Oct. 16, 1951 J. R. WOOD 2,571,806

SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

Filed May 24, 1949 6 Sheets-Sheet 1

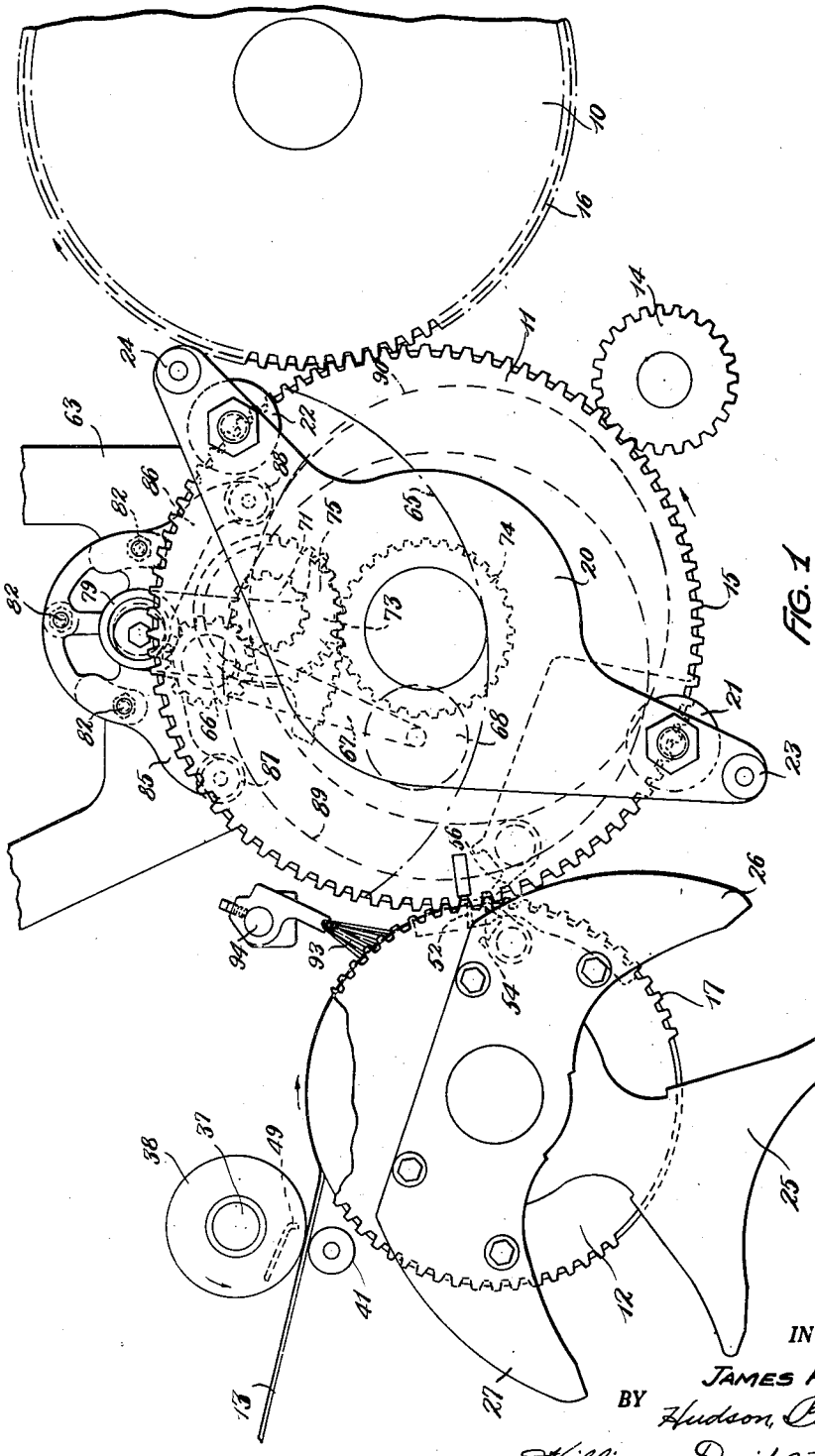


FIG. 1

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SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

Filed May 24, 1949 6 Sheets-Sheet 2

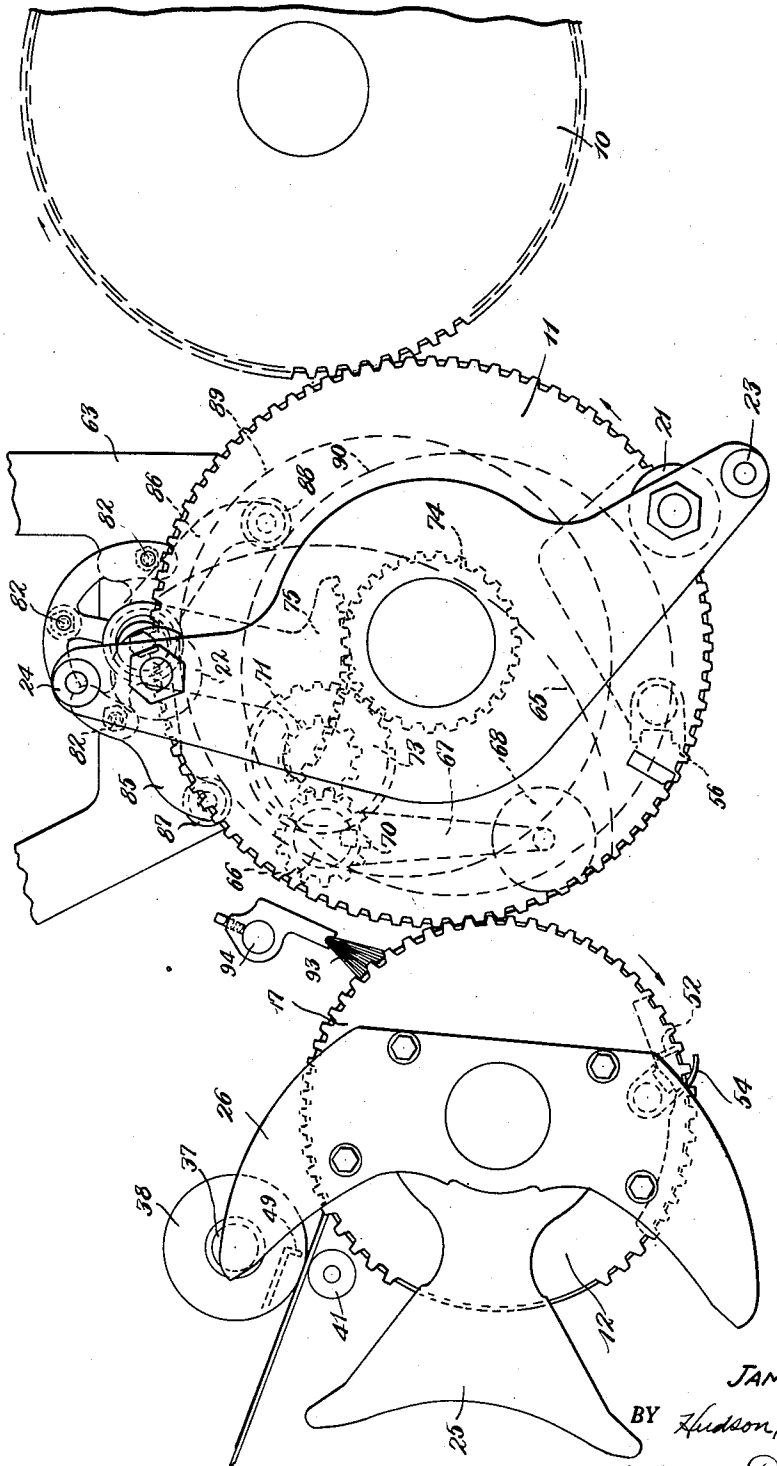


FIG. 2

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SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

Filed May 24, 1949 6 Sheets-Sheet 3

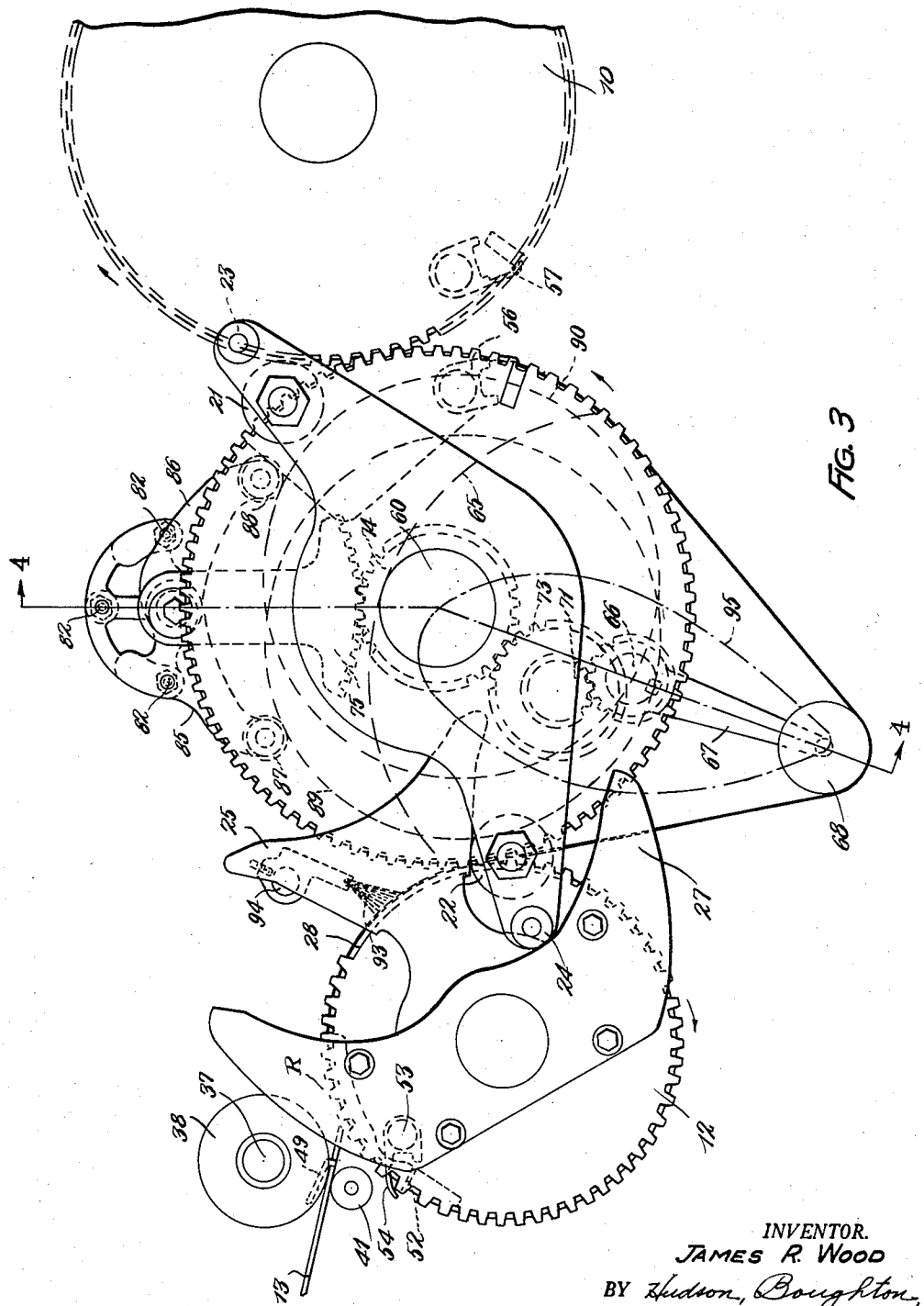


FIG. 3

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SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

Filed May 24, 1949 6 Sheets-Sheet 4

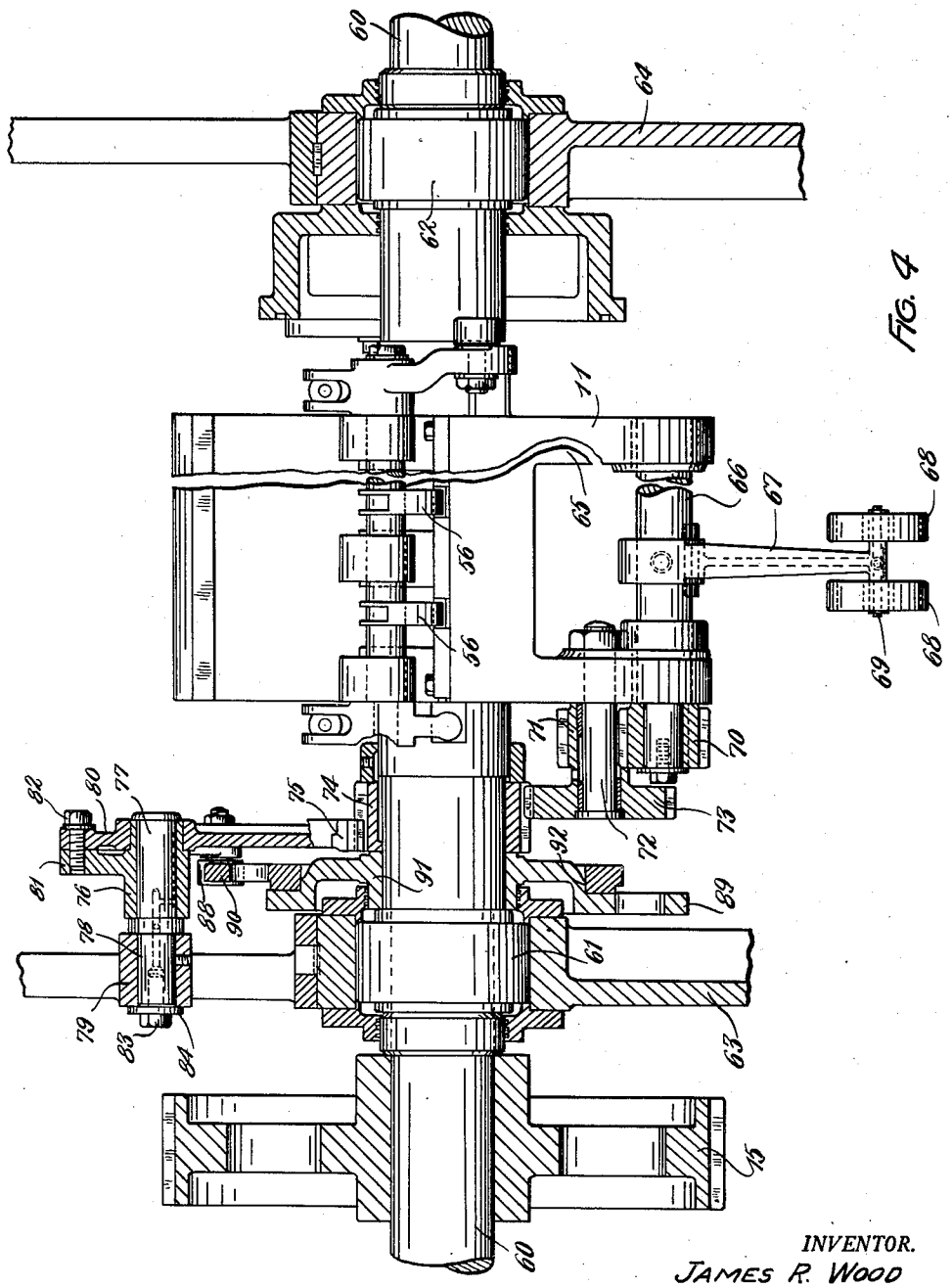


FIG. 4

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Oct. 16, 1951 J. R. WOOD 2,571,806

SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

Filed May 24, 1949 6 Sheets-Sheet 5

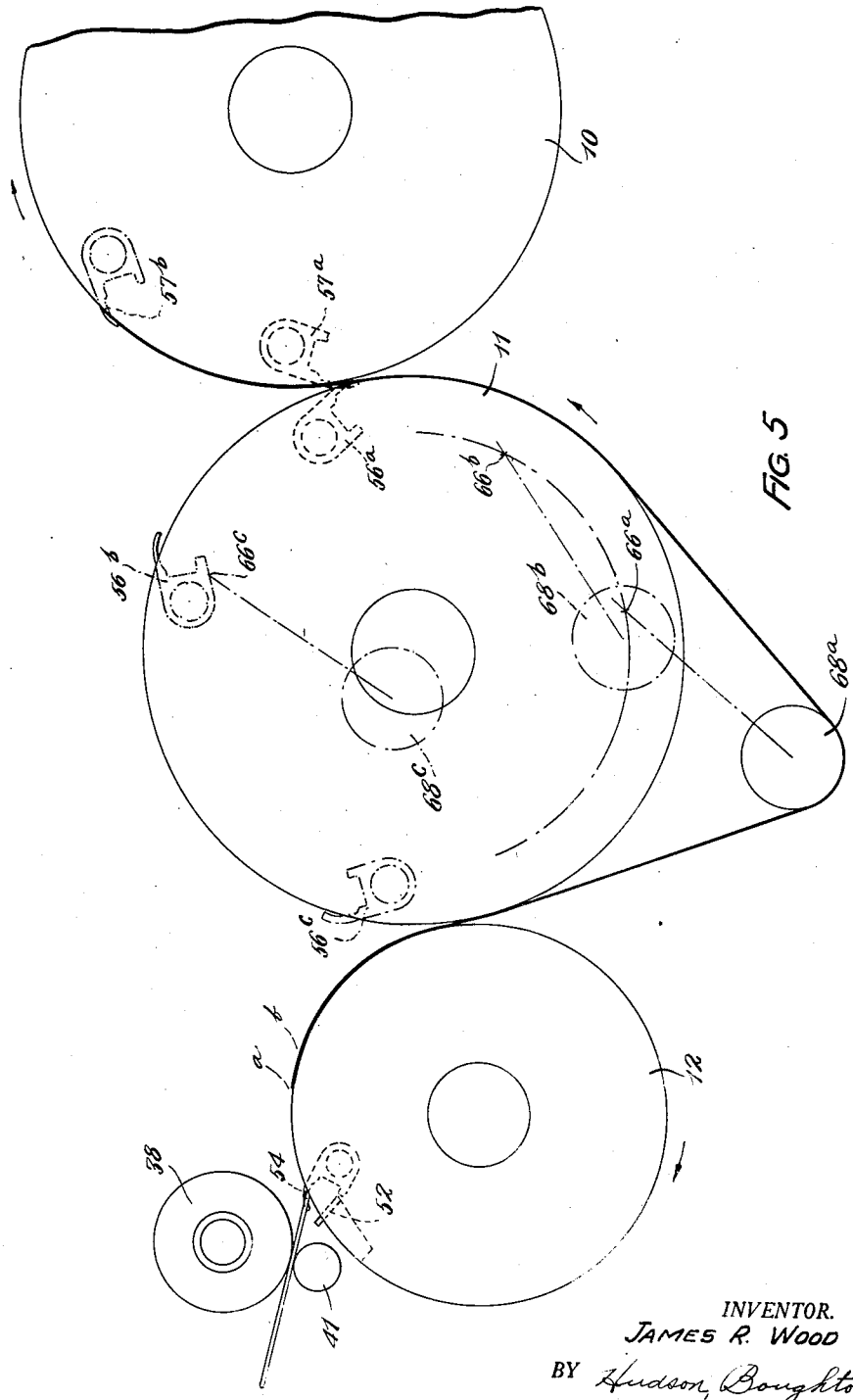


FIG. 5

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SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

Filed May 24, 1949 6 Sheets-Sheet 6

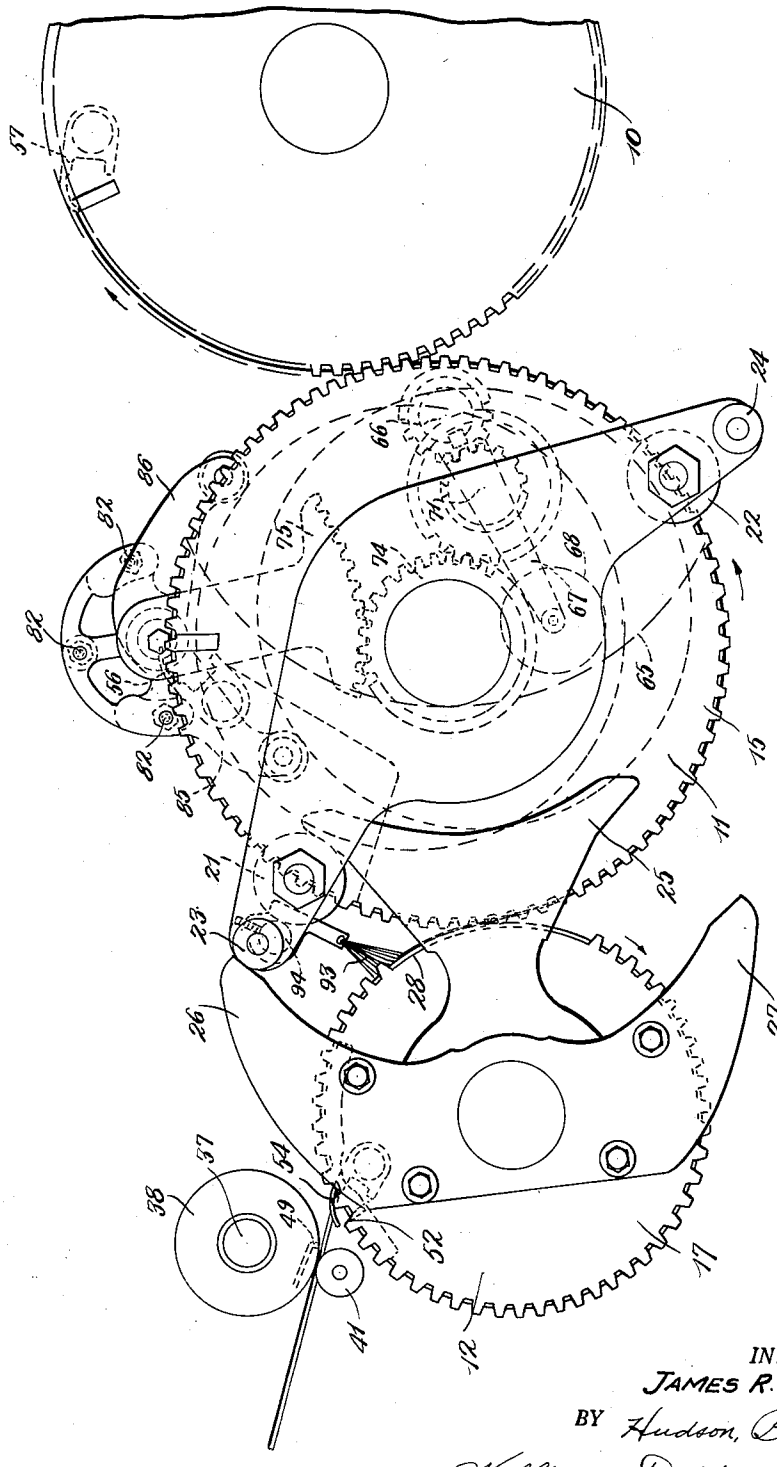


FIG. 6

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Patented Oct. 16, 1951

2,571,806

UNITED STATES PATENT OFFICE

2,571,806

SHEET TAIL ACCELERATING DEVICE FOR SHEET FEEDERS

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Application May 24, 1949, Serial No. 95,062

11 Claims. (Cl. 271—51)

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This invention relates to improvements in sheet tail accelerating device for sheet feeders, that is to say means for producing more rapid travel of the rear edge of a sheet than of the front edge thereof in order to uncover the sheet registration means earlier in the cycle and give additional time for registration of the succeeding sheet, or alternatively to permit the feeding of longer sheets with the same amount of registration time.

In a previous application, Serial No. 11,970, filed February 28, 1948, I have disclosed means for putting a loop into the body of a sheet as the forward edge is advanced toward the printing or other sheet handling machine, thus accelerating the travel of the rear edge of the sheet. In that case mechanism is provided for effecting motion of a pull-out roller or other abutment in a circular path intersecting the path of the sheet grippers at two points. The present invention superposes upon the mechanism for producing such motion in a circular path a means for modifying the motion to produce travel of the pull-out abutment in an oval path and cause its travel outside the gripper path to take place in a considerably shorter time interval or angle of revolution of the cylinder than would otherwise be the case. By this means I am enabled to provide a drag for the tail of the sheet which remains effective until after the pull-out abutment has receded within the gripper path, so that the loop is taken out of the sheet before the drag releases it, thereby preventing whipping or folding of the trail of the sheet.

One of the objects of the invention therefore is the provision of improved means for providing additional time for registration of sheets being fed to a high speed printing press or other sheet handling machine.

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 diagrammatic, of means for feeding sheets to a printing press or the like, illustrating the position of parts at the point where the sheet is being taken by the grippers of the advance cylinder.

Fig. 2 is a similar view showing the parts in the positions which they occupy at the time the pull-out abutment is about to emerge from the periphery of the advance cylinder.

Fig. 3 is a similar view showing the parts at that point in the cycle where the pull-out abutment is in its furthest out position.

Fig. 4 is a schematic view partly in section,

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taken substantially along the line 4—4 of Fig. 3.

Fig. 5 is a diagrammatic view showing different positions of the pull-out abutment in its movement into the cavity in the advance cylinder, and

Fig. 6 is a view illustrating the parts as the intermittently rotating feed cylinder is about to begin its acceleration preparatory to receiving a sheet and accelerating its forward edge for delivery to the constant speed advance cylinder.

In the drawings the impression cylinder of a rotary press is indicated at 10. 11 represents a continuously rotating cylinder which may be termed a sheet advance cylinder, adapted to present sheets to the impression cylinder. An intermittently rotating cylinder 12 arranged to receive sheets from a feed board 13 is driven from cylinder 11, the mechanism being such as to provide a stationary period, an accelerating period, a constant speed rotation period and a decelerating period, the driving mechanism for the purpose being known in the art and fully described in Patent 2,192,908 to Harrold et al.

Drive may be supplied to cylinder 11 by a small gear 14, Fig. 1, meshing with gear 15 which is rigid with the advance cylinder, Gear 15 in turn meshes with gear 16 on cylinder 10 and intermittently with a segmental gear 17 on cylinder 12. The pitch lines of gears 15, 16 and 17 conform approximately with the surfaces of the corresponding cylinders, such surfaces being relieved where necessary, as is customary. While I have termed these members cylinders it will be understood that their cylindrical surfaces may be interrupted so long as proper support for the sheets is provided.

During a portion of each revolution of cylinder 12 gear 17 meshes with gear 15 and the two cylinders turn at equal surface speeds. During the time that the gears 15 and 17 are out of mesh cylinder 12 decelerates, stops and accelerates. The transition from acceleration to constant speed rotation is effected smoothly. The illustrated mechanism for driving cylinder 12 will now be briefly described.

20 is a bracket which turns with cylinder 11. On its inner side it carries two rollers 21 and 22, and at its extremities it carries two other rollers 23 and 24. Rollers 21 and 22 engage at times with the side edges of a fishtail cam 25 which is mounted to turn with the shaft of cylinder 12. A pair of cams 26 and 27 rigid with cam 25 have internal edge surfaces with which the rollers 23 and 24 engage.

In Fig. 6 the acceleration period is beginning, that is roller 21 has come into engagement with an outer end of fishtail cam 25, and as the roller travels downward it rides inwardly along the

cam, thereby gradually increasing the speed of the cam and hence of the cylinder 12. During this time roller 23 by engaging cam 26 holds the cam 25 against the roller 21 and prevents rotation of cylinder 12 faster than intended. When the roller 21 reaches the inner end of cam 25 cylinder 12 will have been accelerated to the same surface speed as cylinder 11, and gear 17 will then have been brought into mesh with gear 15, so that cylinder 12 will turn at the same surface speed as cylinder 11.

The period of constant speed rotation continues until the arc 28 of gear 17 which is devoid of teeth comes into the line of centers of gears 15 and 17, at which time roller 22 will be engaged by the opposite side edge of fishtail cam 25. This occurs just shortly prior to the time illustrated in Fig. 3. At the time this occurs the roller and cam are turning at equal speed, but as the roller travels downwardly or counterclockwise it moves outwardly along the cam surface or away from the center of revolution of the cam, and thereby decelerates the cam and the cylinder 12. During this deceleration period the roller 24 running upon cam 27 maintains the fishtail cam in contact with roller 22.

When the roller 22 runs off the cam 25 the cylinder 12 will have been decelerated to zero speed and the rollers 22 and 24 will leave the cams 25 and 27. The stationary period continues until roller 21 again travels into the position illustrated in Fig. 6, when the cycle repeats. The bracket 20 which is fixed upon gear 15 does not appear upon the schematic view of Fig. 4.

37 is a shaft journaled in the frame of the machine somewhat above cylinder 12 and to the rear of its axis. This shaft carries a series of disks 38 which together constitute a nipper roll. Shaft 37 is driven by suitable means from cylinder 12 in such manner that the surface speed of the disks 38 is greater than the surface speed of cylinder 12. A lower nipper roll 41 is built in spaced sections which are adapted to contact disks 38 through suitable slots in feed board 13. Cam operated lever means, not disclosed herein, is provided for causing the nipper roll 41 to rise, as indicated in Figs. 1 and 6 during a short interval of each cycle to press a sheet against disks 38 of the upper nipper roll. Suitable mechanism for the purpose is fully disclosed in my copending application, Serial No. 31,949, filed June 9, 1948. The interval during which the nipper roll 41 is raised begins at about the end of the stationary period of cylinder 12 illustrated in Fig. 6, and continues into the acceleration period.

Sheets may be brought down the feed board 13 in a stream by conventional means, the rear portion of each sheet overlying the succeeding sheet. Front guides 49 of conventional character are operated in conventional manner to move into the path of the sheets traveling over the feed board at the proper time in the cycle. In Fig. 3 they are illustrated in operative position. The side registration of each sheet directly after it is front registered is contemplated, but as mechanism for accomplishing side registration is well known in the art no means for that purpose is illustrated herein.

Cylinder 12 carries a series of front stops 52 against which the forward edge of each sheet is to be pressed by the nipper rolls. Cylinder 12 also carries a rock shaft 53 upon which are mounted gripper fingers 54 that cooperate with gripper pads which are adjacent the stops 52. Shaft 53 is actuated at properly timed intervals to swing grippers 54 into gripping relation with the pads for grasping the forward edge of a sheet, and at other intervals to swing away from the pads for releasing the sheet. The grippers may be operated by conventional means not herein shown.

Sheet advance cylinder 11 and impression cylinder 10 are also provided with sheet grippers 56 and 57 respectively, grippers 56 taking a sheet from grippers 54 and presenting it to grippers 57, as will be obvious to those skilled in the art.

By virtue of the mechanism thus far described sheets could be moved down the feed board 13 in stream formation, each sheet registered, gripped by the nipper rolls and driven forward against the stops 52 of the feed cylinder, gripped by the gripper fingers 54, accelerated to the surface speed of advance cylinder 11, taken by the grippers 56 of that cylinder, advanced and delivered to the gripper fingers 57 of cylinder 10. However the speed of operation of the press would be limited by the fact that an appreciable time is required for the registering of each sheet on the feed board. This of course cannot be done until the tail end of the preceding sheet has passed the point of registration.

Means for withdrawing the tail end of each sheet from the feed board rapidly by putting a loop in the body of the sheet while its front end is in control of the sheet grippers has been devised and is disclosed in my copending application No. 11,970 previously referred to. According to that invention the loop is formed by a series of pull-out wheels carried by the advance cylinder and caused to partake of motion in a circle eccentric to the advance cylinder, the path of motion of the pull-out wheels cutting the path of motion of the sheet grippers in two places, first as the pull-out wheels emerge from the perimeter of the advance cylinder and second as they withdraw again into the perimeter of that cylinder.

The present invention operates upon the same general principle, but the mechanism for operating the pull-out roller or other abutment is so modified that the path of movement of that abutment is substantially oval rather than circular, with the result that the loop is made in the sheet more rapidly and at an earlier point in the cycle. The tail end of the sheet therefore is withdrawn from the feed board more rapidly and more time for registration is provided, or alternatively a longer sheet may be handled. Also the retraction of the pull-out abutment is at a more rapid rate so that the tail end of the sheet after being withdrawn past the point of registration may remain approximately stationary while the loop is removed by the gripppers holding the front end of the sheet. The sheet pull-out mechanism will now be described.

The showing in Fig. 4 is schematic, in that the view is foreshortened and only a portion of the cylinder 11 is illustrated. Rigidly connected with the opposite end walls of the cylinder are aligned shaft members 60 that are mounted in bearings 61 and 62 in the side members of the machine frame 63 and 64 respectively. While I have termed the member 11 a cylinder, a portion only of its perimeter is cylindrical for it is provided with a series of cavities 65 the inner walls of which are indicated in broken lines in Figs. 1, 2, 3 and 6. In a machine designed to handle sheets of large size there may be ten or more such cavities.

Extending lengthwise of the cylinder 11 there is a shaft 66 which has bearing in the end walls of the cylinder and extends through the intermediate walls separating consecutive cavities 65. To this shaft in each cavity there is keyed an arm 67 which at its outer extremity carries a pair of wheels or rollers 68 that are freely rotatable on a pair of transversely aligned trunnions 69. At one end of the shaft 66 outside the cylinder 11 there is keyed a pinion 70 which meshes with a second pinion 71 that is rotatable upon a stub shaft 72 fixed in an end wall of the cylinder. Pinion 71 is integral with a gear 73 which meshes with a ring gear 74 that is rotatably mounted on shaft 60. Gear 74 meshes with a gear sector 75 that is fixed to a hub 76 which is mounted to oscillate upon a trunnion 77 that has a slightly eccentric portion 78 which is angularly adjustable in a bearing 79 carried by the frame member 63. It is desirable that the sector 75 be angularly adjustable with respect to the hub 76, and to this end the sector is provided with a fan shaped upper end 80, and hub 76 has a similarly shaped spider 81, the two members 80 and 81 being secured together by studs 82. Before these studs are tightened the two members may be moved angularly with respect to each other. The eccentric portion 78 of the trunnion is locked in adjusted position by means of a stud and washer 83, 84, the stud being threaded into the end of the trunnion.

Extending laterally in opposite directions from the hub 76 there are two arms 85 and 86 having rollers 87 and 88 on their extremities which constitute followers that run on cams 89 and 90. These two cams may have identical peripheries. 89 is a primary cam having a hub 91 which is keyed to shaft 60. It is formed with a concentric shoulder 92 which provides a mounting surface for the secondary cam 90. The high points of these cams are disposed at a predetermined angle to each other, and the cams are then bolted together.

A series of transversely aligned brushes 93 are suitably mounted on a rod 94 carried in the opposite side members 63 and 64 of the frame. These brushes are adapted to bear upon the perimeter of the feed cylinder 12 and upon the sheets as they travel over that cylinder. These brushes place a drag on the sheet and hold back the rear end thereof while the loop is being taken out of the sheet, as will presently appear.

Operation.—A sheet coming down the feed board 13 is front registered against front guides 49 and is then side registered in the conventional manner. This occurs as soon as possible after the preceding sheet has passed the front guides 49. When the registration is completed and toward the end of the stationary period of cylinder 12 nipper rolls 38, 41 close upon the sheet, as illustrated in Fig. 6. Immediately thereafter front guides 49 rise to inoperative position. Roller 21 then travels downwardly against fishtail cam 25, accelerating cylinder 12 and the upper nipper roll. Before acceleration begins the sheet is firmly in the grasp of the nipper rolls. These rolls turn at a faster surface speed than the stops 52, and consequently during the acceleration period the forward edge of the sheet is pressed against the stops. Immediately thereafter and before the nipper rolls are opened the sheet grippers 54 grasp the forward edge of the sheet and carry it forward. The speed of the grippers at that time may be of the order of one-half or two-thirds of the surface speed of cylinders 10 and 11. Before the grippers reach the line of centers of cylinders 12 and 11, cylinder 12 will have been accelerated to the same surface speed as cylinder 11. This point in the cycle is illustrated in Fig. 1 of the drawing. The transfer of the sheet to the grippers 56 is now effected.

At this time the pull-out abutment, illustrated as wheels or rollers 68, occupies the position shown in Fig. 1, and the sector has been swung part way toward the left from its intermediate position by reason of the action of the cams 89 and 90 against the followers 87 and 88. Now as the cylinders 10, 11 and 12 turn in the direction of the arrows in Fig. 1, the sector swings further clockwise to approximately the position of Fig. 2. The rollers 68, it will be noted, are still within the perimeter of cylinder 11. At about this point there is a short dwell in the movement of the sector 75 whereupon its starts its swing in the opposite direction, that is counterclockwise. This movement of the sector acts through gears 74, 73, 71 and 70 to swing the latter gear and the arm 67 clockwise. Consequently as the cylinder revolves carrying along with it the shaft 66, the roller 68, which now emerges from the perimeter of the cylinder 11, moves downwardly and toward the right in a steep path, pressing against the internal surface of the sheet. The forward edge of the sheet is of course held by the grippers 56 at the periphery of cylinder 11. Consequently this outward push of the rollers 68 forms a loop in the sheet which pulls the rear edge rapidly forward at a speed greater than the surface speed of the cylinders. The rear edge of the maximum size sheet capable of being handled on the machine will then stand at R in Fig. 3 and will of course be held against cylinder 12 by the brushes 93. In the position of Fig. 3 the cylinder 12 is in its decelerating period and is about to begin its stationary period. The sector 75 it will be noted is in its intermediate position and traveling toward the right, or counterclockwise.

Fig. 5 is a diagrammatic view showing two positions *a* and *b* of the shaft 66, the rollers 68 and the grippers 56 at succeeding points in the cycle. The pull-out rolls 68 have moved inwardly at 68*a* from their maximum outward position shown in Fig. 3. At this point the forward edge of the sheet is being transferred to the grippers 57*a* of cylinder 10. Retraction of rolls 68*a* proceeds rapidly until at position 68*b* they have been withdrawn completely into the perimeter of cylinder 11, at which time the forward edge of the sheet is held by the grippers of cylinder 10 in their position 57*b*. Thus while the forward edge of the sheet has moved from the 57*a* position to the 57*b* position the rear edge has moved merely from the *a* position to the *b* position on cylinder 12, the grippers on the latter cylinder having moved forwardly from the position of Fig. 3 to that of Fig. 5. It will be apparent therefore that the formation of the loop causes the rear edge of the sheet to move forwardly rapidly, while the elimination of the loop leaves the rear edge almost motionless.

The positions of the shaft 66, the rollers 68 and the grippers 56 at a point in the cycle where the rollers have moved inwardly to the maximum extent are indicated by the *c* positions in Fig. 5. The path of the center of the rollers 68 is shown approximately by the broken line 95 in Fig. 3. At the *c* position of Fig. 5 the sector 75 will again occupy its intermediate position. If the gear 74 were a fixed gear the path of roller 68 would be circular. By the oscillation of gear 74 resulting

from the mechanism of the present invention the sides of the path 95 are drawn inward to an oval shape and the travel of the rollers 68 both outwardly and inwardly is more rapid than it would otherwise be. Since the rear edge of the sheet remains under the control of the brushes 93 until after the loop is entirely eliminated it is obvious that the pull-out mechanism does not cause any out of control condition of the rear part of the sheet.

The use of two cams 89 and 90 and two followers 87 and 88 for effecting the oscillation of sector 75 is preferred, but a single cam with spring return or a box cam may be substituted for the double cams if desired.

Having thus described my invention, I claim:

1. In mechanism of the character described, a feed board, an advance cylinder having sheet grippers, means intermediate said feed board and advance cylinder for receiving sheets from the feed board and presenting them to said grippers, a pull-out abutment carried by said advance cylinder for putting a loop in the sheet in order to move its rear edge rapidly off the feed board, mechanical means for moving said abutment in a closed path intersecting the path of said grippers at two points, said mechanical means comprising cam means for modifying the path of travel of said abutment, said mechanical means and said cam means functioning together to provide an oval path of travel for said abutment.

2. In a machine for operating on sheets, an advance cylinder, sheet gripping means adapted to grip and advance the leading edge of a sheet, the said means comprising grippers on said advance cylinder, a shaft mounted in the advance cylinder eccentric to the center of rotation thereof, a gear oscillatable about the center of rotation of the advance cylinder, cam actuated means for oscillating said gear once for each revolution of said cylinder, a driving connection between said oscillatable gear and said shaft arranged to cause reverse rotation of the shaft relative to the advance cylinder at the rate of one revolution for each revolution of the advance cylinder, and means moving with said shaft adapted to engage and displace outwardly the body of a sheet the leading edge of which is held by said sheet gripping means, said gripping means maintaining its hold upon the sheet until after said sheet engaging means has moved to the outermost point of its travel.

3. In a machine for operating on sheets, an advance cylinder, sheet gripping means adapted to grip and forward the leading edge of a sheet, said means comprising grippers on said advance cylinder, a shaft mounted eccentrically in the advance cylinder and carrying a pinion, an arm keyed to said shaft carrying a pull-out abutment at its free extremity, a sun gear mounted axially of the advance cylinder, gearing connections between said sun gear and said pinion for rotating the pinion in the reverse direction during each revolution of said advance cylinder, and means for oscillating the sun gear once for each cycle of the advance cylinder to provide relatively rapid rotation of the pinion during a portion of each cycle and relatively slow rotation during another portion.

4. Mechanism as defined in claim 3, wherein the relatively rapid rotation period of said pinion occurs during the travel of said pull-out abutment exteriorly of the advance cylinder.

5. Mechanism as defined in claim 3, wherein said means for oscillating the sun gear comprises

cam means turning with said advance cylinder.

6. Mechanism as defined in claim 3, wherein said means for oscillating the sun gear comprises a gear sector meshing with said sun gear and mounted to oscillate about a fixed axis, cam means turning with said advance cylinder and follower means operatively connected with said sector and arranged to run upon said cam means.

7. In mechanism of the character described, an advance cylinder, sheet gripping means adapted to grip and forward the leading edge of a sheet, said means comprising grippers on said advance cylinder, rotary means for presenting sheets to said grippers, means for producing a drag on sheets passing over said rotary means, a shaft mounted eccentrically in said advance cylinder and carrying a pinion, an arm keyed to said shaft carrying a pull-out abutment at its free extremity, a sun gear mounted axially of said advance cylinder, gearing connections between said sun gear and said pinion for rotating the pinion in the reverse direction during each revolution of said advance cylinder, and means for oscillating the sun gear combining with the bodily rotation of said eccentric shaft to produce rapid motion of the pull-out abutment outwardly from and then inwardly toward the periphery of said advance cylinder, whereby said pull-out abutment is retracted within said advance cylinder before the sheet is released by said drag means.

8. In mechanism of the class described, a revolving advance cylinder, sheet gripping means adapted to grip and advance the leading edge of a sheet, said means comprising grippers on said advance cylinder, an arm on said cylinder revolving in the opposite direction thereto about a center moving with said cylinder eccentric to its axis and having on its extremity a pull-out roller adapted to displace radially an intermediate portion of the advancing sheet, said sheet gripping means maintaining its hold upon the sheet until after said pull-out roller has moved to the outermost point of its travel, the path of the axis of said roller intersecting the circular path of said grippers at two points along the latter path about 45° apart.

9. In a machine for operating on sheets, an advance cylinder, grippers thereon, means for presenting the leading edge of a sheet to said grippers at one point, means approximately 180° from the first point for taking a sheet from the grippers, and a pull-out abutment moving in a complete oval path intersecting the path of said grippers twice between said points to engage an intermediate portion of a sheet advancing between said points, said intersections being approximately one-eighth of a revolution apart along the gripper path.

10. In a machine of the character described, an advance cylinder, sheet gripping means adapted to grip and advance the leading edge of a sheet, said means comprising grippers on said cylinder, means mounted on said cylinder moving in a complete oval path intersecting at two points the path of said grippers adapted to engage the sheet at said first intersection point and displace it laterally of the path of the leading edge, and means for creating a drag upon the rear portion of the sheet during the period between the greatest displacement and the second intersection point.

11. In a machine of the character described, a constant speed advance cylinder, sheet gripping means adapted to grip and advance the leading

edge of a sheet, a revoluble feed cylinder adapted to present sheets to said advance cylinder, said sheet gripping means comprising grippers on said feed cylinder and said advance cylinder, means mounted on said advance cylinder moving in a complete oval path intersecting the path of the advance cylinder grippers at two points spaced apart approximately one-eighth of a revolution of said advance cylinder grippers, and adapted to engage the sheet at said first intersection point and thereafter displace it laterally of the path of its leading edge, and means associated with said feed cylinder for creating a drag upon the rear portion of the sheet during the period of lateral displacement of the sheet.

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