

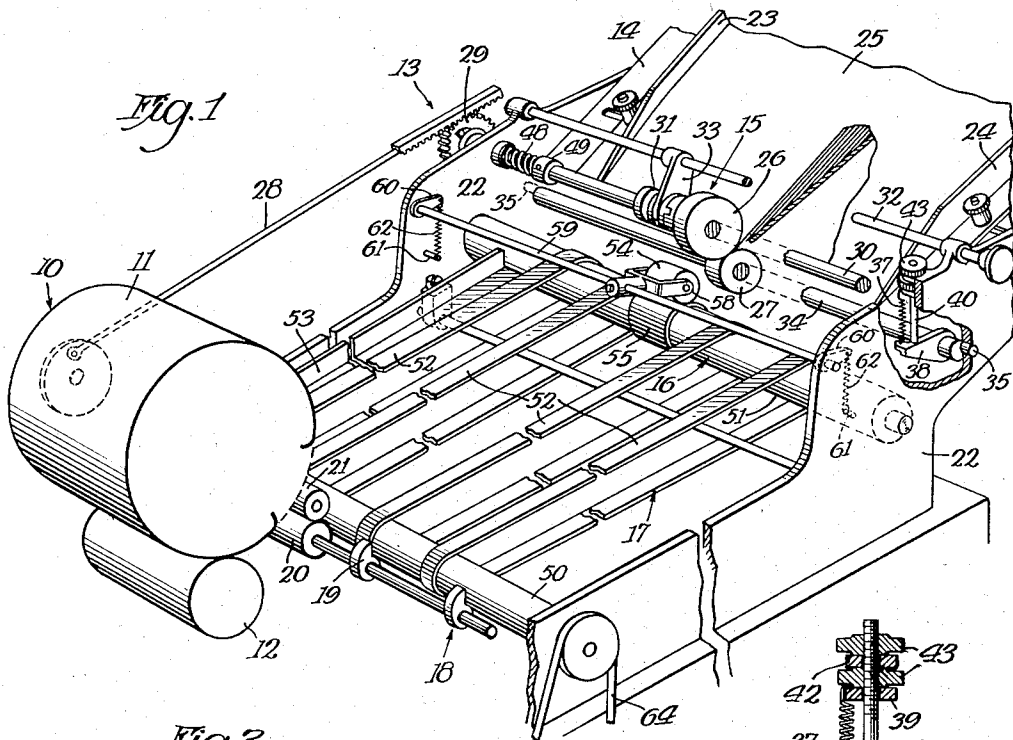
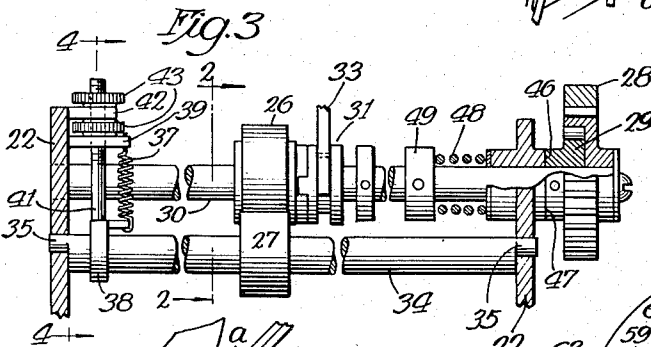
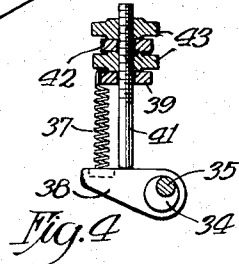
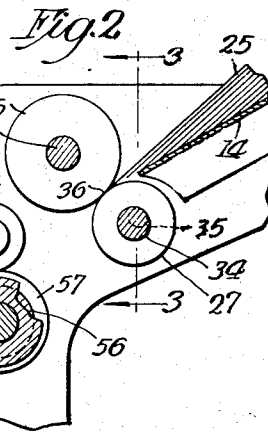
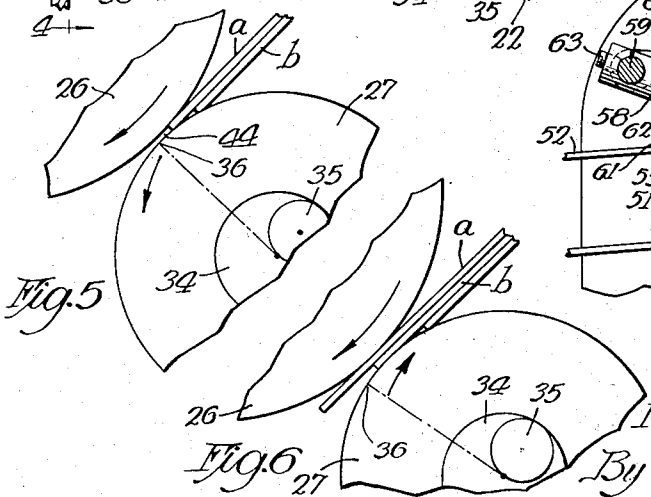
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2,224,137

FRICTION FEEDER

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UNITED STATES PATENT OFFICE

2,224,137

FRICTION FEEDER

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24 Claims. (Cl. 271—37)

The principal object of this invention is to provide a simple and inexpensive friction feed for sheets of paper, or the like, which virtually assures that only one sheet of material will be fed at a time, even though there is considerable variance in the thickness of the stock being fed to the feeder.

Further objects and advantages will become apparent as the disclosure proceeds and the description is read in conjunction with the accompanying drawing, in which

Fig. 1 is a diagrammatic view showing an application of the friction feeder of this invention to a printing machine;

Fig. 2 is a fragmentary sectional view taken on the line 2—2 of Fig. 3;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2, with intermittent portions of the structure being broken away to conserve space;

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 3; and

Figs. 5 and 6 are enlarged views which will be used in explaining the manner in which the feeder prevents more than one sheet from being fed at a time.

A preferred form of the invention has been chosen for illustration and description, in compliance with section 4888 of the Revised Statutes, but persons skilled in the art will readily perceive other means for accomplishing the same results, and the claims are therefore to be construed as broadly as possible, consistent with the prior art.

Friction feeders are often used with apparatus requiring sheets to be fed at predetermined time intervals, and for the purpose of this disclosure the invention will be illustrated with an instance of this kind, a printing press being used as an example of apparatus requiring this type of sheet delivery. It should be understood, however, that other kinds of apparatus, such as folding machines of the buckle type, do not require an intermittent feed so that the feeder can be run continuously.

A printing press is indicated diagrammatically in Fig. 1 by the reference character 10, and it comprises a printing drum 11 and a platen 12. Sheets of paper are fed to the press at timed intervals by feeding mechanism, generally designated 13, comprising a feed board 14, separator rolls, generally designated 15, pull-out rolls, generally designated 16, and a conveyor table, generally designated 17. The delivery end of the conveying table has associated with it a sheet-registering device, generally designated 18, which receives the sheets from the table 17 and delivers

them with extreme accuracy into the bite of the printing roll 11 and platen 12.

The sheet-registering device 18 operates in synchronism with the press 10, and the speed at which the press can operate is partially determined by the ability of the feeding mechanism to deliver sheets to the registering mechanism 18 in sufficiently correct timing relationship with the operation of the registering mechanism 18 that the latter is given an opportunity to properly perform its function.

Since the sheet-registering mechanism forms no part of the present invention, it is sufficient to state that it functions by having stop fingers 19, associated with the lower feed roll 20, moved to an upright position for a given portion of a cycle of press operation to receive and end register a sheet delivered to them by the conveyor board 17. As soon as this registry has been accomplished the upper feed roll 21 of the registering mechanism 18 descends to make contact with the lower roller 20, and after the bite has been made the lower roll is automatically rotated to deliver the sheet into the bite of the printing roll 11 and platen 12. Since this action takes place for each revolution of the printing drum 11, it can readily be understood why it is necessary to have the feeder 13 deliver the sheets to the registering mechanism 18 in reasonably correct timed relationship.

The feed table 14 is suitably mounted on the feeder frame 22, and it is provided with laterally adjustable magazine side walls 23 and 24 so that the pile 25 of fanned-out sheets may be centrally positioned with respect to the feeder mechanism.

The separator rolls 15 comprise a feed roll 26, and a retard roll 27, the former being intermittently driven by a pitman 28, or equivalent means, from the press 10, with an overrunning clutch 29 being interposed in the drive so that the pull-out rolls 16 may draw the sheet being fed by the separator rolls 15 through these rolls, even though the intermittent drive through the pitman has ceased. The roll 26 is mounted on a shaft 30, to rotate about its own axis, and a clutch 31, actuated by a rod 32, operating through a clutch arm 33, is provided to disengage the feed roll 26 from the drive through the pitman 28.

The retard roll 27 is rigidly mounted on a shaft 34, provided with eccentric trunnion bearings 35 journaled in the side frames 22 of the feeder. The bearings for the trunnions 35 are so located with respect to the shaft 30 carrying the feed roll 26 that when the retard roll 27 is in substantial

tangential contact with the feed roll 26, as indicated at 36 (Fig. 2), the axis of the trunnions 35 is so positioned that rotation of the retard roll 27 in the direction in which the sheet is advancing causes the roll to move forward slightly and away from the feed roll 26, as best shown in Fig. 6, where two sheets of the material being fed are shown in the bite of the rolls.

The shaft 34 is constantly urged in the opposite direction (that is, in a clockwise direction when viewing the separator rolls as in Fig. 2) by a spring 37, which acts upon the end of an arm 38 rigidly attached to the shaft 34 and a flange 39 integral with the side frame 22. Rotation of the shaft, however, in the direction in which it is urged by the spring 37 is limited by an adjustable stop 40, which also cooperates with the arm 38, the stop consisting of a threaded rod 41 passing through the flange 39 on the frame 22, and a similar flange 42, also integral with the frame 22, adjusting nuts 43 being provided to fix the position of the rod 41 with respect to the flanges 39 and 42.

The action of the separator rolls is illustrated in Figs. 5 and 6. The stop 40 is preferably adjusted so that the gap 44 between the feed roll 26 and retard roll 27 is slightly less than the thickness of a single sheet of the paper or material being fed to the press. The feed roll 26, being the driven member, makes contact with the top sheet *a* and tries to drive it through the gap 44, and normally it accomplishes this function without drawing with it the lower sheet *b*. If, however, sheet *b* for some reason sticks to the sheet *a*, it will enter the bite of the separator rolls, as shown in Fig. 6, and the retard roll 27, being free to rotate on its eccentric axis, will move slightly to the left and its center will move a corresponding distance from the center of the feed roll 26 (as indicated by the translation of the normal point of tangency 36). As soon as this movement takes place, the arm 38 is moved away from the stop 40, and the spring 37 continuously urges it back to its normal position, with the result that roll 27 has a clockwise force applied to it (Fig. 6), as indicated by the arrow, while the feed roll 26 continues its rotation to advance the upper sheet *a*.

It has been found in practice that this ability of the retard roll 27 to yield whenever more than one sheet enters the bite of the separator rolls, and then exert a force which opposes the movement of the second sheet, effectively prevents more than one sheet from being fed to the pull-out rolls 16 at a time, and this is so even when the thickness of the paper stock in the pile 25 varies within wide limits. In this respect the performance of the feeder is exceptional, because heretofore it has always been necessary to make accurate adjustments for different stocks of paper.

As soon as the sheet *b* is restrained from going along with the sheet *a* as the latter moves toward the pull-out rolls 16, it may, and usually does, remain in the bite of the separator rolls after sheet *a* has been pulled from those rolls, and it is therefore important that the roll be stopped immediately after the sheet passing to the pull-out rolls has left the separator rolls. This is accomplished in the present invention by continuously urging the shaft 30 axially in a direction to cause the face 46 of the clutch 29 to frictionally engage the friction surface 47, associated with the bearing of the shaft 30 (Fig. 3). The axial thrust of the shaft 30 may be conveniently ac-

complished by means of a spring 48, telescoped over the shaft 30 and bearing at one end against the side frame 22 and at the other end against a collar 49 which may be adjustably positioned on the shaft 30 to obtain the desired thrust. Experience has shown that this friction brake is capable of stopping the feed roll 26 substantially instantaneously when the sheet being moved by the pull-out rolls 16 leaves the bite of the separator rolls.

Preferably the feed roll 26 is made of relatively soft rubber, pure gum anemone stock having a durometer reading of 40 having been found satisfactory. The retard roll 27 is preferably made of somewhat harder rubber, grey commercial compound rubber, 78 durometer, having been found satisfactory.

It is obvious that the retard roll 27 may take various forms, and may be mounted in numerous other ways without departing from the spirit of this invention. For example, the retard roll 27 may be elliptical in form or ovate, or any other shape, as long as the roll (used in its broadest sense) retains its characteristic function of retarding the extra sheet with which it is in contact.

The conveyor board 17 comprises parallel belt rollers 50 and 51, fixed in the side frames 22 at a slight angle with respect to the transverse axis of the feeder, so that the conveyor belts 52, which are mounted on the rollers 50 and 51, are biased toward the side guide 53. The guide 53 is adjustable laterally with respect to the conveyor board, as are also the belts 52, so that the sheets may be fed to the printing drum 11 in any desired lateral registry.

The pull-out rolls 16 comprise upper and lower rolls 54 and 55, the latter being formed as a part of the belt roller 51. The roller 51 is preferably made of wood and is formed with a shallow groove, as indicated at 56 (Fig. 2), which receives a rubber facing 57 of suitable hardness. The upper roll 54 is preferably a steel roller, and it is carried by a jaw 58, fixed to a rod 59 journaled in the side frames 22. The rod 59 is provided at each end with an arm 60, the end of which is connected to a stud 61 on the side frame by a spring 62. The jaw 58 may be fixed to the rod 59 at any desired angular position of the rod 59, by means of a set-screw 63, so that the pressure of the roll 54 on the roll 55 may be conveniently adjusted.

The pressure of the upper roll 54 on the lower roll 55 should be sufficient so that the pull-out rolls 16, which are continuously driven by a belt 64 through the conveyor belts 52, will draw the sheets of material delivered to them through the separator rolls 15, against the action of the friction brake at the contacting surfaces 46, 47, associated with the shaft 30. This relationship is necessary so that when the trailing edge of a sheet has left the separator rolls 15 the shaft 30 will immediately stop rotating.

It is important to note that the feeder mechanism is extremely simple and inexpensive to manufacture as compared with most friction feeders, and one reason for this economy in materials and cost of manufacture is that the sheets are delivered to the press 10 along the center line of the feed mechanism. Heretofore it has been the common practice to guide the sheets along one side or the other of the conveyor, and to have the separator rolls and pull-out rolls adjustable laterally to accommodate different sizes of paper stock.

In the present invention the magazine sides 23 and 24 are adjustable so as to initially position the pile 25 in the center of the feed board 14, and the only additional adjustment for lateral registry which is necessary is to properly position the side guide 53. No lateral adjustment of the separator rolls 15 or the pullout rolls 16 is necessary or desirable, and because of this fact the lower pull-out roll 55 may be made a part of the belt roller 51.

We claim as our invention:

1. In a friction feeder, a feed table adapted to support a pile of fanned-out sheets, a pair of separator rolls one of which is intermittently driven through an overrunning clutch device, constantly driven pull-out rolls adapted to receive sheets delivered to them by the separator rolls, the other separator roll being non-rotatably mounted on a shaft, eccentric trunnion bearings for the shaft, yieldable means tending to rotate the shaft in a direction to lessen the distance between the separator rolls, and a stop limiting the rotation of the shaft in that direction.

2. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being intermittently driven through an overrunning clutch device, constantly driven pull-out rolls adapted to receive sheets from the separator rolls and pull them from those rolls, the retard roll being yieldingly held in predetermined cooperative relationship with the feed roll but being adapted to move away slightly from that roll when more than one sheet starts to pass between the separator rolls, and means tending to rotate the retard roll in a direction to oppose forward movement of the sheet with which it is in contact whenever that roll has been moved from its predetermined cooperative relationship with the feed roll.

3. In a friction feeder, separator rolls comprising feed and retard rolls normally held yieldingly in predetermined cooperative relationship, an intermittent drive for the feed roll through an overrunning clutch device, driven pull-out rolls adapted to receive sheets from the separator rolls and pull them from those rolls, and means tending to rotate the retard roll in the same direction as the feed roll, to move a sheet rearwardly, whenever the separator rolls have been separated by an amount greater than that required for the passage of a single sheet.

4. In a friction feeder, a feed board adapted to support a pile of fanned out sheets, separator rolls adapted to successively feed the top sheet from the pile to other apparatus, said separator rolls comprising an upper roll driven in a direction to feed the sheets forwardly, a lower roll yieldingly held against rotation at a predetermined distance from the upper roll but being adapted, when it has been moved away from the upper roll by the sheets, to be rotated in a direction to oppose forward movement of the sheet with which it is in contact.

5. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being driven in a direction to advance sheets of material fed to the rolls and the latter being yieldingly held in a predetermined cooperative relationship with the feed roll, and means tending to return the retard roll to its normal position and simultaneously rotate it in a direction to oppose movement of the sheet with which it is in contact whenever the rolls have been moved apart by the entry of more than one sheet within the bite of the rolls.

6. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being driven to advance the sheet and the latter being substantially non-rotatable, and means for mounting the retard roll in cooperative relationship with the feed roll so that when more than one sheet enters the bite of the separator rolls the retard roll moves away slightly from the feed roll but is yieldingly urged to its normal position by a force which also tends to rotate the retard roll in a direction to oppose movement of the sheet with which it is in contact.

7. In a friction feeder, a pair of separator rolls comprising a feed and a retard roll, the latter being mounted on eccentric bearings in such a manner that when the roll is rotated in the direction of movement of a sheet passing through the rolls the center of the roll moves away a slight distance from the center of the feed roll, and resilient means tending to rotate the retard roll in the opposite direction.

8. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being mounted to rotate on its own center to advance a sheet passing between the rolls and the latter being rotatable upon an eccentric bearing to move the retard roll away from the feed roll when more than one sheet passes into the bite of the separator rolls, yieldable means tending to oppose rotation of the retard roll in one direction, and a stop for limiting rotation of the retard roll in the opposite direction, thereby fixing the normal distance between the rollers for the feeding of single sheets.

9. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being mounted to rotate on its own center to advance sheets into the bite of the rolls and the latter being substantially non-rotatable and mounted in eccentric bearings positioned so that slight rotation of the retard roll in the direction in which the sheets are advanced causes the retard roll to move away from the feed roll, means constantly urging the retard roll to rotate in a direction to oppose sheet advancement, and an adjustable stop for limiting rotation of the retard roll in that direction.

10. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being intermittently driven through an overrunning clutch device, driven pull-out rolls adapted to receive sheets from the separator rolls and pull them from those rolls, the retard roll being yieldingly held in predetermined cooperative relationship with the feed roll but being adapted to move away slightly from the feed roll when more than one sheet starts to pass between the separator rolls, and means for instantly stopping rotation of the feed roll as soon as the pull-out rolls have drawn a sheet from the separator rolls.

11. In combination, apparatus to which sheets are to be fed in predetermined timed relationship, a friction feeder associated with said apparatus including separator rolls and pull-out rolls, one of the separator rolls being intermittently driven at intervals corresponding to the timed relationship with which sheets are to be fed to said apparatus, means for continuously driving the pull-out rolls, and means for substantially instantaneously stopping the rotation of the intermittently driven separator roll as soon as the pull-out rolls have drawn a sheet from the separator rolls.

12. In combination, apparatus to which sheets

are to be fed in predetermined timed relationship, a friction feeder associated with said apparatus including separator rolls and pull-out rolls, one of the separator rolls being intermittently driven at intervals corresponding to the timed relationship with which sheets are to be fed to said apparatus, means for continuously driving the pull-out rolls, and means for substantially instantaneously stopping the rotation of the intermittently driven separator roll as soon as the pull-out rolls have drawn a sheet from the separator rolls, said last-named means including a friction device applied to the intermittently driven separator roll.

13. In a friction feeder, spaced side frames, a pair of rolls mounted between the side frames comprising upper and lower rolls, the upper roll being rotatable on its own axis, and means for yieldingly supporting the lower roll in predetermined cooperative relationship with the upper roll, said means comprising a shaft having eccentric trunnion bearings journaled in the side frame, resilient means tending to rotate the shaft in a direction to oppose advancement of the sheet with which the lower roll is in contact, an arm attached to the shaft, and an adjustable stop cooperating with the arm to limit rotation of the shaft in the direction in which it is urged by the resilient means.

14. In combination, apparatus to which sheets are to be fed at predetermined time intervals and in predetermined lateral registry, a friction feeder associated with the apparatus comprising a feed table, separator rolls centrally positioned with respect to the table, pull-out rolls adjacent to the separator rolls and in alignment therewith, a conveying table for delivering sheets from the pull-out rolls to the apparatus, said conveying table including a side guide adapted to be adjusted through a substantial distance inwardly from the edge of the table and a plurality of conveyor tapes biased toward the side guide, one of the pull-out rolls being a part of the conveying tape roller.

15. In a friction feeder, a pair of separator rolls comprising a feed roll and a retard roll, the former being driven in a direction to advance sheets of material fed to the rolls and the latter being yieldingly and normally non-rotatively held in a predetermined cooperative relationship with the feed roll but rotatable when sufficient force is transmitted thereto by the feed roll through the sheet in contact therewith, and means causing the separator rolls to separate automatically in response to said rotation of the retard roll to a distance apart at which the sheet in contact with the feed roll may be fed thereby with relative freedom but at which the opposition to the passage of sheets not already between the separator rolls is unimpaired.

16. A friction feeder including two separator members, one an advancing roll and the other a retard member adjacent the advancing roll and having a surface extending gradually toward the advancing roll in the direction of movement of the sheets being fed so as to form a bite with the advancing roll, the retard member being so mounted as to permit its surface adjacent the advancing roll to move generally in the direction of the advancing sheets and simultaneously away from the advancing roll, and yieldable means resisting such movement of the retard member and tending to move it in the opposite direction.

17. In a friction feeder, sheet separating means including two cooperating members one of which

has a relatively soft sheet engaging surface and is driven in a direction to advance sheets of material fed to the sheet separating means, and the other of which members has a relatively hard sheet engaging surface and is resiliently urged in a direction that opposes advancement of the sheets by resilient means permitting the said other member to be moved generally in the direction of movement of the sheets by two sheets locked together and the two members to separate slightly under the influence of said movement whereby the pressure between the sheets is automatically reduced for successive positions of the sheet as compared to the pressure that would be present without said movement, until the extra sheet is loosened from the sheet in contact with the driven member and the latter sheet is advanced alone due to the relatively high friction between it and the facing material of the driven member.

18. A friction feeder including two separator members, one an advancing roll and the other a retard member adjacent the advancing roll and having a surface extending gradually toward the advancing roll in the direction of movement of the sheets being fed so as to form a bite with the advancing roll, the retard member being so mounted as to permit its surface adjacent the advancing roll to move generally in the direction of the advancing sheets, and yieldable means resisting such movement of the retard member and tending to move it in the opposite direction, said separator members being separable in response to said movement in the direction of the advancing sheets.

19. A friction feeder including an advancing roll, a retard member having a curved surface adjacent the advancing roll, means for feeding the leading edge of a fanned-out stack of sheets to the bite between the advancing roll and the retard member, means for rotating the advancing roll when a sheet is desired, the retard member being mounted eccentrically to the sheet-engaging surface thereof to rotate as a body about an axis so positioned that movement of the surface with an advancing sheet separates the surface from the advancing roll, and means for yieldingly resisting such rotation.

20. A friction feeder including two separator members, one an advancing roll and the other a retard member adjacent the advancing roll and having a surface extending gradually toward the advancing roll in the direction of movement of the sheets being fed so as to form a bite with the advancing roll, the retard member being so mounted as to permit its surface adjacent the advancing roll to move generally in the direction of the advancing sheets, yieldable means resisting such movement of the retard member and tending to move it in the opposite direction, and means for adjusting the normal minimum spacing between the retard member and the advancing roll for various sheet thicknesses, said separator members being separable in response to said movement in the direction of the advancing sheets.

21. A friction feeder including an advancing roll, a retard member adjacent the advancing roll, means for feeding the leading edge of a fanned-out stack of sheets to the bite between the advancing roll and the retard member, and means for rotating the advancing roll when a sheet is desired, the retard member being so mounted that its sheet-engaging surface may be moved by the sheets under the influence of the

advancing roll with a movement initially approximately in the direction of the sheet movement and being provided with means for opposing said movement, the shapes of the retard member and the advancing roll being such that as the retard member is moved by two or more sheets it will during a short movement squeeze the sheets progressively more tightly against the advancing roll and flex them.

22. A friction feeder including two separator members, one an advancing roll and the other a retard member adjacent the advancing roll and having a surface extending gradually toward the advancing roll in the direction of movement of the sheets being fed so as to form a bite with the advancing roll, the retard member being so mounted as to permit its surface adjacent the advancing roll to move generally in the direction of the advancing sheets and simultaneously away from the advancing roll, yieldable means resisting such movement of the retard member and tending to move it in the opposite direction, and means for adjusting the normal minimum spacing between the retard member and the advancing roll, the retard member engaging the sheets with less retarding force than the advancing force exerted on the sheets by the advancing roll but with enough friction to cause the sheets being moved by the advancing roll to move the surface of the retard member generally in the direction of sheet movement when two sheets stick together.

23. A friction feeder including two separator members, one an advancing roll and the other a retard member adjacent the advancing roll and having a surface extending gradually toward the advancing roll in the direction of movement of

the sheets being fed so as to form a bite with the advancing roll, the retard member being so mounted as to permit its surface adjacent the advancing roll to move generally in the direction of the advancing sheets and simultaneously away from the advancing roll, and yieldable means resisting such movement of the retard member and tending to move it in the opposite direction, the retard member engaging the sheets with less retarding force than the advancing force exerted on the sheets by the advancing roll but with enough friction to cause the sheets being moved by the advancing roll to move the surface of the retard member generally in the direction of sheet movement when two sheets stick together.

24. A friction feeder including two separator members, one an advancing roll and the other a retard roll adjacent the advancing roll a forming a bite with the advancing roll, the retard roll being eccentrically mounted to permit its surface adjacent the advancing roll to move generally in the direction of the advancing sheets and simultaneously away from the advancing roll, yieldable means resisting such movement of the retard roll and means for adjusting the normal minimum spacing between the retard roll and the advancing roll; the retard roll engaging the sheets with less retarding force than the advancing force exerted on the sheets by the advancing roll but enough friction to cause the sheets being moved by the advancing roll to move the surface of the retard roll generally in the direction of sheet movement when two sheets stick together.

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