted to arm 33, and bearing against lug 34 on the impression cylinder head. The movements of the rock shafts, arms and front register elements are controlled by a cam or cams 25 fixed to side frames of the press, against which cams bear rollers 26 carried on arms 27 keyed to the ends of shaft 21. The rollers are held in engagement with the cams by tension springs 29 anchored on pins 30 fixed in the cylinder heads.

The design of the cams and the arrangement of the several parts is such that the impression cylinder rotation bringing the register elements 19 into the zone of their action produces outward movement of these elements to a position across the path of the leading edge of an approaching sheet, i. e., they move from below the sheet as seen in Fig. 6 to a position extending above and ahead of the sheet as seen in Fig. 7, after which a dip in cam 25 gives them a forward relative movement to sheet engaging position as seen in Fig. 8. From the moment when the leading edge of the advancing sheet engages the register elements, the cam and linkages cause the register surfaces of the elements to approach the gripping point on the cylinder surface along a curve which corresponds to an involute of the cross-section of the cylinder, as indicated diagrammatically in Fig. 11 wherein the dotted curve A represents the preliminary and the sheet-contacting movements of the register surfaces and the solid line B represents a true involute of the cylinder cross-section terminating at gripping or register point C on the cylinder surface. Upon the completion of the latter movement the gripper ends 20 act to grip the sheet to the cylinder, as seen in Fig. 9. A continuing valley in the cam 25 then causes the grippers to hold the sheet for an interval sufficient to permit retention of the sheet between the printing cylinder and the impression cylinder, after which a swell of the cam causes the register elements to move outwardly away from the sheet and then entirely out of its path under continued cylinder rotation. In the arrangement shown there is little relative movement between the register points on elements 19 and the leading edge of a sheet being positioned by them; so it is not necessary to give a particular shape to the faces of these elements in order to maintain proper contact.

The printing and impression cylinders and chains used to carry the sheet feeding and side registering elements are driven by suitable gearing in the necessary timed relation. At each end the cylinders are journaled in the side frames of the press. At least one of the journals carries a gear 35 which drives through an idler pinion 36 a pinion 37 keyed to a transverse shaft 38 located below a forward part of the sheet feeding table. Shaft 38 in turn drives a parallel shaft 39 below a backward part of the table through chains 40 which pass at the front over sprockets 41 splined to shaft 38 and, at the back, over sprockets 42 releasably pinned to shaft 39 by set screws 43. Sheet feed chains 13 carrying pushers 12 are each driven by a back sprocket 45 fixed to shaft 39, and guided over a front sprocket 44 which is freely rotatable on shaft 38. The gears 35, 36 and 37 and the

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several sprockets are so proportioned that the linear speed of the chains 13 and 40 will be the same as the surface speed of the impression cylinder.

The invention provides an improved lateral registering mechanism for insuring accurate positioning of the sheet as it is advanced to the printing zone and especially at the moment of its engagement by the front register elements on the impression cylinder. As shown, the lateral registering mechanism is duplicated on opposite sides of the machine, but elements on one side are mounted and adjusted so as to yield laterally under excessive sheet pressure, while elements on the other side are held to a fixed position in order to insure a definite registering position for each sheet.

In the form shown, a chain 40 at each side of the feed table carries a side register or presser finger 50 which moves forward with a sheet being fed by pushers 12 at the speed of movement of the sheet. The position of each finger is determined by a cam 51 which is disposed along one side of the sheet path and against which the finger slides during forward movement so as to progress gradually from a position somewhat away from the desired path of the sheet to a predetermined side registering position where the opposite fingers will hold the sheet between them in proper registration with printing member 18a and the front register elements 19.

Each sprocket chain 40 has a wide link plate 65 (Figs. 4 and 5) to which the side register finger 50 is pivoted at 66. A plate 67 on the opposite side of the chain provides anchorage for a spring 68 which holds finger 50 against the face 51a of cam 51, which cam face slopes laterally inward toward the desired path of the sheet 10 and forces the finger 50 gradually against the sheet during the feeding movement to provide registration thereof. A stop 65a on plate 65 limits the movement of finger 50 when the cam is not engaged thereby.

In order to adjust the feeding and registering mechanism for sheets of different sizes, each side of the press comprises a bracket 52 which supports the cam 51 on that side and is fixed to guide rods 53 which slide in the adjacent side frame 54 of the press. Each bracket 52 is movable to any desired lateral position by turning a hand wheel 55 on a screw 56 which is threaded into a socket 57 forming a part of the bracket. One end of the bracket engages in a groove 58 in the hub of the sprocket wheel 41 to move it along the shaft 38 to which it is splined, and the other end engages in a groove 59 in the hub of sprocket wheel 42 for the same purpose. When set screws 43 of sprocket wheels 42 are released adjustment of the side registering mechanism can be made by turning the hand wheel 55, and adjustment of the relative position of the pushers 12 on feed chains 13 can be made by rotating the shaft 39 while holding the sprocket wheels 42 in fixed position.

As seen in further detail in Figs. 1, 4 and 5, each cam 51 is pivoted at 70 to the corresponding bracket 52, and its forward end is held yieldably inward by a spring 71 compressed between depending ear 73 on the cam and an adjustable nut 74 on a stud 75 secured in the bracket. The finger 50 is moved gradually inward against the sheet 10 by engagement with the cam face 51a during the feeding movement until, just before the leading edge of the sheet is gripped against the cylinder, the finger passes the front end of the cam and is retracted against stop 65a by spring 68.

A top guide and cover member 76 is secured by screws 77 to the top of the cam and extends over the cam face and the path of finger 50 to a position above the sheet path where a depending lip 78 is provided to keep a sheet 10 from bulging away from the finger. The cam 51 on one side of the press preferably has its tensioning nut 74 tightened to hold it in fixed position, so that its finger 50 provides a positive register position for one side of the sheet 10, while the similar nut on the other side of the press is shown backed off to give the desired compression to its spring 71 whereby the corresponding finger 50 on that side will yieldably position the sheet.

In the second illustrative embodiment of the invention, as seen in Figs. 12 to 19, the sheet feeding and side registering elements are substantially the same as those above described, but a different form of cam-controlled operating mechanism is provided for the front register elements. Again, however, those elements are carried

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by the impression cylinder, and their effective movements relative to it and in coordination with the other elements are substantially the same as in the embodiment first described.

Here the combined register-gripper elements 81 are carried by a swinging rock shaft 80 which in turn may be carried by arms 82 fastened to a rock shaft 83 fixed in the impression cylinder, and two cams 87 and 95 are provided on opposite sides of the press frame to bring about the required movements of the rock shafts and register elements as the impression cylinder rotates. Rock shaft 83 is journaled in the cylinder heads, while swinging rock shaft 80 is carried rotatably in the arms 82 and extends through and moves freely in a slot 84 in one of the cylinder heads. The front register elements 81 are pinned to shaft 80 so as to move with it, and its extended end beyond slot 84 carries an arm 97 which holds a roller 96 against cam 95. An arm 85 keyed to rock shaft 83 carries a roller 86 bearing on cam 87 to control the rocking movement of shaft 83 and thereby the position of shaft 80 relative to the impression cylinder surface.

Ordinarily the cam 87 and the control arm and roller which control the radial movement of rock shaft 83 would not be shown in Figs. 15 to 19 because of the position at which the sections are taken, but for the purposes of disclosure of the operation cam 87 is shown in broken lines to indicate its relative position.

A tension spring 88 is connected to an extension of the pin on which roller 86 is mounted and anchored on a pin in the adjacent cylinder head to hold this roller in contact with the cam 87. In addition to the arms 82 carrying rock shaft 80 from rock shaft 83, a lever member 90 (Figs. 12 and 13) keyed to shaft 83 has one arm 91 similar to the arms 82 providing an additional journal support for shaft 80 outside of the cylinder end and has another arm 92 which is shown as L-shaped providing anchorage for a tension spring 93. Spring 93 is connected to an extension of the pin on which roller 96 is mounted and maintains this roller in contact with the stationary cam 95.

The design of the cams 87 and 95 and the arrangement of connected parts is such that the points of contact between the advancing sheet and the register elements 81 move toward the gripping point on the impression cylinder, during the approach of the sheet to printing position, along a curve which corresponds to an involute of a section of the impression cylinder. The several positions of parts appearing in Figs. 15 to 19 indicate the operation obtained and indicate that it is like the operation described in connection with Figs. 1 to 11.

The foregoing particular description of selected embodiments of the invention is illustrative merely and is not intended as defining the limits of the invention. Various modifications in form, construction and arrangement may be made without departing from the spirit of the invention.

We claim:

1. In a sheet-fed printing press comprising a rotary cylinder, means for rotating the cylinder to move an edge register point on its surface through a sheet gripping position in each revolution, and means for advancing a sheet tangentially to said gripping position at a linear speed substantially equal to the peripheral speed of said surface and in the direction of movement of said point through said position, a sheet positioning element carried by the cylinder having a register surface engageable with the leading edge of the advancing sheet, and control means operated by rotation of said cylinder for moving said element relative to the cylinder carrying it while it engages the advancing sheet so that the relative motion of the point of its contact and said register point as the latter and the sheet approach said gripping position defines an involute of a circular section of the cylinder surface.

2. In a sheet-fed printing press comprising a rotary cylinder having a register point on its surface to which the leading edge of a sheet is to be held at a gripping position of the cylinder orbit, a sheet positioning element carried by the cylinder and moving relative thereto as it rotates toward the gripping position to engage said edge of a sheet approaching said position on a tangent thereof, and means moving said element from its initial sheet-engaging position inward relative to said register point, as the latter and said element rotate into the gripping

position, on an involute of a circular section of the cylinder surface.

3. In a sheet-fed printing press comprising a rotary cylinder having a register point on its surface to which the leading edge of a sheet is to be held at a gripping position of the cylinder orbit, sheet positioning elements carried by the cylinder and moving relative thereto as it rotates toward the gripping position to engage said edge of a sheet approaching said position, means moving said elements from sheet-engaging position inward relative to said register point, as the latter and said elements rotate into the gripping position, on an involute of a circular section of the cylinder surface, and grippers on said elements acting at the end of said path to hold said edge to the cylinder.

4. In a sheet-fed printing press comprising a rotary cylinder having a register point on its surface to which the leading edge of a sheet is to be held at a gripping position of the cylinder orbit, register elements carried by the cylinder and moving relative thereto as it rotates toward the gripping position to engage said edge of a sheet approaching said position, means moving said elements from sheet-engaging position inward relative to said register point, as the latter and said elements rotate into the gripping position, on an involute of a circular section of the cylinder surface, and grippers on said elements acting at the end of said path to hold said edge to the cylinder, said means moving said elements outward and beyond said register point as the latter rotates beyond said position to release said edge and displace said elements from its path.

5. In a sheet-fed printing press comprising co-acting printing and impression cylinders forming a printing zone, a sheet support adjacent thereto, and means movable along said support in engagement with a sheet thereon for feeding the sheet tangentially into said zone, gripper elements carried by the impression cylinder having register means positioned by its rotation to engage the leading edge of a sheet approaching said zone, sheet positioning means at opposite sides of said support including a register element movable along a side thereof to engage a side edge of an advancing sheet, a relatively stationary cam along the path of said side register element acting to bring the same gradually into registering contact with the sheet and having an extended portion parallel to the sheet path along which said side register element moves in continuing contact with the sheet until the sheet is gripped by said gripper elements, means for driving the feeding means and said side register element at a speed in the direction of sheet travel equal to the surface speed of the impression cylinder, and means operative as said cylinder carries the gripper elements from initial sheet-engaging position into the printing zone to move said register means of the gripper elements into said zone tangentially at the said speed.

6. An apparatus as described in claim 5, said positioning means including a movable register element and cam as aforesaid at each side of said support.

7. An apparatus as described in claim 6, and means yieldably holding one of said cams at the desired sheet registering position under a predetermined force against which such cam and its contacting register element are movable laterally by excessive pressure from an advancing sheet.

8. In a sheet-fed printing press comprising a rotary cylinder and register elements thereon movable to position the leading edge of a sheet advancing to the cylinder on a tangent thereof, operating mechanism for said elements including two rock shafts carried by and within the cylinder on relatively fixed axes parallel to its axis, said rock shafts respectively carrying radial arms, each of said register elements having one of said arms of each shaft swivelled thereto and the swivels of the respective arms to each register element being spaced apart lengthwise of the register element so that said elements interconnect said shafts for movement in unison and are themselves positioned angularly and radially relative to a part of the cylinder surface according to the position of said shafts, and means for rocking one of said shafts as the cylinder rotates to control the positions of said elements so that the point of contact of each element with the sheet moves on said tangent to a sheet gripping position at the surface speed of the cylinder.

9. An apparatus as described in claim 8, said shaft rocking means comprising a fixed cam adjacent an end of the

cylinder and a rocker arm on said one shaft positioned by said cam.

10. In a sheet-fed printing press comprising a rotary cylinder carrying relatively movable elements adapted to position the leading edge of a sheet fed thereto on a tangent of the cylinder for gripping, operating mechanism for said elements including a rock shaft carried by and within the cylinder on a relatively fixed axis parallel to its axis, radial arms fixed to said shaft, another shaft carried by and rockable on said arms within the cylinder, said positioning elements being fixed to said other shaft and extending radially from it outside the cylinder, and separate means for rocking the respective shafts as the cylinder rotates to control the positions of said elements so that the point of contact of each element with the sheet moves on said tangent to a sheet gripping position at the surface speed of the cylinder.

11. An apparatus as described in claim 9, said rocking means comprising fixed cams adjacent opposite ends of said cylinder, each of said shafts having a rocker arm on one end positioned by one of said cams.

12. In a sheet-fed printing press comprising a rotary cylinder, means for rotating it to move an edge-register point on its surface through a sheet gripping position in each revolution, and means for advancing a sheet tangentially into gripping position simultaneously with the movement of said point thereto and at a linear speed substantially equal to the peripheral speed of said surface, a sheet registering element carried by the cylinder and engaged with the leading edge of an advancing sheet as the sheet and said register point approach and reach said gripping position, said registering element having means providing a path for its point of contact with said leading edge which extends substantially on an involute of a circular section of said surface from a location of initial contact away from said register point to a location adjacent said register point at gripping position.

13. In a sheet-fed printing press comprising a rotary cylinder, means for rotating it to move an edge-register point on its surface through a sheet gripping position in each revolution, and means for advancing a sheet tangentially into gripping position simultaneously with the movement of said point thereto and at a linear speed substantially equal to the peripheral speed of said surface, a sheet registering element carried by the cylinder and engaged with the leading edge of an advancing sheet as the sheet and said register point approach and reach said gripping position, said registering element having means providing a path for its point of contact with said leading edge which extends substantially on an involute of a circular section of said surface from a location of initial contact away from said register point to a location adjacent said register point at gripping position, and register element moving means comprising a mechanism responsive to the cylinder rotation to move said element so that the point of its initial contact with the advancing sheet travels on said involute.

14. In a sheet-fed printing press comprising a rotary cylinder and a register element thereon movable to position the leading edge of a sheet advancing to a sheet gripping position at the surface of the cylinder, operating mechanism for said element including two rock shafts carried by and within the cylinder on axes parallel to its axis, the axis of at least one of said rock shafts being fixed relative to the cylinder, means interconnecting said shafts for coordinated movement and connecting at least one of them with the register element to move the latter, a rocker arm on the relatively fixed shaft, and a fixed cam activating said arm as the cylinder rotates to position said register element through said shafts and said connecting means so that the point of contact of said element with the sheet moves on a tangent to said sheet gripping position at the surface speed of said cylinder.

15. In a sheet-fed printing press comprising a rotary cylinder, means for rotating the cylinder to move an edge register point on its surface through a sheet gripping position in each revolution, and means for advancing a sheet tangentially to said gripping position at a linear speed substantially equal to the peripheral speed of said surface and in the direction of movement of said point through said position, a sheet positioning element carried by the cylinder having a trailing register surface extending away from said cylinder surface adjacent said register point, and means including said rotary cylinder for moving said element in the path of such advancing sheet so

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that said register surface makes and holds contact with the leading edge of such sheet as such edge and said point approach said gripping position, the locus of the point of contact of said register surface with said edge during the angular approach of said element to said gripping position extending toward said register point approximately as an involute of a circular section of said cylinder surface.

16. In a sheet-fed printing press comprising a rotary cylinder, means for rotating the cylinder to move an edge register point on its surface through a sheet gripping position in each revolution, and means for advancing a sheet tangentially to said gripping position at a linear speed substantially equal to the peripheral speed of said surface and in the direction of movement of said point through said position, a sheet positioning element carried by the cylinder having a trailing register surface extending away from said cylinder surface adjacent said register point, and means including said rotary cylinder for moving said element in the path of such advancing sheet so that said register surface makes and holds contact with the leading edge of such sheet as such edge and said point ap-

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proach said gripping position, the locus of the point of contact of said register surface with said edge during the angular approach of said element to said gripping position extending toward said register point approximately as an involute of a circular section of said cylinder surface, and gripping means operative at the end of said angular approach to clamp said edge to said register point.

References Cited in the file of this patent

UNITED STATES PATENTS

335,634	Scott	Feb. 9, 1886
484,141	Crowell	Oct. 11, 1892
1,108,220	Pancoast	Aug. 25, 1914
1,285,774	Middleditch	Nov. 26, 1918
1,597,941	White	Aug. 31, 1926
1,897,484	La Bombarde	Feb. 14, 1933
1,979,253	Coy	Nov. 6, 1934
2,059,561	Cowan et al.	Nov. 3, 1936
2,488,551	Nordquist et al.	Nov. 22, 1949